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**Bachelor of Science (Basic/Hons.) Degree in Biochemistry**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Biochemistry held on 15<sup>th</sup> November, 2021 in the Department of Biochemistry, Yuvaraja College, Mysuru.

To discuss the following agenda:

1. Preparation of National Education Policy (NEP) Syllabus for I and II Semesters
2. Preparation of panel of examiners for B.Sc. degree course for the year 2021-2022
3. Any other subjects raised by the members for discussion during the meeting with the permission of the Chairman

| Sl. No. | Members                                                                                                                     | Position | Signature/<br>Remarks |
|---------|-----------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. J Rajesha, Professor and Head<br>Department of Biochemistry, Yuvaraja College,<br>University of Mysore, Mysuru          | Chairman | Sd/                   |
| 2.      | Smt. Aiysha Firdouse,<br>Assistant Professor, Department of Biochemistry,<br>Yuvaraja College, University of Mysore, Mysuru | Member   | Sd/                   |
| 3.      | Prof. K. Kemparaju, Chairman, DOS in Biochemistry,<br>University of Mysore, Manasagangotri, Mysuru                          | Member   | Sd/                   |
| 4.      | Dr. M.S. Kumar, Assistant Professor,<br>Department of Biochemistry,<br>Govt. First Grade College for Women, Mandya          | Member   | Sd/                   |
| 5.      | Dr. N. Shobha,<br>Assistant Professor. Department of Biochemistry,<br>Maharani's Science College for Women, Mysuru.         | Member   | Sd/                   |
| 6.      | Dr. H.R. Puneeth<br>Guest faculty, Department of Biochemistry,<br>Yuvaraja College, University of Mysore, Mysuru            | Member   | Sd/                   |
| 7.      | Dr. K.S. Rakesh, Assistant Professor (contract),<br>Department of Biochemistry, Yuvaraja College.                           | Member   | Absent                |
| 8.      | Dr. Sharath Chandra, Assistant professor,<br>Department of Biochemistry, Govt. Science College,<br>Hassan                   | Member   | Absent                |
| 9.      | Dr K. S. Girish, Associate Professor, DoS in Biochemistry<br>Tumkur University, Tumkuru                                     | Member   | Absent                |
| 10      | Dr. R. Sahana, Scientist, Syngene International Ltd,<br>Biocon Park, Bengaluru                                              | Member   | Absent                |

The Chairperson welcomed the members to Board of Studies meeting in Biochemistry.

**Agenda No. 1: To discuss and prepare I and II semester syllabus of NEP scheme from the academic year 2021-2021 onwards**

The board members thoroughly discussed and scrutinized the I and II semester syllabus of NEP. It was unanimously resolved to adapt the syllabus for the academic year 2021-2022.

**Agenda No. 2: Preparation of panel of examiners for B. Sc. degree course**

The board members have unanimously approved the panel of examiners for B. Sc. Biochemistry Examination. The list of both internal and external examiners was prepared and sent to the Controller of examination, YCM.

**Agenda No. 3: Any other subjects raised by the members for discussion during the meeting with the permission of the Chair.**

-Nil-

Finally, The Chairperson thanked the members and the meeting was concluded

15-11-2021  
Mysuru

Chairman,  
BOS in Biochemistry

**Details of Course of Study: I and II Semesters**

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)     | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|--------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Chemical Foundations of Biochemistry-1 (4+0+0)  | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Volumetric Analysis (0+0+2)                    | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Biochemistry in Health and Diseases (3+0+0)      | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Chemical Foundations of Biochemistry -2 (4+0+0) | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Qualitative and Quantitative Analysis (0+0+2)  | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Nutrition and Dietetics (3+0+0)                  | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Programme Outcome:**

- To create interest in Biochemistry and appreciation for chemical basis of biological processes.
- To inculcate the spirit of inquiry and value of systematic study of a discipline.

- Provide a general understanding of the related disciplines with a holistic knowledge generation in biological sciences.
- To provide an in-depth understanding of chemical reaction mechanisms in biological processes.
- To provide a flavor of historical developments of enzymes and their applications in research, diagnostics and various industries.
- Gain proficiency in basic laboratory techniques and be able to apply the scientific method to the processes of experimentation, hypothesis testing, data interpretation and logical conclusions.
- Develop problem solving and analytical skills through case studies, research papers and hands-on-experience
- To appreciate biochemical mechanistic basis of physiological processes, metabolism under normal and pathological conditions importance and levels of metabolic regulations.
- To apply and effectively communicate scientific reasoning and data analysis in both written and oral forms. They will be able to communicate effectively with well-designed posters and slides in talks aimed at scientific audiences as well as the general public.
- To bridge the knowledge and skill gap between academic out and industry requirements.
- To give students experience in conducting independent, hypothesis-driven, biological research, project planning and management
- To provide skills to publish research findings, and awareness of IP rights, and scientific publication ethics and problems of plagiarism.
- To prepare competent human resource with better knowledge, hands-on-experience and scientific attitude, at national and global levels for careers in research and development, academia and Pharma-, biotech- and agro-, and food processing industries.

**Program Learning Outcome:** The learning outcome-based curriculum is specific in terms of changes in cognitive and psychomotor behavior of students. Biochemistry Honors course is intended to provide a broad framework enabling students to acquire a skill set that helps them understand and appreciate the field of biochemistry. The structure or design of this framework shall ensure a high standard of the Honors degree in Biochemistry at national level. The program specification is intended as a reference point for prospective students, current students, academic in delivering the program and realizing its objectives. Keeping in pace with the developmental trends in Biochemistry and allied areas, it is expected that the students undertaking Biochemistry (Honors) course become conversant with the essence of Biochemistry and exhibit certain levels of learning outcomes as proposed below;

Graduates with strong academic knowledge, discipline-specific and generic skills complemented with social responsibility are greatest asset of the country. The

curriculum frame work under NEP for Biochemistry graduates aims to build the following attributes;

**Disciplinary Knowledge:**

- a) Ability to comprehend fundamental concepts of biology, chemistry and apply basic principles of chemistry to biological systems.
- b) Ability to relate various interrelated physiological and metabolic events.
- c) Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts
- d) Ability to think laterally and in an integrating manner and develop interdisciplinary
- e) Good experimental and quantitative skills and awareness of laboratory safety
- f) A general awareness of current developments at the forefront in biochemistry and allied subjects.
- g) Awareness of resources, and their conservation.

**Communication Skills:**

- a) Ability to speak and write clearly in English and local language
- b) Ability to listen to and follow scientific viewpoints and engage with them.
- c) Ability to understand and articulate with clarity and critical thinking one's position.

**Critical Thinking:**

- a) Ability to conceptualize critical readings of scientific texts in order to comprehend.
- b) Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.

**Problem Solving:**

- a) Ability make careful observation of the situation, and apply lateral thinking and analytical skills.

**Analytical Reasoning:**

- a) Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments. b. Ability to use scientific evidences and experimental approach to substantiate one's argument in one's reading of scientific texts.

**Research Skills:**

- a) Ability to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers.
- b) Ability to plan and write a research paper.

**Teamwork and Time Management:**

- a) Willingness to participate constructively in class room discussions and contribute to group work.
- b) Ability to meet a deadline.

**Scientific Reasoning:**

- a) Ability to analyze theories and beliefs, evaluate ideas and scientific strategies.
- b) Ability to formulate logical and convincing arguments.

**Reflective Thinking:**

- a) Ability to locate oneself and see the influence of location—regional, national, global— on critical thinking.

**Self-Directing Learning:**

- a) Ability to work independently in terms of organizing laboratory, and critically analyzing scientific literature.
- b) Ability to postulate hypothesis, questions and search for answers.

**Digital Literacy:**

- a) Ability to use digital resources, and apply various platforms to convey and explain concepts of biochemistry.

**Multicultural Competence:**

- a) Ability to engage with and understand cultures of various nations and respect and transcend differences.

**Moral and Ethical Values:**

- a) Ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.
- b) Ability to read values inherited in society and criticism vis-a-vis, the environment, religion, spirituality, and structures of power.

**Leadership qualities:**

- a) Ability to lead group discussions, to formulate questions related to scientific and social issues.

**Life-long Learning:**

- a) Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day to day business.

**I SEMESTER**

**Course Outcome:** This will inculcate confidence and clarity of mind in students to understand the chemistry of Biomolecules, and Biological reactions. Aptitude. Critical thinking. Subject clarity. Analytical Skill.

**Pedagogy:** MOOC/desk work/book chapter/problem solving /assignment.

**DSC-1: CHEMICAL FOUNDATIONS OF BIOCHEMISTRY-1 (THEORY):****4 Credits****56 Hrs.****Unit-1: Scope of Biochemistry and Units of measurement:****14 Hrs.**

Origin of life, types of organisms, prokaryotes, eukaryotes, unicellular, multicellular, compartmentation of functions in lower and higher organisms, and common physiological events of organisms, chemical composition of living organisms, subcellular organelles, SI units, mass, volume, temperature, amount, length and time. An overview on the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases, Avogadro's number, molarity, normality, molality, Dalton concept, mole concept, concentration, mole to molar conversion, oxidation number and

its significance, density and specific gravity, their significances.

### **Unit-2: Atomic structure and Chemical bonds:**

**14 Hrs.**

Structure of an atom, electrons and Quantum numbers, orbitals, shapes of orbitals, s, p, d, and f subshells, K, L, M, N, O, P, and Q shells. Illustration of Pauli's exclusion principle, Aufbau principle, and Hund's rule, electron configuration, octet rule. Formation and properties of noncovalent and covalent bonds, hydrogen bonds, ionic bonds, van der Waals interactions, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and co-ordinate bonds, back bonding. Corresponding energy associated, outline of theories of bonding.

### **Unit-3: Buffers and Colligative properties:**

**14 Hrs.**

Acids, bases, Arrhenius concept, proton transfer theory, Lewis concept, Lowry and Bronsted concepts. Buffers, composition, pH, pH scale, Henderson- Hasselbalch equation, titration curve of  $\text{H}_3\text{PO}_4$ , pK value, isoelectric pH, ionization of  $\text{HCl}$ ,  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ . Colligative properties and anomalous colligative properties of solutions, structure of water, phase diagram of pure water, ionic product of water, special properties of water, buffers in animal system. Solutions and types, ionizable solutes, non-ionizable solutes, vapor pressure and its application in distillation, Vant Hoff law, Roul't's law, boiling point, freezing point, de-icing, osmosis and osmotic pressure determination, reverse osmosis, surface tension.

### **Unit-4: Electrochemistry and Redox reactions:**

**14 Hrs.**

Scope of electrochemistry, electrochemical cells, Daniel cell, galvanic cell, electrode potential and its measurement, electrolysis, types of electrolytes, primary and secondary batteries, electrodes, half-cell reaction, standard electrodes. Laws of thermodynamics, entropy and enthalpy, their relation, Gibb's energy, free energy change, Lewis concept, ions, redox reactions, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biological active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt,  $\text{NAD}^+/\text{NADH}$ ,  $\text{NADP}^+/\text{NADPH}$ ,  $\text{FAD}/\text{FADH}_2$ ,  $\text{FMN}/\text{FMNH}_2$ . Molecularity and order of a reaction.

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### **DSCP-1: VOLUMETRIC ANALYSIS (PRACTICAL): 2 Credits 56 Hrs.**

#### **LIST OF EXPERIMENTS**

1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.
2. Calibration of volumetric glassware's (Burette, pipette).
3. Preparation of standard Sodium carbonate solution, standardization of  $\text{HCl}$  (Methylorange) and estimation of  $\text{NaOH}$  in the given solution. (methyl orange or phenolphthalein).



4. Preparation of standard Oxalic acid. Standardization of NaOH and estimation of  $\text{H}_2\text{SO}_4$  in the given solution (phenolphthalein).
5. Preparation of standard Oxalic acid. Standardization of  $\text{KMnO}_4$  and estimation of  $\text{H}_2\text{O}_2$  in the given solution.
6. Preparation of standard  $\text{K}_2\text{Cr}_2\text{O}_7$ . Standardization of  $\text{Na}_2\text{S}_2\text{O}_3$  and estimation of  $\text{CuSO}_4$  in the given solution.
7. Preparation of  $\text{ZnSO}_4$ . Standardization of EDTA and estimation of total hardness of water using Eriochrome-Black-T indicator.
8. Preparation of standard potassium bipthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
9. Estimation of sulphuric acid and oxalic acid in a mixture using standard NaOH solution and standard  $\text{KMnO}_4$  solution.
10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).
11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
12. Preparation of standard potassium bi-phthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids.
13. Preparation of standard Oxalic acid solution. Standardization of  $\text{KMnO}_4$  solution and estimation of calcium in milk.

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2. Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5th edition, Pearson Publication.
3. Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication.
4. Inorganic Chemistry, 2015, Overton, Rourke, Weller, Armstrong and Hagerman, Oxford Press.
5. Physical Chemistry: A molecular approach, 2019, Donald A, McQuarrie and Simon JD, Viva Books Publication.
6. Physical chemistry 2019, Atkins P, Paula JD, Keeler J, 11th edition, Oxford press.
7. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
8. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
9. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
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11. Instrumental Methods of chemical Analysis B.K Sharma.
12. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata McGraw Hill
13. Advanced Practical Physical Chemistry J.B. Yadav, Goel Publishing House
14. Advanced Experimental Chemistry. Vol-I J.N. Gurtu and R Kapoor, S. Chand and Co.
15. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
16. General Chemistry experiment – Anil J Elias (University press).



17. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
18. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
19. Practical Chemistry Dr O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
20. College Practical Chemistry. V K Ahluwalia, SunithaDingra, Adarsh Gulati
21. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication

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### Open Elective Course:

#### **OE-1: BIOCHEMISTRY IN HEALTH AND DISEASES (THEORY): 3 Credits 42 Hrs.**

**Course Outcome:** This open elective course offering to students of various streams gives knowledge about health and various terminologies used in health and disease conditions; Difference between communicable and non-communicable diseases; Health promotion and treatments for various diseases and disorders.

**Pedagogy:** MOOC/desk work/book chapter/problem solving /assignment.

##### **Unit-1: Introduction:**

**14 Hrs.**

WHO definition of health, Health and hygiene, General health care, Factors affecting health, Indices and evaluation of health, Disease patterns in developed and developing world; Classification of diseases - Endemic, Epidemic, Pandemic; Professional health hazards.

Disease conditions: Acute disease, Chronic disease, Incurable disease, Terminal disease, Illness, disorders, Syndrome, Pre-disease.

Treatment: Psychotherapy, Medications, Surgery, Medical devices, and Self-care. Dimensions of Health: Physical, Mental, Spiritual, Emotional, Environmental, and Philosophical.

##### **Unit-2: Communicable Diseases:**

**14 Hrs.**

Tuberculosis, Cholera, Typhoid, Conjunctivitis.

Sexually transmitted diseases (STD): Information, statistics, and treatment guidelines for STD, Prevention: Syphilis, Gonorrhea, AIDS, etc.

Non-communicable diseases: Malnutrition- Under nutrition, Over nutrition, Nutritional deficiencies; Anemia, Stroke, Rheumatic heart disease, Coronary heart disease, Cancer, blindness, accidents, mental illness, Iodine deficiency, Fluorosis, Epilepsy, Asthma.

Genetic disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Thalassemia, Sickle cell anemia.

Lifestyle disorders: Obesity, Liver cirrhosis, Diabetes mellitus, Hypertension (Causative agents, symptoms, diagnosis, treatment, prognosis, prevention).

##### **Unit-3: Health Promotions:**

**14 Hrs.**

Preventing drug abuse, Oral health promotion by tobacco control.

Mental hygiene and mental health: Concepts of mental hygiene and mental health, Characteristics of mentally healthy person, Warning signs of poor mental health, Promotive mental health, strategies and services, Ego defense mechanisms and

implications, Personal and social adjustments, Guidance and Counseling.

Infection control: Nature of infection, Chain of infection transmission, Defences against infection transmission.

### REFERENCE BOOKS

1. Modern Nutrition in Health and Disease 2006 10th Edition by Maurice E. Shils, Moshe Shike, A Catharine Ross.
2. Clinical Biochemistry and Metabolic Medicine, 2012 Eighth Edition by Martin Andrew Crook, CRC Press,
3. Nutrition & Health in Developing Countries, 2000, Editors: R. Semba and M.W. Bloem, Humana Press.

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## II SEMESTER

### DSC-2: CHEMICAL FOUNDATIONS OF BIOCHEMISTRY -2 (THEORY):

**4 Credits**

**56 Hrs.**

**Course Outcome:** These topics will enable students to understand the fundamentals of chemical processes in biological systems; Aptitude, Critical thinking, Subject clarity, Analytical Skill.

**Pedagogy:** MOOC/desk work/book chapter/problem solving /assignment.

#### Unit-1: Chemical Catalysis:

**14 Hrs.**

Definition, characteristics, types, intermolecular, multifunctional, theories of catalysis, properties, characteristics of enzyme catalysis, autocatalysis, industrial catalysis and their role in biological systems (brief). Colloids: true solutions, classification, peptisation, purification, ultrafiltration, Brownian movements, electric properties, coagulation, mutual, lyophilic sols, boiling, dialysis, electro and persistent dialysis, addition of electrolytes, colloids in daily life and applications. Emulsion, types, micelles with biomolecules and its biological applications.

#### Unit-2: Nomenclature of Organic Compounds:

**14 Hrs.**

Classification, naming- IUPAC nomenclature, compounds containing one, twofunctional groups with chains, homologous series. Stereochemistry, geometrical and structural Isomerism, conformation and free rotation. Optical isomerism, symmetry of elements, plane polarized light and optical purity. Nomenclature of enantiomers, epimers, racemic mixture, resolution. Fischer and Newman projection formulae, molecule with one and two chiral and achiral centers. Priority rules; E and Z (CIP rules), R and S, D and L notations, absolute (r and s) and relative (d and l) configuration. Role of stereochemistry in biological systems.

#### Unit-3: Organometallic Compounds:

**14 Hrs.**

Metal atom linked organic compounds. Preparation of Grignard reagents and structure, limitations, protonolysis and reactions. Organolithium compounds, preparation and

reactions. Organozinc compounds. Organoboranes its mechanisms. Ferrocenes.

Introduction to mineral and ores, classification, concentration, extraction, refining, uses of minerals and metals and its importance.

Porphyrins and Metal ions: Role of metal ions in biological systems, Fe, Cu, Zn. Structure and functions of porphyrins, metalloporphyrins and iron-sulphur clusters with suitable examples and their role in biological systems.

#### **Unit-4: Inorganic Chemistry:**

**14 Hrs.**

Nomenclature of inorganic molecules and coordination compounds, formula. IUPAC nomenclature. Central metal ion, ligand, coordination number, sphere, complex ion, oxidation number of central atom, homoleptic and heteroleptic complexes. Isomerism in complexes, structural, ionisation, solvate, linkage and coordination, Stereoisomerism, geometrical, optical isomerism with simple inorganic complexes. Applications of qualitative, quantitative analysis, photographic, metallurgy, medicine, catalysis and biosystems.

Heavy Metal Poisons: Introduction, poisons, lead, mercury, aluminium, arsenic, corrosives, cyanide, irritants, phosphorus, CO<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, halides and acid fumes, poisoning, sources, signs and symptoms. Free radicals: introduction, definition, generation and scavenger systems. Redox reactions, types, stock notations, change in oxidation number and combination. Endergonic and exergonic reactions with examples. The Importance in biological systems.

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#### **DSCP-2: QUALITATIVE AND QUANTITATIVE ANALYSIS (PRACTICAL):**

**2 Credits**

**56 Hrs.**

**Course Outcome:** The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

**Pedagogy:** MOOC/desk work/book chapter/problem solving /assignment.

#### **LIST OF EXPERIMENTS**

1. Systematic Semi micro–Qualitative Analysis of Inorganic Salt Mixtures Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganic salt mixture. The constituent ions in the mixture to be restricted to the following. (Any four binary mixtures shall be given)

Anions: HCO<sup>-</sup>, CO<sub>3</sub><sup>2-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, NO<sup>-</sup>, BO<sub>3</sub><sup>3-</sup>, SO<sub>3</sub><sup>2-</sup> and PO<sub>3</sub><sup>3-</sup>.

Cations: Pb<sup>2+</sup>, Al<sup>3+</sup>, Fe<sup>3+</sup>, Fe<sup>2+</sup>, Mn<sup>2+</sup>, Zn<sup>2+</sup>, Ca<sup>2+</sup>, Sr<sup>2+</sup>, Ba<sup>2+</sup>, Mg<sup>2+</sup>, K<sup>+</sup>, Na<sup>+</sup> and NH<sup>+</sup>.

2. Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
3. Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.

4. Determination of molecular weight of non-volatile solute by Walker-Lumsden method.
5. Determination of rate constant of decomposition of  $\text{H}_2\text{O}_2$  using  $\text{KMnO}_4$  by volumetric analysis method using ferric chloride as catalyst.
6. Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbon tetrachloride.
7. Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures- Solid – Solid, Solid – Liquid, Liquid – Liquid).
8. Verification of Beer's Law. Estimation of unknown concentration of a biomolecule by using colorimeter.
9. Calibration of pH meter and determination of pH of aerated soft drinks.

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24. Practical Physical Chemistry- B. Viswanathan, P S Raghavan. MV Learning Publication.

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## Open Elective Course:

**OE-2: NUTRITION AND DIETETICS (THEORY):                      3 Credits                      42 Hrs.**

**Course Outcome:** On completion of this course, the students will be able to;

- The student will gain knowledge about energy requirements and the Recommended Dietary Allowances.
- The student will understand the functions and role of macronutrients, their requirements and the effect of deficiency and excess.
- The student learns the impact of various functional foods on our health.
- The student will be able to apply basic nutrition knowledge in making food choices and obtaining an adequate diet.
- The student gains competence in connecting the role of various nutrients in maintaining health and learn to enhance traditional recipes.

**Pedagogy:** MOOC/desk work/book chapter/problem solving /assignment.

### **Unit-1: Basic Concepts of Nutrition: 14 Hrs.**

Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children and pregnant women. Protein calorie malnutrition.

### **Unit-2: Macronutrients and Micronutrients: 14 Hrs.**

Carbohydrates- Digestible and non-digestible, Dietary fibers, Essential fatty acids, lipoproteins and cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories.

Vitamins-Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, Vitamin B12. Absorption of fat-soluble vitamins- A, D, E and K.

Micronutrients: Source, Daily requirement, functions and deficiency disease symptoms of Macro-minerals (Ca, P, and Cl) and micro minerals/trace elements (I, Fe, Zn and Se).

### **Unit-3: Dietetics and Diet Therapy: 14 Hrs.**

Introduction. Food pyramid. Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child, expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders.

Diet therapy: Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and or manage the gastrointestinal diseases (indigestion, peptic ulcer, constipation, diarrhea, steatorrhea, irritable bowel syndrome. Functional foods-based diet therapy for diabetes, cardiovascular disease and cancer.

**REFERENCE BOOKS**

1. Clinical Dietetics and Nutrition, 2002, Antia FP and Abraham P. Oxford University Press; 4th Edition. ISBN-10: 9780195664157.
2. Oxford Handbook of Nutrition and Dietetics, 2011, Webster-Gandy J, Madden A and Holds worth M. Oxford University Press, Print ISBN-13: 9780199585823.
3. Krause's Food, Nutrition and Diet therapy, 2003, Mahan KL and Escott-Stump S. Elsevier, ISBN: 9780721697840.
4. Human Nutrition and Dietetics. 1986, Passmore R. and Davidson S. Churchill Livingstone Publications, ISBN-10: 0443024863.
5. Rosemary Stanton's Complete Book of Food & Nutrition, 2007, Simon & Schuster Publishers, Australia, ISBN 10: 0731812999.
6. Food Science and Nutrition, 2018, Roday S. Oxford University Press Publishers, ISBN: 9780199489084/0199489084.
7. Food Science, 2007, Srilakshmi S. New Age International (P) Limited Publishers, ISBN: 9788122420227/ 8122420222.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1, and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****Note:** All sections are compulsory**PART-A**

Answer any FOUR of the following:

**5 x 2 = 10**

- Q1** a)  
 b)  
 c)  
 d)  
 e)  
 f)  
 g)

**PART-B**

Answer any FOUR of the following

**4 x 5 = 20****Q2 - Q7****PART-C**

Answer any THREE of the following (May include sub-questions

**3 x 10 = 30**

a, b)  
**Q8 - Q12**

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTERS (Applicable to DSCP-1 and DSCP-2):****Time: 03 Hours****Max. Marks: 25**

|          |                                                       |           |
|----------|-------------------------------------------------------|-----------|
| <b>1</b> | Write the principle and procedure of ..... experiment | <b>05</b> |
| <b>2</b> | Major experiment (Conduct and report the results)     | <b>10</b> |
| <b>3</b> | Minor Experiment (Conduct/observation)                | <b>05</b> |
| <b>4</b> | Viva-voce                                             | <b>05</b> |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Biotechnology**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

The Board of Studies in Biotechnology (UG) meeting was held on 26<sup>th</sup> Nov, 2021 at 11.00 AM in the chamber of Head of the Department of Biotechnology, Yuvaraja College, Mysuru-05. The Chairman welcomed the members of the Board for the meeting and placed the syllabus for discussion. The Board discussed the concept and papers of NEP B.Sc. BIOTECH 60:40I & II Semester viz. Core papers (DSC), Open elective (OE) and SEC (Skill Enhancement Course) adapted for I & II semesters and retained them as it is. However, question paper pattern with necessary modifications were made and approved. The following **Annexures** are enclosed along with the Proceedings:

**Annexures:**

1. The Syllabus of NEP and scheme of Examination for Theory and Practical-I and II semester scheme.
2. The panel of Examiners for the year 2021-22.

| Sl. No. | Members                                                                                                                     | Position | Signature/<br>Remarks |
|---------|-----------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. R. Chandavar Vidya,<br>BOS in Biotechnology<br>Yuvaraja College, Mysuru                                                 | Chairman | Sd/                   |
| 2.      | Dr. H.S. Aparna, Professor and Head,<br>DOS in Biotechnology, University of Mysore, Mysuru                                  | Member   | Absent                |
| 3.      | Prof. G.A. Ravi Shankar, Professor and Head,<br>Dept. of Biotechnology,<br>Dayanandasagar College of Engineering, Bengaluru | Member   | Absent                |
| 4.      | Dr. P. Ranjini, Assistant Professor,<br>Department of Biotechnology<br>Maharani's Science College for Women, Mysuru         | Member   | Sd/                   |
| 5.      | Dr. Giridhar Parvatam, Senior Principal Scientist,<br>Plant Cell Biotechnology Dept, CFTRI, Mysuru-570020                   | Member   | Sd/                   |
| 6.      | Mr. Abhijit Singh, Assistant professor and Head,<br>Dept. of Biotechnology, JSS College for women, Mysuru                   | Member   | Sd/                   |
| 7.      | Mrs. B. Ashwini, Research Scholar, Dept. of Biochemistry<br>University of Mysore, Yuvaraja College, Mysuru.                 | Member   | Absent                |

Finally, the Chairman thanked the members for their active participation, invaluable suggestions and co-operation.

26-11-2021  
Mysuru

Chairman,  
BOS in Biotechnology

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)         | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|------------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Cell Biology and Genetics (4+0+0)                   | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Cell Biology and Genetics (0+0+2)                  | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Biotechnology for human welfare (3+0+0)              | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Microbiological Methods and Techniques (4+0+0)      | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Microbiological Methods and Techniques (0+0+2)     | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Applications of Biotechnology in Agriculture (3+0+0) | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

### I SEMESTER

#### Programme outcome:

Competencies need to be acquired by a candidate securing B.Sc. (Basic) or B.Sc. (Hons) degree in Biotechnology. At the end of the course the student should be able to:

- Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects.
- Understanding concepts of Biotechnology and demonstrate knowledge acquired in interdisciplinary skills in cell biology, genetics, biochemistry, microbiology, and molecular biology.
- Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
- Critically analyze the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.
- Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
- Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.

- Critically analyze, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.
- Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.
- Learning and practicing professional skills in handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.
- Exploring the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
- Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries.
- Understanding and application of molecular biology techniques and principles in forensic and clinical biotechnology.
- Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

#### **Pedagogy:**

- The general pedagogy to be followed for theory and practical are as under. Lecturing, Tutorials, Group/Individual.
- Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation, and Innovative methods.
- Active learning as per LSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level 3. Case studies about application of microbial biomolecules in various industries.
- Seminar on topics of microbial biochemistry.
- Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project-based learning/ case studies/self-study like seminar, term paper or MOOC.
- Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

### **DSC-1: CELL BIOLOGY AND GENETICS (THEORY):      4 Credits      56 Hrs.**

#### **Unit-I:**

**14 Hrs.**

**Cell as a Basic unit of Living Systems and Cellular Organelles:** Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of prokaryotic and eukaryotic cell- (Both plant and animal cells).

**Surface Architecture:** Structural organization and functions of plasma membrane and cell wall of bacteria and plants.

**Cellular Organelles:** Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).

## Unit-2:

14 Hrs.

**Chromosomes and Cell Division:** General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi-stranded hypothesis, folded-fibre and nucleosome models. Special type of chromosomes: Salivary gland and Lampbrush chromosomes.

**Cell Division:** Cell cycle, phases of cell cycle, Regulation of cell cycle-, checkpoints and enzymes involved. Significance of cell cycle, interphase nucleus, stages of mitosis and meiosis, achromatic apparatus, synaptonemal complex. Cell Senescence and programmed cell death.

## Unit-3:

14 Hrs.

**Genetics: Mendelian Genetics:** Introduction and brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross.

**Gene interaction:** Deviations to Mendelian inheritance- Supplementary factors: comb pattern in fowls, Complementary genes- Flower colour in sweet peas, Multiple factors- Skin colour in human beings, Epistasis- Plumage colour in poultry (13:3), Multiple allelism: Blood groups in Humans- ABO and Rh.

**Maternal Inheritance:** Plastid inheritance in *Mirabilis*, Petite characters in yeast and Kappa particles in *Paramecium*. Sex-linked inheritance- Colour blindness, hemophilia, Y-linked traits.

## Unit-4:

14 Hrs.

**Linkage and Crossing Over:** Introduction, Chromosome theory of inheritance, Coupling and repulsion hypothesis, Linkage in maize and *Drosophila*, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.

**Chromosomal variations:** A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.

**Mutations:** Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Applications of mutations- plants, animals and microbes.

**Sex Determination in Plants and animals:** Concept of allosomes and autosomes, XX-XY, XX-XO, ZW-ZZ, ZO-ZZ types.

**Human Genetics:** Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat

Syndrome).

**Epigenetics:** Plant and humans.

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**DSCP-1: CELL BIOLOGY AND GENETICS (PRACTICAL): 2 Credits 56 Hrs.**

#### LIST OF EXPERIMENTS

1. Study and maintenance of simple and compound microscope.
2. Use of Micrometer and calibration, measurement of onion. epidermal cells and yeast.
3. Study of stages in mitosis from onion root tips.
4. Study of stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
5. Mounting of polytene chromosomes.
6. Buccal smear - Barr bodies.
7. Karyotype analysis - Human and Onion; Human – Normal and Abnormal – Down and Turner's syndromes.
8. Isolation and staining of Mitochondria.
9. Isolation and staining of Chloroplast.
10. RBC cell count by Haemocytometer.
11. Simple genetic problems based on theory.

**Note:** Each student is required to submit 2 permanent slides each of mitosis & meiosis.

#### REFERENCE BOOKS

1. Molecular Biology of Cell - Bruce Alberts et al, Garland publications.
2. Animal Cytology and Evolution- MJD, White Cambridge University Publications.
3. Molecular Cell Biology-Daniel, Scientific American Books.
4. Cell Biology - Jack d Bruke, The William Twilkins Company.
5. Principles of Gene Manipulations- Old & Primrose, Black Well Scientific Publications.
6. Cell Biology-Ambrose & Dorothy M Easty, ELBS Publications.
7. Fundamentals of Cytology- L. W. Sharp, McGraw Hill Company.
8. Cytology-Willson & Marrison, Reinform Publications.
9. Molecular Biology- Christopher Smith, Faber & Faber Publications.
10. Cell Biology & Molecular Biology – EDP De Robertis& EMF Robertis, Saunder College.
11. Cell Biology- C.B Powar, Himalaya Publications.
12. Basic Genetics- Daniel L. Hartl, Jones & Barlett Publishers USA.
13. Human Genetics and Medicine lark Edward Arnold P London.
14. Genetics – Monroe W Strickberger, Macmillain Publishers, New York.
15. Genes V - Benjamin Lewin, Oxford University Press.
16. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi.
17. Genes II - Benjamin Lewin, Wiley & Sons Publications.
18. Genes III- Benjamin Lewin, Wiley & Sons Publications.
19. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky, McGraw-Hill.

20. Genetics – Edgar Altenburg Oxford & IBH publications.
21. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications.
22. Genetics- P.K.Gupta, Rastogi Publication, Meerut, India.

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### Open Elective Course:

**OE-1: BIOTECHNOLOGY FOR HUMAN WELFARE (THEORY): 3 Credits 42 Hrs.**

**Unit-1: 14 Hrs.**

**Industry:** Introduction, Scope, branches and applications of Biotechnology.

Biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase). Applications of biotechnology in food, detergent and pharmaceutical industries.

**Unit-2: 14 Hrs.**

**Environment:** Application of biotechnology in environmental aspects: Bioremediation: Degradation organic pollutants, hydrocarbons and agricultural wastes, Superbug. Bioplastics and Biofuels.

**Unit-3: 14 Hrs.**

**Forensic and Health Sciences:** Application of biotechnology in forensic science: Solving crimes of murder and rape, paternity testing and theft using DNA finger printing techniques. Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, diagnostics-ELISA and PCR, human genome project.

### REFERENCE BOOKS

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra.
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Josef Winter.
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).

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## II SEMESTER

**Programme outcome:** At the end of the course the student should be able to:

- Would be able to comprehend the structure of a cell with its organelles.
- Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations.
- Can distinguish between the structure of prokaryotic and eukaryotic cell.

**Pedagogy:**

- Demonstrating the Laboratory skills in basic and applied microbiology with reference to technological aspects.
- Thorough knowledge and application of good laboratory and good manufacturing practices in biotech industries.

### **DSC-2: MICROBIOLOGICAL METHODS AND TECHNIQUES (THEORY):**

**4 Credits**

**56 Hrs.**

#### **Unit-1:**

**14 Hrs.**

**General Microbiology and Instrumentation:** General Introduction to Microbiology: Scope and relevance of microbiology, important contributions by Robert Koch, Leeuwenhoek, Jenner, Pasteur, Flemming, Ivanowsky. General account on structure, classification and reproduction of bacteria, virus and fungi.

**Microscopy:** Principles and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, Confocal microscope, Electron Microscopes- TEM and SEM. **Analytical techniques:** Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper, TLC, Column (adsorption, gel-filtration, ion exchange, affinity), HPLC, GC.

#### **Unit-2:**

**14 Hrs.**

**Sterilization techniques:** Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agent and antimicrobial agent.

**Physical methods of control:** Principle, construction and applications of moist heat sterilization- Pasteurization, Boiling, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization-Incineration and hot air oven. Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA. Radiation: Ionizing radiation- $\gamma$  rays and non-ionizing radiation- UV rays.

**Chemical methods:** Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents.

#### **Unit-3:**

**14 Hrs.**

**Microbiological techniques:**

**Culture Media:** Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media.

**Pure culture methods:** Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria.



**Microbial growth and its measurements:** Growth curve, enumeration methods (turbidity, cell counting, colony counting).

**Stains and staining techniques:** Principles of staining, Types of stains-simple stains, structural stains, negative stain and differential stains.

**Unit-4:**

**14 Hrs.**

**Antimicrobial agents:**

**Antibiotic sensitivity testing methods:** Disc and Agar well diffusion techniques.

**Five modes of action with one example each:** Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism.

**Antifungal agents:** Mechanism of action of Amphotericin B, Griseofulvin.

**Antiviral agents:** Mechanism of action of Amantadine, Acyclovir, Azidothymidine  
Antibiotic resistance, MDR, XDR, MRSA, NDM-1.

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**DSCP-2: MICROBIOLOGICAL METHODS AND TECHNIQUES (PRACTICALS):**

**4 Credits**

**56 Hrs.**

**LIST OF EXPERIMENTS:**

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
2. Sterilization of medium using Autoclave and assessment for sterility.
3. Sterilization of glassware using Hot Air Oven and assessment for sterility.
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility.
5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate and streak plate.
7. Isolation of bacteria and fungi from soil, water and air.
8. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts.
9. Colony characteristics study of bacteria from air exposure plate.
10. Staining techniques: Bacteria- Gram, Negative, Capsule, Endospore staining Fungi - Lactophenol cotton blue staining.
11. Water analysis - MPN test.
12. Biochemical Tests - IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis.
13. Bacterial cell motility - hanging drop technique.

**REFERENCE BOOKS**

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall.
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.



4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht.
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
9. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.
10. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications.
11. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications.
12. Introductory Biotechnology-R.B Singh C.B.D. India (1990).
13. Fundamentals of Bacteriology – Salley.
14. Frontiers in Microbial Technology-P.S. Bison, CBS Publishers.
15. Biotechnology, International Trends of perspectives A. T. Bull, G.
16. General Microbiology –C.B. Powar.

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### Open Elective Course:

#### OE-2: APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE (THEORY):

3 Credits

42 Hrs.

**Unit-1: Agricultural Biotechnology:** Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups, Small scale bioenterprises: Mushroom cultivation. **14 Hrs.**

**Unit-2: Transgenic plants:** The GM crop debate-safety, ethics, perception and acceptance of GM crops. GM crops case study: Bt cotton, Bt brinjal. Biopesticides: Baculovirus pesticides, Mycopesticides. Genetic Engineering for quality improvement: Golden rice, Seed storage proteins, Flavours- capsaicin, vanillin. **14 Hrs.**

**Unit-3: Molecular pharming and post-harvest protection:** Plants as bio-factories for molecular pharming: edible vaccines, plantibodies, nutraceuticals. Post-harvest Protection: Antisense RNA technology for extending shelf life of fruits and shelf life of flowers. Biosafety, bioethics and IPR. **14 Hrs.**

#### REFERENCE BOOKS

1. Chrispeels M.J.et al. Plants, Genes and Agriculture-Jones and Bartlett Publishers
2. Gamborg O.L. and Philips G.C. Plant cell, tissue and organ culture (2nd Ed.) Narosa Publishing House. New Delhi. 1998.

3. Hammound J, P McGravey & Yusibov.V. Plant Biotechnology, Springer verlag. 2000.
4. Heldt. Plant Biochemistry and Molecular Biology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi. 1997.
5. Lydiane Kyte and John Kleyn. Plants from test tubes. An introduction to Micropropagation (3 rd. Ed.). Timber Press, Portland. 1996.
6. Murray D.R. Advanced methods in plant breeding and biotechnology. Panima Publishing.
7. NickoloffJ.A. Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana press incorp, USA. 1995.
8. Sawahel W.A. Plant genetic transformation technology. Daya Publishing House, Delhi.
9. Gistou, P and Klu, H.Hand book of Plant Biotechnology (Vol. I & II).John Publication. 2004.
10. Sateesh M.K. 2008. Biosafety and Bioethics. Oxford and IBH Publishers.
11. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7<sup>th</sup> International, edition 2008, McGraw Hill.
12. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
13. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
14. Brock Biology of Microorganisms, M.T. Madigan, J.M. Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
15. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008, Pearson.
16. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
17. Microbiology- Concepts and Applications, PelczarJr, Chan, Krieg, McGraw Hill.
18. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
19. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
20. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
21. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub. Sudbury, 835 pp.
22. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
23. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1, and DSC-2 Papers)**

**Time: 02 Hours**

**Max. Marks: 60**

**Instructions:** Draw neat and labelled diagrams wherever necessary.

**PART-A**

**Q1** Answer ALL of the following (minimum one question from each unit): **5 x 1 = 5**

- a)
- b)
- c)
- d)
- e)

**PART-B**

**Q2** Write short notes on any **FIVE** of the following (minimum one question from each unit). **5 x 3 = 15**

- a)
- b)
- c)
- d)
- e)
- f)
- g)

**PART-C**

Write Explanatory note on any **FOUR** of the following (minimum one question from each unit). **5 x 4 = 20**

**Q3-Q8**

**PART-D**

Answer any **TWO** of the following (Descriptive).

**10 x 2 = 20**

**Q9-Q11**

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**SCHEME OF PRACTICAL EXAMINATION**

**I SEMESTER:**

**DSCP-1: Cell Biology and Genetics Practical**

**DSCP-2: Microbiological Methods and Techniques Practical**

**Time: 03 Hours**

**Max. Marks: 25**

- Major experiment (Procedure-03 Marks; Conducting Experiment-04 Marks; Result & Report-03 Marks = Total 10 Marks).
- Minor experiment (Procedure-02 Marks; Conducting Experiment-03 Marks; Result & Report-02 Marks = Total 07 Marks).
- Comments-2 (Identification-01 Mark each; Diagram/Comment-1.5 M each = 2.5x2 = 5 Marks).
- Viva-Voce-03 Marks.

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**II SEMESTER:****DSCP-2: Microbiological Methods and Techniques Practical****Time: 03 Hours****Max. Marks: 25**

|                                                          |   |                |
|----------------------------------------------------------|---|----------------|
| Major experiment (from practical 10 & 11)                | - | 10 Marks       |
| Minor experiment/ Demonstration (any one from 6, 12, 13) | - | 07 Marks       |
| Comment on A & B (any two from 1, 2, 3, 4, 5, 8, 9)      | - | 2.5X2=05 Marks |
| Viva-Voce                                                | - | 03 Mark        |

1. Major experiment (Procedure 03; Conducting Experiment 04; Result & Report 03= Total 10)
2. Minor experiment (Procedure 02; Conducting Experiment 03; Result & Report 02= Total 07)
3. Comment (Identification 01 M; Diagram/Comment 1.5= 2.5 M each)

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Botany**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

the Board of Studies meeting in Botany (UG), Yuvaraja College was held in the Chamber of Head of the department, Department of Botany, Mysuru, on 26<sup>th</sup> November 2021 at 11.00 AM. The Chairperson of the BOS welcomed the members for the meeting and placed the following agenda for discussion:

| Sl. No. | Members                                                                                                                  | Position | Signature/<br>Remarks |
|---------|--------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. K.A. Sharvani, HOD & Associate Professor,<br>Department of Botany, Yuvaraja College,<br>University of Mysore, Mysuru | Chairman | Sd/                   |
| 2.      | Dr. M. K. Mahesh, Professor, Department of Botany,<br>Yuvaraja College, University of Mysore, Mysuru                     | Member   | Sd/                   |
| 3.      | Sri. G. Krishnamurthy, Associate Professor,<br>Department of Botany, Yuvaraja College,<br>University of Mysore Mysuru    | Member   | Sd/                   |
| 4.      | Dr. K. Krishna. Professor, Department of Botany,<br>Yuvaraja College, University of Mysore Mysuru                        | Member   | Sd/                   |
| 5.      | Dr. Sowmya R. Associate Professor,<br>Department of Botany, Yuvaraja College,<br>University of Mysore Mysuru             | Member   | Sd/                   |
| 6.      | Dr. N. S. Suresh<br>Associate Professor, Department of Botany,<br>Govt. Maharani's College for Women, Mysuru             | Member   | Sd/                   |
| 7.      | Dr. Shivalingaiah<br>Associate Professor, Department of Botany,<br>Govt. Maharani's College for Women, Mysuru            | Member   | Absent                |
| 8.      | Dr. Manoj Kumar Mishra, Divisional Head, Plant Biotech<br>Centre, Coffee Board, Mysuru                                   | Member   | Sd/                   |
| 9.      | Dr. Dharma Prasad<br>Managing Director, PROSETTA, Hootagalli, Mysuru                                                     | Member   | Sd/                   |
| 10      | Dr. Devika M.<br>Principal Saradavilas College, Mysuru                                                                   | Member   | Sd/                   |
| 11      | Dr. Venkata Rao<br>Assistant Professor, College of Horticulture<br>Yalachahalli, Yelwala, Mysuru                         | Member   | Absent                |
| 12      | Dr. N. S. Devaki, Course Co-ordinator,<br>Molecular Biology, Yuvaraja College, Mysuru                                    | Member   | Sd/                   |

1. Review of syllabus for I, II, III and IV semester (Modified CBCS Scheme 2019-20 onwards).
  2. Proposing Tittles for V and VI Semester (Modified CBCS Scheme 2019-20 onwards).
  3. Framing new syllabus for V and VI Semester (Modified CBCS Syllabus 2018-19 onwards).
  4. Preparation of list of Examiners.
    - The Board reviewed the syllabus for I, II, III and IV semester (Modified CBCS Scheme 2019 2020 onwards) and approved the same.
    - The Board proposed the Tittles for V and VI Semester (Modified CBCS Scheme 2019 2020 onwards) and approved the titles.
    - The Board framed syllabus for V and VI Semester (Modified CBCS Syllabus 2018 -2019 onwards) and approved the same.
    - The Board also prepared the list of Examiners and approved.
- The Following Annexure are attached along with the proceedings.

#### Annexures:

1. Updated theory and practical syllabus; scheme of examination for I, II, III and IV Semester (Modified CBCS Scheme 2019-20 onwards).
2. The Tittles of papers for V and VI Semester (Modified CBCS Scheme 2019-20 onwards)
3. Updated theory and practical syllabus, scheme of examination for V and VI, Semester (Modified CBCS Syllabus 2018-19 onwards).
4. The updated list of Examiners for the academic year 2020-2021.

The Chairperson thanked the members for their active participation and cooperation.

Sd/-  
Chairperson

#### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)       | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Microbial<br>Diversity and Technology<br>(4+0+0)  | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Microbial<br>Diversity and Technology<br>(0+0+2) | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Plants and Human<br>Welfare (3+0+0)                | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Diversity of Non-<br>Flowering Plants (4+0+0)     | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Diversity of Non-<br>Flowering Plants (0+0+2)    | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Plants and Human<br>Welfare (3+0+0)                | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

## I SEMESTER

**Programme outcome:** At the end of the course the student should be able to:

- Understand the fascinating diversity, evolution, and significance of microorganisms.
- Comprehend the systematic position, structure, physiology and life cycles of microbes and their impact on humans and environment.
- Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

### DSC-1: MICROBIAL DIVERSITY AND TECHNOLOGY (THEORY):

**4 Credits**

**56 Hrs.**

#### Unit-I

**14 Hrs.**

**Chapter 1: History and developments of microbiology** - Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and Paul Ehrlich). Microscopy-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM).

**7 Hrs.**

**Chapter 2: Microbial diversity** - Introduction to microbial diversity; Methods of estimation; Hierarchical organization and positions of microbes in the living world. Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature.

**Sterilization methods** - Principle of disinfection, antiseptic, tyndallisation and Pasteurization, **Sterilization**-Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents.

**7 Hrs.**

#### Unit-2

**14 Hrs.**

**Chapter 3: Culture media for Microbes**-Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media,transport media, and storage media.

**Microbial cultures and preservation** - Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.

**7 Hrs.**

**Chapter 4: Microbial Growth**-Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs. Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram's and differential staining.

**7 Hrs.**

#### Unit-3

**14 Hrs.**

**Chapter 5: Viroids**- General characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses. Mycoplasmas and Phytoplasmas- General characteristics and diseases.



**Viruses-** General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types. **7 Hrs.**

**Chapter 6: Bacteria-** General characteristics and classification. Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of *Rhizobium* and its applications. Economic importance of Bacteria. A brief account of Actinomycetes and Cyanobacteria. **7 Hrs.**

**Unit-4** **14 Hrs.**

**Chapter 7: Fungi-**General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of *Phytophthora*, *Rhizopus*, *Neurospora*, *Puccinia*, *Penicillium* and *Trichoderma*. Economic importance of Fungi. **7 Hrs.**

**Chapter 8: Lichens** – Structure and reproduction. **VAM Fungi** and their significance. **Plant diseases** - Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker, Root Knot Disease of Mulberry. **7 Hrs.**

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**DSCP-1: MICROBIAL DIVERSITY AND TECHNOLOGY (PRACTICAL): 2 Credits 56 Hrs.**

#### LIST OF EXPERIMENTS

1. Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, LAF, Colony counter, Haemo cytometer, Micrometer etc.).
2. Enumeration of soil/food /seed microorganisms by serial dilution technique.
3. Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E. coli*/ *B. subtilis*/ Fungi and study of cultural characteristics.
4. Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.
5. Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.
6. Isolation and study of morphology of *Rhizobium* from root nodules of legumes.
7. Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.
8. Study of vegetative structures and reproductive structures - *Albugo*, *Phytophthora*, *Rhizopus*, *Saccharomyces*, *Puccinia*, *Agaricus*, *Lycoperdon*, *Penicillium*, (Depending on local availability).
9. Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.
10. Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobaccomosaic disease, Sandal spike disease.
11. Study of well-known microbiologists and their contributions through charts and photographs (As mentioned in theory).

12. Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory).

### REFERENCE BOOKS

1. Ananthnarayan R and Panikar JCK. 1986. Text Book of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C. Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi Publications. Meerut.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Ltd., New Delhi.
9. Alexopoulos CJ, Mims CW. 1989. Introductory Mycology, Wiley Eastern. New Delhi.
10. Allas RM. 1988. Microbiology: Fundamentals and Applications, MacMillan Publishing Co. New York.
11. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4<sup>th</sup> Ed. Eaglewood Cliffs. N.J. Prentice- Hall. New Delhi.
12. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge University Press. Cambridge.
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14. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
15. Michel J, Pelczar Jr. EC and Krieg CR. 2005. Microbiology, McGraw-Hill, New Delhi.
16. Powar CB and Dagainawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house, Bombay.
17. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
18. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
19. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. 587pp.
20. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5<sup>th</sup> edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
21. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford, New Delhi.

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## Open Elective Course:

### OE-1: PLANTS AND HUMAN WELFARE (THEORY):

3 Credits 42 Hrs.

#### Course Outcome:

On completion of this course, the students will be able to;

- To make the students familiar with economic importance of diverse plants that offer resources to human life.
- To make the students known about the plants used as-food, medicinal value and also plant source of different economic value.
- To generate interest amongst the students on plants importance in day today life, conservation, ecosystem and sustainability.

**Pedagogy:** Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc.

**Unit I:** Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation.

**Unit II: Cereals:** Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses). Green revolution. Brief account of millets and their nutritional importance.

**Unit III: Legumes:** General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem.

**Unit IV: Fruits:** Mango, grapes and Citrus (Origin, morphology, cultivation, processing and uses).

**Unit V: Cash crops:** Morphology, new varieties and processing of sugarcane, products and by-products of sugarcane industry. Natural Rubber –cultivation, tapping and processing.

**Unit VI: Spices:** Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom.

**Unit VII: Beverages-** Tea, Coffee (morphology, processing & uses).

**Unit VIII: Oils and fats:** General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications.

**Unit IX: Essential Oils:** General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents.

**Unit X: Drug-yielding plants:** Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera and Cannabis.

**Unit XI: Fibers:** Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).

**Unit XII: Forests:** Forest and forest products. Community forestry. Concepts of reserve forests, sanctuaries and national parks with reference to India. Endangered species and red data book.

### REFERENCE BOOKS

1. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett – Publishers.

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## II SEMESTER

**Programme outcome:** At the end of the course the student should be able to:

- Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
- Understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms, and their ecological and evolutionary significance.
- Obtain laboratory skills/explore non-flowering plants for their commercial applications.

**DSC-2: DIVERSITY OF NON- FLOWERING PLANTS (THEORY): 4 Credits 56 Hrs.**

**Unit-I 14 Hrs.**

**Chapter 1:** Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae. Morphology and reproduction and life-cycles of *Nostoc*, *Oedogonium*, *Chara*, *Sargassum* and *Batrachospermum*. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins. **10 Hrs.**

**Chapter 2:** Algal cultivation- Cultivation of microalgae-*Spirulina* and *Dunaliella*; Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses. **4 Hrs.**

**Unit-2 14 Hrs.**

**Chapter 3:** Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes. Distribution, morphology, anatomy, reproduction and life-cycles of *Riccia*, *Anthoceros*, and *Funaria*. Ecological and economic importance of Bryophytes. Fossil Bryophytes. **10 Hrs.**

**Chapter 4: Pteridophytes-** General characteristics and classification; Stellar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Structure of sporophytes and life-cycles. **4 Hrs.**

**Unit-3** **14 Hrs.**

**Chapter 5:** A brief account of heterospory and seed habit. Distribution, morphology, anatomy, reproduction and life-cycles in *Selaginella*, *Equisetum*, *Pteris* and *Salvinia*. Ecological and economic importance. **7 Hrs.**

**Chapter 6: Gymnosperms** – General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, distribution, habit, anatomy reproduction and life-cycles in *Cycas*, *Pinus* and *Gnetum*. **7 Hrs.**

**Unit-4** **14 Hrs.**

**Chapter 7:** Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines.

**Origin and evolution of Plants:** Origin and evolution of plants through Geological Time scale.

**Paleobotany-** Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. **10 Hrs.**

**Chapter 8:** Fossil taxa- *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Lyginopteris* and *Cycadeoidea*. Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences. **4 Hrs.**

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**DSCP-2: DIVERSITY OF NON- FLOWERING PLANTS (PRACTICAL):**  
**2 Credits** **56 Hrs.**

#### LIST OF EXPERIMENTS

1. Study of morphology, classification, reproduction and life cycle of *Nostoc*.
2. Study of morphology, classification, reproduction and life-cycle of *Oedogonium* & *Chara*, *Sargassum*, *Batrachospermum*/ *Polysiphonia*.
3. Study of morphology, classification, reproduction and life-cycle of *Riccia*/ *Marchantia* & *Anthoceros*.
4. Study of morphology, classification, anatomy, reproduction and life-cycle of *Selaginella* and *Equisetum*.
5. Study of morphology, classification, anatomy, reproduction and life-cycle of *Pteris*, *Azolla*.
6. Study of morphology, classification, anatomy and reproduction in *Cycas*.
7. Study of morphology, classification & anatomy, reproduction in *Pinus*.
8. Study of morphology, classification & anatomy, reproduction in *Gnetum*.
9. Study of important blue green algae causing water blooms in the lakes.
10. Study of different methods of cultivation of ferns in a nursery.
11. Preparation of natural media and cultivation of *Azolla* in artificial ponds.
12. Media preparation and cultivation of *Spirulina*.

13. Study different algal products and fossils impressions and slides/Photographs.
14. Visit to algal cultivation units/lakes with algal blooms/Fern house/Nurseries/Geology museum/lab to study plant fossils.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory).

#### REFERENCE BOOKS

1. Chopra, G.L. A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
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25. Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge University Press, Cambridge.
26. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

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### Open Elective Course:

#### OE-2: PLANT PROPAGATION, NURSERY MANAGEMENT AND GARDENING (THEORY): 3 Credits 42 Hrs.

**Course Outcome:** On completion of this course, the students will be able to;

- To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
- To get knowledge of new and modern techniques of plant propagation.
- To develop interest in nature and plant life.

**Pedagogy:** Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc.

**Unit I: Nursery:** Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/synthetic growth mediums for pots and nursery.

**Unit II: Seed:** Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification.

**Unit III: Vegetative propagation:** Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants. Green house, mist chamber, shed root, shade house and glass house.

**Unit IV: Gardening:** Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

**Unit V: Sowing/raising of seeds and seedlings:** Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, ferns, petunia, orchids, etc. Storage and marketing procedures. Developing and maintenance of different types of lawns. Bonsai technique.

### REFERENCE BOOKS

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
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3. Jules, J. (1979). Horticultural Science, 3rd edition. San Francisco, California: W.H. Freeman and Co.
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5. Musser E., Andres. (2005). Fundamentals of Horticulture. New Delhi, Delhi: McGraw Hill..
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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****Instructions:** Draw neat and labelled diagrams wherever necessary.**PART-A**

Define/ Explain the following:

**4 x 1 = 4**

(2 from Unit I; 1 Each from Unit III and Unit IV)

- Q1** a)  
 b)  
 c)  
 d)

**PART-B**

Write short notes on any FOUR of the following

**4 x 3 = 12**

(1 from Unit I; 2 from Unit II; 2 from Unit III)

- Q2** a)  
 b)  
 c)  
 d)  
 e)

**PART-C**

Answer any FOUR of the following

**4 x 5 = 20**

(1 each from Unit I, II and III; 2 from Unit IV)

**Q3 -Q7****PART-D**

Describe any THREE of the following in detail.

**3 x 8 = 24**

(1 each from Unit I, II, III and IV)

**Q8 -Q11**

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**SCHEME OF PRACTICAL EXAMINATION****I SEMESTER: DSCP-1: Microbial Diversity and Technology Practical****Time: 03 Hours****Max. Marks: 25**

- Write critical notes on A, B & C.** 3 x 2 = 06 Marks  
A and B- Microbial Instruments (As mentioned in the syllabus) C- Microbiologists (As mentioned in the Syllabus) (Identification- 1 Mark, Application/Contribution- 1 Mark).
  - Bacterial staining D -Simple / Gram's staining.** 05 Marks  
(Preparation- 3 Marks; Flow chart- 2 Marks).
  - Prepare a temporary stained slide E of the given material and leave the preparation for evaluation.** 05 Marks  
(*Rhizobium, Rhizopus, Saccharomyces, Penicillium*) (Identification- 1 Mark, Mounting- 2 Marks, Diagram with reasons- 2 Marks).
  - Identify the Specimens F & G.** 2 x 3 = 06 Marks  
(F- Albugo, Phytophthora, Agaricus, Lycoperdon) (G - Plant Diseases (As Mentioned in the Syllabus)) (Identification with Diagram - 2 Marks, Reason – 1Mark).
  - Identify the Permanent Slide H.** 03 Marks  
(Fungi/Pathology) (Identification & Diagram- 2 Marks, reasons- 1 Marks).
- Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**II SEMESTER:****DSCP-2: Diversity of Non- Flowering Plants Practical****Time: 03 Hours****Max. Marks: 25**

- Prepare a temporary stained slide of the given material A and leave the preparation for evaluation.** 05 Marks  
Algae (*Nostoc, Oedogonium, Chara, Batrachospermum/Polysiphonia*) (Preparation - 2 Marks, Diagram-1 Mark, Identification with Reasons- 2 Marks).
  - Identify the given specimens B & C.** 2 x 3 = 06 Marks  
B-Bryophytes (*Marchantia* and *Anthoceros*); C-Pteridophytes (*Selaginella, Equisetum, Pteris, Azolla*)(Identification- 1 Mark, Diagram with reasons- 2 Marks).
  - Identify the Permanent Slides D, E, F & G.** 4 x 2 = 08 Marks  
(One each from Algae, Bryophyte, Pteridophyte and Gymnosperms) (Identification- 1 Mark, Diagram with Reasons-1 Marks).
  - Comment on H & I.** 2 x 3 = 06 Marks  
H- Gymnosperm I-Fossils. (Identification- 1 Mark, Diagram with Reasons- 2 Marks).
- Note:** Duly certified practical record shall be submitted at the practical examination.

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**Bachelor of Science (Basic/Hons.) Degree in Chemistry**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

The meeting of the Board of Studies (UG) in Chemistry, YCM was held on 23<sup>rd</sup> November 2021 at 11.00am in the Department of Chemistry, Yuvaraja's College, Mysuru.

| Sl. No. | Members                                                                        | Position | Signature/<br>Remarks |
|---------|--------------------------------------------------------------------------------|----------|-----------------------|
| 1.      |                                                                                | Chairman | Sd/                   |
| 2.      | Dr. Ajay Kumar, Department of Chemistry,<br>Yuvaraja College, Mysuru.          | Member   | Sd/                   |
| 3.      | Dr.B.M. Venkatesha, Department of Chemistry,<br>Yuvaraja College, Mysuru.      | Member   | Sd/                   |
| 4.      | Dr.K.B. Umesha, Department of Chemistry,<br>Yuvaraja College, Mysuru.          | Member   | Sd/                   |
| 5.      | Dr.B.S. Sudha, Department of Chemistry,<br>Yuvaraja College, Mysuru.           | Member   | Sd/                   |
| 6.      | Dr.D.G. Bhadre Gowda, Department of Chemistry,<br>Yuvaraja College, Mysuru.    | Member   | Sd/                   |
| 7.      | Dr. Bibi Ahmadi Khatoon, Department of Chemistry,<br>Yuvaraja College, Mysuru. | Member   | Sd/                   |
| 8.      | Dr.M.N. Kumara, Department of Chemistry,<br>Yuvaraja College, Mysuru.          | Member   | Sd/                   |
| 9.      | Dr. Devaraj, Department of Chemistry,<br>Yuvaraja College, Mysuru.             | Member   | Sd/                   |
| 10      | Dr. R.T. Radhika, Maharani's Science College for Women,<br>Mysuru              | Member   | Sd/                   |
| 11      | Dr.C.N. Kavitha, Maharani's Science College for Women,<br>Mysuru               | Member   | Sd/                   |
| 12      | Dr. Amruthraj, Apotex pharmachem India Pvt. Ltd.<br>Bangaluru                  | Member   | Sd/                   |
| 13.     | Dr.B. Manju, Maharaja Institute of Technology, Mysore                          | Member   | Sd/                   |
| 14      | Dr. Shaukath Ara Khanum, Department of Chemistry,<br>Yuvaraja College, Mysuru. | Member   | Absent                |
| 15      | Dr. H. P. Jayadevappa, Department of Chemistry,<br>Yuvaraja College, Mysuru.   | Member   | Absent                |
| 16      | Dr. B.K. Kendagannaswamy, JSS College, Nanjanagud.                             | Member   | Absent                |
| 17      | Dr. B.J. Ullas, R&D Department, Jubilant Generics Ltd.<br>Nanjanagud, Mysore   | Member   | Absent                |

**Agenda**

1. Approval of B.Sc. I and II Semester new syllabus [NEP-2020].
  - The board discussed and approved the syllabus (as approved by the University of Mysore) for B.Sc. I and II semester for the year 2021-22 onwards as per NEP 2020 (**Annexure- I**).
2. Revision of B.Sc. III<sup>rd</sup> to VI<sup>th</sup> semester CBCS Syllabus (If any).
  - The Board resolved to incorporate any modifications and/or suggestions relating to the syllabus/scheme of examination by the University of Mysore from time to time.
3. Approval of list of Panel of Examiners for 2021-22.
  - The Board prepared and approved the question paper model and Scheme of Examination for Practical Examination for the B.Sc. I and II semester for the year 2021-22 onwards as per NEP 2020 (**Annexure- II**).
4. Any other subject with the permission of chair.
  - The Board reviewed the existing new CBCS syllabus for V and VI semesters.
  - The Board approved the list of panel of internal and external examiners for 2021-22 examinations (**Annexure - III**).

The Chairperson Prof. P. G. Chandrashekara, thanked all the Members at the end of the Meeting

Sd/  
Chairman

**Details of Course of Study: I and II Semesters**

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P) | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Chemistry-1 (4+0+0)                         | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Chemistry-1<br>Practical (0+0+2)           | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Chemistry In Daily Life<br>(3+0+0)           | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Chemistry-2 (4+0+0)                         | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Chemistry-2<br>Practical (0+0+2)           | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Molecules of Life<br>(3+0+0)                 | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Program Outcomes:** By the end of the program the students will be able to:

- To create enthusiasm among students for chemistry and its application in various fields of life.
- To provide students with broad and balanced knowledge and understanding of key concepts in chemistry

- To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in the laboratory.
- To develop in students the ability to apply standard methodology to the solution of problems in chemistry
- To provide students with knowledge and skill towards employment or higher education in Analytical chemistry or multi-disciplinary areas involving chemistry.
- To provide students with the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical Industries of well-trained graduates
- To develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

### **Learning/Course Outcomes:**

After studying this course student will be able to understand:

- The concepts of chemical analysis, accuracy, precision and statistical data treatment.
- Prepare the solutions after calculating the required quantity of salts in preparing the reagents/solutions and dilution of stock solution.
- Describe the dual nature of radiation and matter; dual behavior of matter and radiation, de Broglie's equations, Heisenberg uncertainty principle and their related problems.
- Quantum mechanics. Derivation of Schrodinger's wave equation. Radial and angular Orbital shapes of s, p, d and f atomic orbitals, nodal planes. Electronic configurations of the atoms.
- Pauli's exclusion principle, Hund's rule, Aufbau's principle and its limitation.
- The concepts of Organic reactions and techniques of writing the movement of electrons, bond breaking, bond forming.
- The Concept of aromaticity, resonance, hyper conjugation, etc.
- Explain bond properties, electron displacement effects (inductive effect, electrometric effect, resonance effect and Hyper conjugation effect). steric effect and their applications in explaining acidic strength of carboxylic acids, basicity of amines.
- Understand basic concept of organic reaction mechanism, types of organic reactions.
- Understand the preparation and reactions of alkanes.
- Understand the stability and conformational analysis of cycloalkanes.
- Understand the concept of resonance, aromaticity and anti-aromaticity.
- Describe relative strength of aliphatic and aromatic carboxylic acids.
- Explain the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion.
- Understand the conditions required for liquefaction of gases. Realize that there is

- Understand the properties of liquids in terms of intermolecular attractions.
- Understand the existence of different states of matter in terms of balance between intermolecular forces and thermal energy of the particles. Explain the laws governing behavior of ideal gases and real gases. Understand cooling effect of gas on adiabatic expansion.
- Understand the conditions required for liquefaction of gases. Realize that there is continuity in gaseous and liquid state.
- Understand the properties of liquids in terms of intermolecular attractions.

## I SEMESTER

**DSC-1: CHEMISTRY-1 (THEORY):**      **4 Credits;**      **56 Hrs.**

**Unit-1: Analytical Chemistry: 14 Hrs.**

Language of analytical chemistry: Definition of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range). Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient ( $R^2$ ). Numerical problems.

Basic laboratory practices: calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

**Unit-2: Inorganic Chemistry: 14 Hrs.**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of  $\psi$  and  $\psi^2$ . Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations- Electronic configurations of the elements (Z=1-30), effective nuclear charge, shielding/screening effect, Slater's rules Problems. Variation of effective nuclear charge in Periodic Table.

**Unit-3: Organic Chemistry:****14 Hrs.**

Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties. Nature of bonding in Organic molecules. Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene.

**Mechanisms of Organic Reactions:** Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking-homolytic and heterolytic. Types of Reagents-Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions: substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples. Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigma bonds. Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity. Carbon-carbon pi bonds. Formation of alkenes and alkynes by elimination reaction. Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations. Addition reactions-Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism. Stereospecificity of halogen addition. Ozonolysis mechanism - ozonolysis of propene. Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylic bromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.

**Unit-4: Physical Chemistry:****14 Hrs.**

**Gaseous State:** Elementary aspects of kinetic theory of gases, Ideal and real gases. Boyle temperature (derivation not required), Molecular velocity, collision frequency, collision diameter, Collision cross section, collision number and mean free path and coefficient of viscosity, calculation of  $\sigma$  and  $\eta$ , variation of viscosity with temperature and pressure. Maxwell's Boltzmann distribution law of molecular velocities (Most probable, average and root mean square velocities). Relation between RMS, average and most probable velocity and average kinetic energies. (Mathematical derivation not required), law of equipartition of energy. Behaviour of real gases: Deviation from ideal gas behaviour. Compressibility factor (Z) and its variation with pressure for different gases. Causes of deviation from ideal behaviour, vander Waals equation of state (No derivation) and application in explaining real gas behaviour. Critical phenomena - Andrews isotherms of



CO<sub>2</sub>, critical constants and their calculation from van der Waals equation, Continuity of states, Law of corresponding states. Numerical problems.

**Liquid State:** Surface Tension: Definition and its determination using stalagmometer, effect of temperature and solute on surface tension. Viscosity: Definition, Coefficient of viscosity. Determination of viscosity of a liquid using Oswald viscometer. Effect of temperature, size, weight, shape of molecules and intermolecular forces.

**Refraction:** Specific and molar refraction- definition and advantages. Determination of refractive index by Abbes Refractometer. Additive and constitutive properties.

**Parachor:** Definition, Atomic and structure parachor, Elucidation of structure of benzene and benzoquinone. Viscosity and molecular structure. Molar refraction and chemical constitution. Numerical problems.

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### **DSCP-1: CHEMISTRY-1 (PRACTICALS): 4 Credits;**

**56 Hrs.**

**Learning/Course Outcomes:** After studying this course and performing the experiments set in it, student will be able to understand:

- Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.
- Explain the principles of acid-base, redox and iodometric titrations.
- Work out the stoichiometry relations based on the reactions involved in the titrimetric analysis.
- Describe the significance of organic quantitative analysis.
- Understand the preparation of organic compounds involving addition, substitution, hydrolysis, diazotization and condensation reactions.

### **LIST OF EXPERIMENTS**

#### **PART-A: Inorganic Chemistry**

1. Preparation of standard sodium carbonate solution and standardization of hydrochloric acid solution (methyl orange indicator). Estimation of sodium hydroxide present in the solution using phenolphthalein indicator.
2. Determination of carbonate and hydroxide present in a mixture.
3. Determination of oxalic acid and sodium oxalate in a given mixture using standard KMnO<sub>4</sub>/NaOH solution.
4. Estimation of ferrous and ferric iron in a given mixture using standard potassium dichromate solution.
5. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of hydrogen peroxide present in the solution.
6. Preparation of standard oxalic acid solution and standardization of potassium permanganate solution. Estimation of ferrous ammonium sulphate present in the solution.

#### **PART-B Organic Chemistry**

1. Preparation of acetanilide from aniline using Zn/acetic acid (Green method).

- Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
- Bromination of acetanilide.
- Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventional method).
- Synthesis of diazoaminobenzene from aniline (conventional method).
- Preparation of dibenzalacetone (Green method).

### REFERENCE BOOKS

- Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3<sup>rd</sup> Ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J. J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
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- Shriver, D.F. & Atkins, P.W. Inorganic Chemistry, Oxford University Press.
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- Heterocyclic Chemistry- R. K. Bansal, 3<sup>rd</sup> Edition, New- Age International, 2004.
- McMurry, J.E. Fundamentals of Organic Chemistry, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013.
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- Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods of Analysis, 7<sup>th</sup> Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.

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### Open Elective Course (OE)

**OE-1: CHEMISTRY IN DAILY LIFE:                      3 Credits;                      42 Hrs.**

**Learning/Course Outcomes:** On completion of the course students will be able to:

- Understand the chemical constituents in various day to day materials using by a common man.

- Understand the chemical constituents in vitamins, soaps and detergents.
- Understand the renewable chemical energy resources.
- Understand different types of polymers and their applications.

**Unit-1:** Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food.

**14 Hrs.**

**Unit-2:** Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K. Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents, composition and uses.

**14 Hrs.**

**Unit-3:** Chemical and Renewable Energy Sources: principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer. Polymers: Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.

**14 Hrs.**

#### REFERENCE BOOKS

1. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Ashtoush Kar: Medicinal Chemistry.
3. H.E. Cox: Analysis of Foods.
4. H.E. Cox and Pearson: Chemical Analysis of Foods.
5. N. Shakuntala Many and S. Swamy: Foods: Facts and Principles. 4<sup>th</sup> Ed. New Age International (1998).
6. P.I. Atkins and J. de Paula: Physical Chemistry, 7<sup>th</sup> Ed. 2002, Oxford Univ. Press.
7. Swaminathan and Goswamy: Handbook on Fertilizer Technology 6<sup>th</sup> Ed. 2001.
8. I.L. Finar: Organic Chemistry by Vol. 1 & 2.
9. J. R. Fired: Polymer Science and Technology, PrenticeHall.

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## II SEMESTER

**Learning/Course Outcomes:** After studying this course student will be able to:

- Understand principles of titrimetric analysis.
- Understand principles of different type's titrations. Titration curves for all types of acid-base titrations.
- Gain knowledge about balancing redox equations, titration curves, theory of redox indicators and applications.
- Understand titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.
- Indicators for EDTA titrations - theory of metal ion indicators. Determination of hardness of water.
- Understand periodic table, classification and properties of s p d and f block elements.
- Understand different scales for the measurement of electro-negativity and factors affecting it.
- Understand chemistry of the hydrides, carbides, oxides and halides of group 13-17.
- Understand nucleophilic substitution at saturated carbon, energy profile diagram.
- Stereochemistry and factors affecting SN1 and SN2 reactions.
- Aromatic electrophilic substitution reactions; nitration, sulfonation Friedel-Crafts.
- Understand liquid crystals, classification with examples.
- Understand the different forms of solids, laws of crystallography, miller indices and its calculation, X-ray diffraction studies. Bragg's law and its equation.
- Defects in solids, properties of glasses and concept of liquid crystals.

**DSC-2: CHEMISTRY-2 (THEORY):**

**4 Credits;**

**56 Hrs.**

**Unit-1: Analytical Chemistry:**

**14 Hrs.**

Titrimetric analysis: Basic principle of titrimetric analysis. Classification, Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of  $N_1V_1 = N_2V_2$  formula, Preparation of ppm level solutions from source materials (salts), conversion factors. Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity. Complexometric titrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application- determination of hardness of water. Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications. Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic

reagents, reagents used in gravimetry (8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG). Numerical problems on all the above aspects.

### **Unit-2: Inorganic Chemistry:**

**14 Hrs.**

s, p, d and f-block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s and p-block elements: a) Atomic radii: van der Waals, b) Ionic and crystal radii, c) Covalent radii, d) Ionization enthalpy, successive ionization enthalpies and factors affecting ionization enthalpy Applications of ionization enthalpy, e) Electron gain enthalpy, trends of electron gain enthalpy, f) Electronegativity, Pauling's, Mulliken's, Allred Rachow's and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Trends in the chemistry of the compounds of groups 13 to 17 (hydrides, carbides, oxides and halides) are to be discussed.

### **Unit-3: Organic Chemistry:**

**14 Hrs.**

Nucleophilic substitution at saturated carbon. Mechanism of SN1 and SN2 reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting SN1 and SN2 reactions. Aromatic Electrophilic substitution reactions, Mechanisms,  $\sigma$ - and  $\pi$ -complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: S<sub>N</sub>Ar and Benzyne mechanism with suitable examples.

### **Unit-4: Physical Chemistry:**

**14 Hrs.**

**Liquid Crystals:** Explanation, classification with examples- Smetic, nematic, cholesteric, discs shaped and polymeric. Structures of nematic and cholesteric phases-molecular arrangements in nematic and cholesteric liquid crystals. Applications of liquid crystals in LCDs and thermal sensing.

**Solids:** Forms of solids: Unit cell and space lattice, anisotropy of crystals, size and shape of crystals, Laws of Crystallography: Law of constancy of interfacial angles, Law of rational indices, Law of symmetry (Symmetry elements), Crystal systems, Bravais lattice types and identification of lattice planes. Miller indices and its calculation, X-Ray diffraction by crystals: Bragg's law and derivation of Bragg's equation, Single crystal and powder diffraction methods. Defects in crystals, glasses and liquid crystals. Numerical problems.

**Distribution Law:** Nernst Distribution Law - Statement and its derivation. Distribution constant, factors affecting distribution constant, validity of Distribution Law, Modification of distribution law when molecules undergo a) Association b) Dissociation. Application of Distribution Law in Solvent extraction. Derivation for simple and multiple extraction. Principles of distribution law in Parkes Process of desilverisation of lead. Numerical Problems.

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**DSCP-2: CHEMISTRY-2 (PRACTICALS): 4 Credits;****56 Hrs.**

**Learning/Course Outcomes:** After studying this course and performing the experiments set in it, student will be able to understand:

- Basic concepts involved in titrimetric analysis, primary standard substances, preparation of standard solutions.
- Explain the principles of acid-base, redox and iodometric titrations.
- Describe the significance of inorganic quantitative analysis.
- Determine of density followed by the determination of viscosity and surface tension of different liquid samples.
- Determination of partition coefficient of different liquid mixtures.
- Determination of rate constant in the decomposition reaction of hydrogen peroxide.

**LIST OF EXPERIMENTS****PART-A Analytical Chemistry**

1. Preparation of standard sodium carbonate solution; standardization of given HCl solution and estimation of alkali present in soap/detergent
2. Preparation of standard  $K_2Cr_2O_7$  solution and estimation of Iron (II) in the given solution.
3. Preparation of standard oxalic acid solution standardization of given  $KMnO_4$  solution and estimation of given oxalic acid solution.
4. Preparation of EDTA solution and estimation of hardness ( $CaCO_3$ ) of two different samples.
5. Preparation of standard  $Na_2CO_3$  solution, standardization of given HCl solution and estimation of alkali present in given antacid.
6. Determination of chlorine in two different samples of bleaching powder by iodometry (standard sodium thiosulphate solution to be supplied)

**PART-B: Physical Chemistry**

1. Determination of density using specific gravity bottle and viscosity of liquids using Ostwald's viscometer (Ethyl acetate, Toluene, Chloroform, Chlorobenzene or any other non-hazardous liquids).
2. Determination of the density using specific gravity bottle and surface tension of liquids using Stalagmometer (Ethyl acetate, Toluene, Chlorobenzene, any other non-hazardous liquids).
3. Determination of the composition of liquid mixture by refractometry. (Toluene & Alcohol, Water & Sucrose).
4. Determination of partition/distribution coefficient - i) Acetic acid in water and cyclohexane ii) Acetic acid in Water and Butanol. iii) Benzoic acid in water and toluene.
5. Determination of rate constant of decomposition of  $H_2O_2$  catalyzed by  $FeCl_3$ .
6. Determination of percentage composition of NaCl solution by determining miscibility temperature of phenol-water system.



**REFERENCE BOOKS**

1. Rodgers, G. E. Inorganic & Solid State Chemistry, Cengage Learning India Ltd., 2008.
2. Mark Weller and Fraser Armstrong, 5 Edition, Oxford University Press.
3. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
4. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
5. Mahan, B.H. University Chemistry 3rd Ed. Narosa (1998).
6. Petrucci, R.H. General Chemistry 5<sup>th</sup> Ed. Macmillan Publishing, New York (1985).
7. Graham Solomons, T. W., Fryhle, C. B. & Snyder, S.A. Organic Chemistry, John Wiley.
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9. Organic Chemistry-F. A. Carey, 4th Edition, McGraw Hill (2000).
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11. Understanding Organic reaction mechanisms - A. Jacobs, Cambridge Univ. Press.
12. Organic Chemistry - L. Ferguson, Von Nostrand, 1985.
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14. Organic Chemistry- Mehta and Mehta, PHI Learning Pvt. Ltd, New Delhi, 2005.
15. Text Book of Physical Chemistry - S. Glasstone, Macmillan India Ltd., 1982.
16. Principles of Physical Chemistry - B. R. Puri, L. R. Sharma, M. S. Patania, S. Chand & Co. 1987.
17. Physical Chemistry - Alberty R. A. and Silbey, R. J. John Wiley and sons, 1992.
18. Physical Chemistry - G. M. Barrow, McGraw Hill, 1986.
19. Physical Chemistry (3<sup>rd</sup> Edition) - Gilbert W. Castilian, Narosa Publishing House, 1985.
20. Chemical Kinetics by K. J. Laidler, Tata McGraw Hill Publishing Co., New Delhi.
21. Kinetics and Reaction Mechanisms by Frost and Pearson, Wiley, New York, 1981.
22. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York, 2004.
23. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
24. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed, 2017.
25. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.

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**Open Elective Course (OE)****OE-2: MOLECULES OF LIFE      3 Credits;    42 hrs.****Course/Learning Outcomes:** On completion of the course students will be able to:

- Acquire knowledge about different types of sugars and their chemical structures.
- Identify different types of amino acids and determine the structure of peptides.
- Explain the actions of enzymes in our body and interpret enzyme inhibition.
- Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism. Differentiate RNA and DNA and their replication.



Explain production of energy in our body.

**Unit-1: Carbohydrates-** Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structures. Epimers, mutarotation and anomers. Linkage between monosaccharides, structure of disaccharides (sucrose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation. Amino Acids, Peptides and Proteins. Classification of amino acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides. **14 Hrs.**

**Unit-2: Enzymes and correlation with drug action -** Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Noncompetitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure-activity relationships of drug molecules, binding role of -OH group, -NH<sub>2</sub> group, double bond and aromatic ring. Lipids- Introduction to lipids, classification. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol). **14 Hrs.**

**Unit-3: Nucleic Acids -** Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

**Concept of Energy in Bio-systems-** Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates. **14 Hrs.**

#### REFERENCE BOOKS

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd.
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed.
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. & Stryer, L. Biochemistry, 2002.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours**

**Max. Marks: 60**

**Instructions:** Draw a neat labelled diagrams wherever necessary.

**PART-A**

Answer any six of the following (Two questions from each unit)  $6 \times 2 = 12$

- Q1** a)  
 b)  
 c)  
 d)  
 e)  
 f)  
 g)  
 h)

**PART-B: Analytical Chemistry**

Answer any two of the following  $2 \times 6 = 12$

**Q2 -Q4**

**PART-C: Inorganic Chemistry**

Answer any two of the following  $2 \times 6 = 12$

**Q5 -Q7**

**PART-D: Organic Chemistry**

Answer any two of the following  $2 \times 6 = 12$

**Q8 -Q10**

**PART-E: Physical Chemistry**

Answer any two of the following  $2 \times 6 = 12$

**Q11 -Q13**

The sub-questions in Q2-Q13 shall be of (3 + 3) or (4 + 2) or (6) Marks

**SCHEME OF VALUATION****DSCP-1: CHEMISTRY-1 (PRACTICALS):****Time: 03 Hours****Max. Marks: 25****Note:** Duly certified practical record shall be submitted at the examination (No evaluation).**Distribution of Marks****Part A: Volumetric Estimations (Inorganic) = 13 Marks**

| Experiments    | Titration values                                                                          |                                                                              |                  |
|----------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------|
| <b>2, 3, 4</b> | Discrepancy                                                                               | First titration                                                              | Second titration |
|                | $\pm 0.2 \text{ cm}^3$                                                                    | 04 Marks                                                                     | 05 Marks         |
|                | $\pm 0.3 \text{ cm}^3$                                                                    | 03 Marks                                                                     | 04 Marks         |
|                | Any other value                                                                           | 02 Marks                                                                     | 03 Marks         |
|                | Calculation                                                                               | 02 Marks                                                                     | 02 Marks         |
| <b>1, 5, 6</b> | Preparation of standard solution and calculation of its normality =<br>01 + 01 = 02 Marks |                                                                              |                  |
|                | Titration values                                                                          |                                                                              |                  |
|                | Discrepancy                                                                               | Standardization                                                              | Estimation       |
|                | $\pm 0.2 \text{ cm}^3$                                                                    | 03 Marks                                                                     | 05 Marks         |
|                | $\pm 0.3 \text{ cm}^3$                                                                    | 02 Marks                                                                     | 04 Marks         |
|                | Any other value                                                                           | 01 Mark                                                                      | 03 Marks         |
|                | <b>Calculation</b>                                                                        | Normality of link solution = 01 Mark                                         |                  |
|                |                                                                                           | Normality of given solution = 01 Mark                                        |                  |
|                |                                                                                           | Weight/dm <sup>3</sup> or 500cm <sup>3</sup> or 250cm <sup>3</sup> = 01 Mark |                  |

**Part B: Organic preparations = 12 Marks**

|                   |          |
|-------------------|----------|
| Equation          | 02 Marks |
| Preparation       | 06 Marks |
| Yield             | 01 Mark  |
| Recrystallization | 02 Marks |
| Melting point     | 01 Mark  |

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**DSCP-2: CHEMISTRY-2 (PRACTICALS):****Time: 03 Hours****Max. Marks: 25****Note:** Duly certified practical record shall be submitted at the examination (No evaluation).**Distribution of Marks****Part A: Volumetric Estimations (Analytical) = 13 Marks**

Experiments 1, 3, 4, 5 Preparation of standard solution and calculation of its normality = 01 + 01 = 02 Marks

| Titration values       |                                                                              |            |
|------------------------|------------------------------------------------------------------------------|------------|
| Discrepancy            | Standardization                                                              | Estimation |
| $\pm 0.2 \text{ cm}^3$ | 03 Marks                                                                     | 05 Marks   |
| $\pm 0.3 \text{ cm}^3$ | 02 Marks                                                                     | 04 Marks   |
| Any other value        | 01 Mark                                                                      | 03 Marks   |
| <b>Calculation</b>     | Normality of link solution = 01 Mark                                         |            |
|                        | Normality of given solution = 01 Mark                                        |            |
|                        | Weight/dm <sup>3</sup> or 500cm <sup>3</sup> or 250cm <sup>3</sup> = 01 Mark |            |

Experiment 2 Preparation of standard potassium dichromate solution and calculation of its normality = 02 + 02 = 04 Marks

| Titration values       |                                                                              |
|------------------------|------------------------------------------------------------------------------|
| Discrepancy            | Estimation                                                                   |
| $\pm 0.2 \text{ cm}^3$ | 05 Marks                                                                     |
| $\pm 0.3 \text{ cm}^3$ | 04 Marks                                                                     |
| Any other value        | 03 Marks                                                                     |
| <b>Calculation</b>     | Normality of given solution = 02 Mark                                        |
|                        | Weight/dm <sup>3</sup> or 500cm <sup>3</sup> or 250cm <sup>3</sup> = 01 Mark |

Experiment 6 Preparation of two solutions = 02 + 02 = 04 Marks

| Titration values       |                                                                                                              |              |
|------------------------|--------------------------------------------------------------------------------------------------------------|--------------|
| Discrepancy            | Estimation-1                                                                                                 | Estimation-2 |
| $\pm 0.2 \text{ cm}^3$ | 04 Marks                                                                                                     | 04 Marks     |
| $\pm 0.3 \text{ cm}^3$ | 03 Marks                                                                                                     | 03 Marks     |
| Any other value        | 02 Marks                                                                                                     | 02 Marks     |
| <b>Calculation</b>     | Normality of given solution and Weight/dm <sup>3</sup> or 500cm <sup>3</sup> or 250cm <sup>3</sup> = 01 Mark |              |

**Part B: Physical Chemistry Experiments = 12 Marks****Density and Viscosity/Surface tension**

| Expt.   | Discrepancy     | Marks | Expt.     | Discrepancy     | Marks | Expt.           | Discrepancy     | Marks |
|---------|-----------------|-------|-----------|-----------------|-------|-----------------|-----------------|-------|
| Density | $\pm 0.2$       | 02    | Viscosity | $\pm 0.5$       | 06    | Surface tension | $\pm 0.5$       | 06    |
|         | $\pm 0.3$       | 01    |           | $\pm 1.0$       | 05    |                 | $\pm 1.0$       | 05    |
|         | Any other value | 01    |           | Any other value | 04    |                 | Any other value | 04    |
|         | Calculation     | 01    |           | Calculation     | 01    |                 | Calculation     | 01    |
|         | SI unit         | 01    |           | SI unit         | 01    |                 | SI unit         | 01    |

**Percentage composition of mixture using  
Abbe's refractometer**

|                            |          |
|----------------------------|----------|
| Preparation of the mixture | 03 Marks |
| Discrepancy                | Marks    |
| ± 5%                       | 07       |
| ± 10%                      | 06       |
| Any other value            | 05       |
| Graph                      | 02       |

**Percentage of NaCl with one  
unknown**

|                            |          |
|----------------------------|----------|
| Preparation of the mixture | 04 Marks |
| Discrepancy                | Marks    |
| ± 0.2%                     | 06       |
| ± 0.3%                     | 05       |
| Any other value            | 04       |
| Graph                      | 02       |

**Kinetics of hydrogen peroxide**

|                                          |          |
|------------------------------------------|----------|
| 5 Constant values                        | 08 Marks |
| 4 Constant values                        | 06 Marks |
| Any other values                         | 05 Marks |
| Calculation                              | 02 Marks |
| Graph log V <sub>2</sub> /V <sub>1</sub> | 02 Marks |

**Determination of partition coefficient**

|       |          |
|-------|----------|
| (i)   | 04 Marks |
| (ii)  | 04 Marks |
| (iii) | 04 Marks |

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## **Bachelor of Science (Basic/Hons.) Degree in Computer Science**

### **Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020**

#### **(2021-22 Batch Onwards)**

#### **BOARD OF STUDIES: PROCEEDINGS**

The meeting of the Board of Studies in Computer Science (UG) of Yuvaraja College Mysore, was held at 11:00 a.m. on 27-11-2021, at the Department of Computer Science, Yuvaraja College (Autonomous), University of Mysore, Mysuru.

#### **Annexures:**

1. The Syllabus of NEP and scheme of Examination for Theory and Practical-I and II semester scheme.
2. The panel of Examiners for the year 2021-22.

| Sl. No. | Members                                                                                                                           | Position | Signature/<br>Remarks |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Annapurna. H, Dept. of Computer Science, Yuvaraja College, Mysore                                                                 | Chairman | Sd/                   |
| 2.      | Chandraiah. T, Dept. of Computer Science, Yuvaraja College, Mysore                                                                | Member   | Sd/                   |
| 3.      | Dr. Manjunatha. K. S, Associate Professor and Head, Dept. of Computer Science, Maharani's Science College for Women, Mysore       | Member   | Sd/                   |
| 4.      | Gloriya Priyadarshini, Head of the Department, Dept. of Computer Science, St. Philomena's College, Mysore                         | Member   | Sd/                   |
| 5.      | Vidya Shankar, Head of the department, Dept. of Computer Science, J S S College for Arts, Science and Commerce, Ooty road, Mysore | Member   | Sd/                   |
| 6.      | Nagesh, Project Leader, Excelsoft, Mysore                                                                                         | Member   | Sd/                   |
| 7.      | Dr. Basavanna. M, Associate Professor, and Chairman, DOS in Computer Science, Davanagere University, Davangere, India.            | Member   | Absent                |

#### **Resolutions Passed:**

1. The Board resolved to adopt the CBCS scheme under NEP-2020 with 60+40 pattern in the framing of the syllabus for first year B.Sc. and BCA Programme.
2. The Board after discussions and deliberations framed and passed the syllabus for Computer Science Course for the I and II semesters of the B.Sc. and BCA Programme under CBCS scheme (NEP-2020) proposed to commence from the academic year 2021-22.

Finally, the Chairman thanked the members for their active participation, invaluable suggestions and co-operation.

27-11-2021  
Mysuru

Chairman,  
BOS in Computer Science

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)        | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|-----------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Computer Fundamentals and Programming in C (4+0+0) | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-1: C Programming (0+0+2)                             | 4                          | 2       | 25                                        | 25                                        |
|           | OE-1: Office Automation (3+0+0)                           | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | DSC-2: Data Structures using C (4+0+0)                    | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-2: Data structures (0+0+2)                           | 4                          | 2       | 25                                        | 25                                        |
|           | OE-2: C Programming Concepts (3+0+0)                      | 3                          | 3       | 40                                        | 60                                        |

**Course objectives:** The present Curriculum Framework for BSc degrees is intended to facilitate the students to achieve the following.

- To build up an indulgent and knowledge of the basic theory of Computer Science and Information Technology with good basis on theory, systems and applications such as algorithms, data structures, data handling, data communication, computation and analysis.
- To develop the capability to use this knowledge to analyse new situations in the application domain including software tiny tools.
- To gain indispensable and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems.
- To learn skills and tools like mathematics, statistics and electronics to find the solution, interpret the results and make predictions for the future developments.
- To formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.

**Programme Outcomes:** The Bachelor of Computer Science (Basic/Hons) program makes possible students to accomplish following additional attributes besides the aforementioned attributes, by the time of graduation:



- ❖ The ability to apply skill set in computing with strong programming and mathematics skills, as well as wide ranging skills in project management, effective presentations and teamwork.
- ❖ Run by contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems.
- ❖ The capability to apply the knowledge and understanding noted skills to the analysis of a given information handling problems.
- ❖ The skill to work independently on a generous software project and as an effective team member.
- ❖ Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
- ❖ Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
- ❖ Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.
- ❖ Application Systems Knowledge: Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.
- ❖ Communication: Must have a reasonably good communication knowledge both in oral and writing.
- ❖ Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the internality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
- ❖ Lifelong Learning: Should become an independent learner. So, learn to learn ability.
- ❖ Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

## I SEMESTER

**Course Outcomes:** After completing this course satisfactorily, a student will be able to:

- Confidently operate Desktop Computers to carry out computational tasks.
- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays.

**DSC-1: COMPUTER FUNDAMENTALS AND PROGRAMMING IN C (THEORY):****4 Credits****56 Hrs.****Unit-1:****14 Hrs.**

**Fundamentals of Computers:** Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples.

**Introduction to C Programming:** Over View of C; History and Features of C; Structure of a C Program with examples; Creating and Executing a C Program; Compilation process in C.

**Unit-2:****14 Hrs.**

**C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.

**Input and output with C:** Formatted I/O functions - *printf* and *scanf*, control stings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar*, *putchar*, *gets* and *puts* functions.

**C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion.

**Unit-3:****14 Hrs.**

**Control Structures:** Decision making Statements - *Simple if*, *if\_else*, *nested if\_else*, *else\_if ladder*, *Switch-case*, *goto*, *break* & *continue* statements; Looping Statements - Entry controlled and Exit controlled statements, *while*, *do-while*, *for* loops, Nested loops.

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.

Strings: Declaring & Initializing string variables; String handling functions - *strlen*, *strcmp*, *strcpy* and *strcat*; Character handling functions - *toascii*, *toupper*, *tolower*, *isalpha*, *isnumeric* etc.

**Unit-4:****14 Hrs.**

**Pointers in C:** Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers;

**User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.

**User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions.

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### **DSCP-1: C PROGRAMMING (PRACTICALS): 4 Credits 56 Hrs.**

**Practice Lab:** The following activities be carried out/ discussed in the beginning of lab.

1. Basic Computer Proficiency.
  - a) Familiarization of Computer Hardware Parts.
  - b) Basic Computer Operations and Maintenance.
  - c) Do's and Don'ts, Safety Guidelines in Computer Lab.
2. Familiarization of Basic Software – Operating System, Word Processors, Internet Browsers, Integrated Development Environment (IDE) with Examples.
3. Type Program Code, Debug and Compile basic programs covering C Programming fundamentals discussed during theory classes.

#### **Part A:**

1. Write a C Program to read radius of a circle and to find area and circumference.
2. Write a C Program to read three numbers and find the biggest of three.
3. Write a C Program to demonstrate library functions in *math.h*.
4. Write a C Program to check for prime.
5. Write a C Program to generate n primes.
6. Write a C Program to read a number, find the sum of the digits, reverse the number and check it for palindrome.
7. Write a C Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers.
8. Write a C Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder).
9. Write a C Program to find the roots of quadratic equation (demonstration of switch-case statement).
10. Write a C program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array).
11. Write a C Program to remove Duplicate Element in a single dimensional Array.
12. Program to perform addition and subtraction of Matrices

#### **Part B:**

1. Write a C Program to find the length of a string without using built in function.
2. Write a C Program to demonstrate string functions.
3. Write a C Program to demonstrate pointers in C.
4. Write a C Program to check a number for prime by defining *isprime( )* function.

5. Write a C Program to read, display and to find the trace of a square matrix.
6. Write a C Program to read, display and add two m x n matrices using functions.
7. Write a C Program to read, display and multiply two m x n matrices using functions.
8. Write a C Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Write a C Program to Reverse a String using Pointer.
10. Write a C Program to Swap Two Numbers using Pointers.
11. Write a C Program to demonstrate student structure to read & display records of n students.
12. Write a C Program to demonstrate the difference between structure & union.

**Note:** Student has to execute a minimum of 10 programs in each part to complete the Lab course.

### REFERENCE BOOKS

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication.
2. E. Balgurusamy: Programming in ANSI C (TMH).
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education).
4. V. Rajaraman: Programming in C (PHI – EEE).
5. S. ByronGottfried: Programming with C (TMH).
6. Kernighan & Ritchie: The C Programming Language (PHI).
7. Yashwant Kanitkar: Let us C.
8. P.B. Kottur: Programming in C (Sapna Book House).

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### Open Elective Course (OE)

**OE-1: OFFICE AUTOMATION:**

**3 Credits**

**48 Hrs.**

**Unit – 1: Computer & Internet:** Desktop computers, Block diagram of a computer, Input and output devices, memory and storage devices, different ports and its uses, Different type of printers. Software: OS, Windows OS, Application software. Networking, different LAN and WAN connections, connecting to a network, testing connection, Internet, IP address, Hypertext, Uniform Resource Locator, Web Browsers, IP Address, Domain Name, Internet Services Providers, Internet Security, Internet Requirements, Web Search Engine, Net Surfing, Internet Services.

**Intranet tools:** E-mail: Anatomy of e-mail, e-mail address, finding e-mail address, adding signature, attaching files, opening attachments, managing e-mail account, Web mail, and Case study: Yahoo Mail, Outlook express. FTP, ftp commands, ftp software, Telnet, using telnet, Web pages, HTML, basics of HTML. MS Front page: Page Properties, Text, Hyperlinks, Tables, Graphics and Pictures, Miscellaneous, shared borders, Navigation bars cascading Style Sheets, Themes, Frames, Components, Forms, create web

site. Uploading and downloading files. Portals, creating portals, digital signature, computer virus and antivirus software.

**E-governance:** E-government, need of e-governance, e-assistance, e-democracy, e-administration, citizen services, e-procurement, Mobile government, Law and policies, IT Act, Right for Information Act, Introduction to various TAX Payable, Purchase & Tender procedures and E-filing of Information. E-governance implementations: Software and Hardware required for e-governance Implementation, E-governance in a Small Office, Web Portal for E-governance, E-governance for Public utilities, E-governance in a Medium Enterprise, E-governance & Finance, E-Tender & Web e-governance efforts of Government of India and Karnataka.

ICT, LMS and E-governance in Education sector:

Windows: Windows concepts, Features, Windows Structure, Desktop, Taskbar, Start Menu, My Computer, Recycle Bin, Windows Accessories- Calculator, Notepad, Paint, WordPad, Character Map, Windows Explorer, Entertainment, Managing Hardware & Software Installation of Hardware & Software, Using Scanner, System Tools, Communication, Sharing Information between programs. **32 Hrs.**

**Unit – 2: Introduction to essential tools:** Introduction to facilities & commonly used features:

**a) Word:** Working with word document, Inserting, filling and formatting a table, Mail Merge including linking with Access Database, Creating Macros -Sending E-mail from Word Import / Export of files Converting Word Document to Web Document, PDF files Hyperlinks; OLE Security features in MS-Word - Protection of Documents - Password for Documents - Checking for viruses in macros, referencing, creating bibliography, manage sources and citations, review documents.

**b) Power Point:** Preparing Presentations, Slides, Handouts, Speaker's Notes - Outlines - Media Clips - Charts – Graphs, Adding the Transitions to the Slide Show - Special effects in detail, - Setting Slide timings.

**c) Excel:** Creating a work book, Rearranging Worksheet, Organizing Charts and graphs, Ranges and Functions & Formulae: Mathematical, Statistical Financial Functions such as NPV (Net present value), Future value, IRR (Internal Rate of Return), EMI (Equated Monthly Installments, Compounding Yearly, periodic and monthly) - Auto Calculate Using Names in a Formula, Formula Editing, Macros, Consolidation of Data & Data Analysis - Sorting List, Filter & More Filtering Techniques - Consolidate data in multiple worksheets - What-if analysis, Goal Seek Scenario Manager, Solver, Lookup Function - Sub Totals, Nested-IF, Statistical Analysis; Data Validation & Protection - Create a drop-down list from a range of cells - Apply data validation to cells - Copy data validation setting, remove data validation - Find cell that have data validation, protect cell data, using password to protect sheet and workbook. - Use validation to create dependent list; Pivot table Reports & Pivot Chart Reports. **16 Hrs.**

## REFERENCE BOOKS

1. Sanjay Saxena, A First Course in Computers (Based on Windows 8 And MS Office 2013) Vikas Publishing 2015.
2. Jennifer fulton, Sherri Kinkoph, and Joe Kraynak, The Big Basics Book of Microsoft Office 1997, PHI, 1998.
3. Laura Acklen et al, Microsoft Office 97 Professional Essentials, EEE Que E&T, PHI (1998).
4. Andy Channelle, Beginning OpenOffice 3, APress 2009.
5. Professional Office Procedure by Susan H Cooperman, Printice Hall
6. Information Technology:Principles , Practices and Oppertunities by James A Senn, Printice Hall.
7. Technology and Procedures for Administrative Professionals by Patsy Fulton-Calkins, Thomson Learning Public.
8. Information Technology and E-Governance: Managing the Virtual State (Paperback) by G. David Garson.

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## II SEMESTER

**Course Outcomes:** After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms.
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs.
- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs.
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance.
- Describe the concept of recursion, give examples of its use.
- Discuss the computational efficiency of the principal algorithms for sorting and searching.

**DSC-2: DATA STRUCTURES USING C (THEORY):**      **4 Credits**      **56 Hrs.**

**Unit-1: 14 Hrs.**

Introduction to data structures: Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures.

## Algorithm Specification, Performance Analysis, Performance Measurement

Recursion: Definition; Types of recursions; Recursion Technique Examples - Fibonacci numbers, GCD, Binomial coefficient  $nCr$ , Towers of Hanoi; Comparison between iterative and recursive functions.



**Unit-2:****14 Hrs.**

Arrays: Basic Concepts – Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory;

Traversing linear arrays; Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices.

Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - *malloc*, *calloc*, *realloc* and *free*.

**Unit-3:****14 Hrs.**

Linked list: Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly linked list, Header linked list, Circular linked list; Representation of Linked list in Memory;

Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection.

Stacks: Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.

**Unit-4:****14 Hrs.**

Queues: Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues;

Trees: Definition; Tree terminologies – node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth;

Binary tree: Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; *preorder*, *inorder* and *postorder* traversal; Reconstruction of a binary tree when any two of the traversals are given.

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**DSCP-2: DATA STRUCTURES (PRACTICAL): 4 Credits 56 Hrs.****Part A:**

1. Write a C Program to find GCD using recursive function.
2. Write a C Program to display Pascal Triangle using binomial function.
3. Write a C Program to generate n Fibonacci numbers using recursive function.
4. Write a C Program to implement Towers of Hanoi.
5. Write a C Program to implement dynamic array, find smallest and largest element of the array.



6. Write a C Program to create two files to store even and odd numbers.
7. Write a C Program to create a file to store student records.
8. Write a C Program to read the names of cities and arrange them alphabetically.
9. Write a C Program to sort the given list using selection sort technique.
10. Write a C Program to sort the given list using bubble sort technique.

#### **Part B:**

1. Write a C Program to sort the given list using insertion sort technique.
2. Write a C Program to sort the given list using quick sort technique.
3. Write a C Program to sort the given list using merge sort technique.
4. Write a C Program to search an element using linear search technique.
5. Write a C Program to search an element using recursive binary search technique.
6. Write a C Program to implement Stack.
7. Write a C Program to convert an infix expression to postfix.
8. Write a C Program to implement simple queue.
9. Write a C Program to implement linear linked list.
10. Write a C Program to display traversal of a tree.

#### **REFERENCE BOOKS**

1. Satraj Sahani: Fundamentals of Data Structures.
2. Tanenbaum: Data structures using C (Pearson Education).
3. Kamathane: Introduction to Data structures (Pearson Education).
4. Y. Kanitkar: Data Structures Using C (BPB).
5. Kottur: Data Structure Using C.
6. Padma Reddy: Data Structure Using C.
7. Sudipa Mukherjee: Data Structures using C – 1000 Problems and Solutions (McGraw Hill Education, 2007).

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### **Open Elective Course (OE)**

#### **Course Outcomes:**

- ❖ Confidently operate Desktop Computers to carry out computational tasks.
- ❖ Understand working of Hardware and Software and the importance of operating systems.
- ❖ Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts
- ❖ Read, understand and trace the execution of programs written in C language.
- ❖ Write the C code for a given problem.
- ❖ Perform input and output operations using programs in C.
- ❖ Write programs that perform operations on arrays.

**OE-2: C PROGRAMMING CONCEPTS:****3 Credits****42 Hrs.**

**Unit-1: Fundamentals of Computers:** Introduction to Computers -Hardware, software- System software, Application software, Utility software, Operating System; Computer Languages - Machine Level, Assembly Level & High-Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program – Algorithm and Flowchart with Examples.

**Unit-2: Introduction to C Programming:** Over View of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.

**C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.

**Input and output with C:** Formatted I/O functions - *printf* and *scanf*, control stings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar*, *putchar*, *gets* and *puts* functions.

**Unit-3: C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion.

**Control Structures:** Decision making Statements - *Simple if*, *if\_else*, *nested if\_else*, *else\_if ladder*, *Switch-case*, *goto*, *break* & *continue* statements; Looping Statements – Entry controlled and Exit controlled statements, *while*, *do-while*, *for* loops, Nested loops.

**Unit-4: User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.

**Unit-5: Arrays:** One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions - *strlen*, *strcmp*, *strcpy* and *strcat*; Character handling functions - *tolower*, *toupper*, *isalpha*, *isnumeric* etc.

**Basics of Pointers in C:** Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointer Arithmetic; Advantages and disadvantages of using pointers.

**REFERENCE BOOKS**

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication.
2. E. Balgurusamy: Programming in ANSI C (TMH).
3. Kamthane: Programming with ANSI and TURBO C (Pearson Education).

4. V. Rajaraman: Programming in C (PHI –EEE).
5. S. ByronGottfried: Programming with C (TMH).
6. Kernighan & Ritchie: The C Programming Language (PHI).
7. Yashwant Kanitkar: Let us C.
8. P.B. Kottur: Programming in C (Sapna Book House).

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours**

**Max. Marks: 60**

Answer the following questions. Each question carries 10 Marks ( 4 X 10 = 40)

- Q1 a)  
b)  
OR  
c)  
d)

- Q2 a)  
b)  
OR  
c)  
d)

- Q3 a)  
b)  
OR  
c)  
d)

- Q4 a)  
b)  
OR  
c)  
d)

Answer one question from each unit

4 x 5 = 20

- Q5 a)  
b)  
c)  
d)  
e)  
f)

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTERS:****DSCP-1: C PROGRAMMING PRACTICAL****Time: 03 Hours****Max. Marks: 25**

| <b>Assessment Criteria</b>        |                          | <b>Marks</b> |
|-----------------------------------|--------------------------|--------------|
| Program – 1 from Part A           | Flowchart / Algorithm    | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Program -2 from Part B            | Flowchart/Algorithm      | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Viva Voice based on C Programming |                          | 05           |
| <b>Total</b>                      |                          | <b>25</b>    |

**DSCP-2: DATA STRUCTURES PRACTICAL****Time: 03 Hours****Max. Marks: 25**

| <b>Assessment Criteria</b>        |                          | <b>Marks</b> |
|-----------------------------------|--------------------------|--------------|
| Program – 1 from Part A           | Flowchart                | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Program -2 from Part B            | Flowchart                | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Viva Voice based on C Programming |                          | 05           |
| <b>Total</b>                      |                          | <b>25</b>    |

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## **Bachelor of Science (Basic/Hons.) Degree in Electronics**

### **Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020**

**(2021-22 Batch Onwards)**

#### **BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Biochemistry held on 9<sup>th</sup> October, 2021 in the Department of Electronics, Yuvaraja College, Mysuru.

| Sl. No. | Members                                                                                                                   | Position | Signature/<br>Remarks |
|---------|---------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. H. Somashekarappa, Professor and Head<br>Department of Electronics, Yuvaraja College,<br>University of Mysore, Mysuru | Chairman | Sd/                   |
| 2.      | Dr. Halappa Gajera,<br>Department of Electronics, Hemangangothri,<br>University of Mysore                                 | Member   | Absent                |
| 3.      | Sri. A. Nagesh, Department of Electronics, Govt. FGC,<br>Kuvempunagara, Mysuru                                            | Member   | Sd/                   |
| 4.      | Smt. T.V. Latha, Department of Electronics,<br>JSS College, Ooty Road, Mysuru.                                            | Member   | Sd/                   |
| 5.      | Sri A.V. Ravi Shankar, Department of Electronics,<br>Sarada Vilas College, Mysuru.                                        | Member   | Sd/                   |
| 6.      | Dr. K.S. Chandrashekar, Department of Electronics,<br>Yuvaraja College, University of Mysore, Mysuru                      | Member   | Sd/                   |
| 7.      | Dr. M.N. Bharathi, Department of Electronics, Yuvaraja<br>College, University of Mysore, Mysuru                           | Member   | Sd/                   |
| 8.      | Dr. P. Naveen Kumar, Department of Electronics,<br>Yuvaraja College, University of Mysore, Mysuru                         | Member   | Sd/                   |

The Chairperson welcomed the members and requested them to Frame the Electronics new CBCS scheme of syllabus for V and VI semesters. The syllabus for V and VI semesters is discussed. All the members of the board actively participated in the discussion the syllabus has been framed to meet the present day academic and Industrial requirements, considering the valuable discussion.

- The BOS also unanimously decided to implement the NEP syllabus for B.Sc., I and II semesters on par with the syllabus to be adopted by the University of Mysore for the academic year 2021-22.
- The BOS also approved the panel of Board of Examiners for 2021 – 22.

At the end chairmen thanked all the members and requested to continue the same support in future.

15-11-2021  
Mysuru

Chairman,  
BoS in Electronics

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)            | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|---------------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Electronic Devices and Circuits (4+0+0)                | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Electronic Devices and Circuits (0+0+2)               | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Fundamentals of Electronics and Domestic Wiring (3+0+0) | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-2: Domestic Equipment Maintenance (3+0+0)                  | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Analog and Digital Electronics (4+0+0)                 | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Analog and Digital Electronics (0+0+2)                | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-3: Fundamentals of Semiconductor Devices (3+0+0)           | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-4: Renewable Energy and Energy Harvesting (3+0+0)          | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-5: PCB Design and Fabrication (3+0+0)                      | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

### I SEMESTER

#### Course objectives:

The objectives of the Course are to enable the student to understand Principle of operation of passive components.

- Basics principles of network theorems.
- Analysis of Electronic circuits Construction, operation and applications of semiconductor diode, BJT and special purpose devices
- Number systems, Boolean laws and methods of simplifications of Boolean expressions
- Course Outcomes at the end of this course, students will be able to explain the principles and behavior of basic semiconductor devices.
- Analyse basic networks using network theorems.
- Apply the concepts to realize the circuits. As per the requirement build simple electronic circuits used in various applications.
- Evaluate the critical internal parameters of semiconductor devices for the given standard device models. Demonstrate the working of analog and digital circuits as per the specifications.

**DSC-1: ELECTRONIC DEVICES AND CIRCUITS (THEORY): 4 Credits 56 Hrs.****Unit-1: 14 Hrs.**

**Electronic Components:** Passive components – R, L, and C, and their properties, V-I relation, mutual and self-inductance, Transformer and its working, Definition and list of Active components, Concept of Voltage and Current Sources, Electric Energy and Power. (Qualitative only) Network Theorems: KCL, KVL and node analysis of circuits, Superposition, Thevenin's, Norton's, Maximum Power Transfer, and Reciprocity Theorems, inter-conversion between Thevenin and Norton equivalent circuits, (For Circuits with DC Source).

**Network Analysis:** DC and AC analysis of RC and RL circuits, RLC Series and Parallel Resonant Circuits. PN-junction Diode: Ideal and practical diodes, Formation of Depletion Layer, mention of diode equation, I-V characteristics, DC load line, Static and Dynamic resistance, Zener diode and its I-V Characteristics, Reverse saturation current, Zener and avalanche breakdown.

**Rectifiers:** Half-wave and Full-wave centre-tap and bridge rectifiers, expressions for output voltage, PIV, ripple factor and efficiency, Operation with and without shunt capacitor filter. (Numerical examples wherever applicable).

**Unit-2: 14 Hrs.**

**Applications of Diode:** Clippers, Clampers and Voltage Multipliers (Qualitative analysis only).

**Voltage Regulator:** Block diagram of regulated power supply, Zener diode as voltage regulator – circuit diagram, load and line regulation, Fixed and Variable IC Voltage Regulators (78xx, 79xx, LM317).

**Special Semiconductor Devices:** Construction, working principles, characteristics, symbol, and applications of Varactor diode, Schottky diode, and Tunnel diode, Solar Cell. Display Devices: Construction, working principles, characteristics, symbol, and applications of LED and LCD, operation of 7-segment display, common anode and common cathode type 7-segment display. (Numerical examples wherever applicable).

**Unit-3: 14 Hrs.**

**Bipolar Junction Transistor:** Construction and working of NPN transistor, CE, CB and CC configurations (mention only), Input and Output characteristics of a transistor in CE mode, Regions of operation of BJT (active, cut off and saturation), leakage currents (mention only), Current gains  $\alpha$ ,  $\beta$  and their interrelations, dc load line and Q point.

**Applications of Transistor:** Circuit and working principles of Transistor as an amplifier and switch. Transistor Biasing: Fixed and Voltage Divider Bias. Thermal runaway, mention of stability and stability factor, Transistor as a two-port network, h-parameter equivalent circuit for CE configuration.

**Amplifier:** Small signal analysis of single-stage CE amplifier using h-parameters, Frequency Response, Input and Output impedances, Current and Voltage gain.

**Multi-stage Amplifiers:** Types of coupling of amplifiers, Two-stage RC Coupled Amplifier – circuit, working and its Frequency Response, loading effect, GBW product.



**Power Amplifiers:** Class A, B and C Power Amplifiers (qualitative). (Numerical examples wherever applicable).

**Unit-4:**

**14 Hrs.**

**Number System:** Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Representation of signed and unsigned binary numbers, Binary arithmetic - addition, subtraction by 1's and 2's complement method, BCD code (8421, 2421, Excess-3), Gray code, Gray to binary inter conversion, parity error checking, single-bit error correction codes.

**Boolean Algebra:** Constants, variables, operators, SOP and POS form, canonical form, conversion from SOP to POS and Vice-versa, Boolean laws, Duality Theorem, De Morgan's Theorem. Logic gates: AND, OR, NOT, Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. Simplification and realization of Boolean expressions using gates. (Numerical examples wherever applicable).

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**DSCP-1: ELECTRONIC DEVICES AND CIRCUITS (PRACTICALS): 4 Credits 56 Hrs.**

**Course Objectives:** The objectives of the Course are to enable the student get the hands-on training on the Working principles of Electronics Instruments and components.

- ❖ Analyse Electronic circuits by applying Network theorems
- ❖ Understand the I-V characteristics of Diode, BJT, and other semiconductor devices
- ❖ Design and construct the biasing, amplifier, resonant circuits and to understand their behaviour.
- ❖ Simplify Boolean Expressions and construct the circuits to verify the truth table.

**LIST OF EXPERIMENTS:**

**Part – A:**

1. Verification of Thevenin's, Norton's, and Maximum Power Transfer Theorems.
2. Study the I-V Characteristics of p-n junction and Zener diodes.
3. Study of Half and full wave rectifiers without and with shunt capacitor filter and find the ripple factor for different values of filter capacitors.
4. Study of Zener diode as a voltage regulator using bridge rectifier with shunt capacitor filter and find the Load and line regulation.
5. Study of clipping and clamping circuits.

**Part – B:**

1. Study of Transistor characteristics in CE configuration – determination of hparameters.
2. Study of Voltage divider bias circuits.
3. Study of single stage CE amplifier and obtain its frequency response, input and output impedances in mid-band.
4. Study of Series and Parallel Resonance circuits.

5. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs and Realization of basic gates using universal gates.
6. Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC 7486.

### REFERENCE BOOKS

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.
2. Ravish R Singh, "Network Analysis and Synthesis," 1st Edition, MGH, 2018.
3. Robert L Boylestad, "Introductory Circuit Analysis," 15th edition, Pearson, 2015.
4. R. S. Sedha, "A Text book of Applied Electronics," 7 th edition., S. Chand and Company Ltd., 2011.
5. A. P. Malvino, and, David J Bates, "Electronics Principles," 7 th Edition, TMH, 2011.
6. David A. Bell, "Electronic Devices and Circuits," 5 th Edition, Oxford Uni. Press, 2015.
7. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
8. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8 th Edition, TMH, 2014.
9. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1 st Edition, TMH, 2011.

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## Open Elective Courses (OE)

### OE-1: FUNDAMENTALS OF ELECTRONICS AND DOMESTIC WIRING: 3 Credits 48 Hrs.

**Course Objectives:** The objectives of the Course are to enable the student to understand

- Ability to gain the knowledge of basic electronics and electronic components.
- Ability to analyse various components behaviour in AC and DC circuits.
- Ability to get the knowledge of electrical wiring and safety precautions.
- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electrical and electronics.
- Provide students with skills that enable them to get employment in various organisations, industries, and turn as entrepreneurs.

**Unit-1: Introduction to Electronics:** Evolution of Electronics, Definition and expression for of Charge, Current, Voltage, Potential Difference, Power, Energy. Coulombs Law, Ohm's Law.

**Electronic Components:** Definition and list of passive and active components.

**Resistors:** Definition, application, and mention of types of resistors, color coding of resistors, series and parallel combinations.

**Capacitors:** Definition, application and mention of types capacitors, series and parallel combinations, factors affecting capacitance, color coding of capacitors.

**Inductors:** Definition, application, and mention of types of inductors, series and parallel combinations. Self and mutual inductance, factors affecting inductance. **12 Hrs.**

**Unit-2: Kirchhoff's laws:** KCL and KVL, voltage divider rule and current divider rule, open and short circuits.

**Network Theorems (DC analysis only):** Thevenin's theorem, Norton's theorem and maximum power transfer theorem, Superposition Theorem (Qualitative Approach with statements and steps involved in solving) as applied to simple T-network.

**DC power supplies:** Block diagram and working, Applications.

**Cells and Batteries:** Primary and Secondary cells, Mention of types of batteries, series and parallel combination of batteries.

**Lead Acid Battery:** Construction, Internal resistance, Efficiency and capacity of a battery, condition of a fully charged and discharged lead acid battery. **12 Hrs.**

**Unit-3: A.C. Fundamentals:** Definition and waveform of ac signal. Definition of Amplitude, Frequency, Time period, RMS value, average value, Phase and phase angle difference of sinusoidal signal. Sinusoidal signal applied to resistor, capacitor and Inductor, waveforms and phasor diagram for each. Expression for capacitive and inductive reactance. Circuit diagram and working of series and parallel resonance circuits, expression for resonance frequency.

**Transformers:** Definition, construction, working principle and application, step-up and step- down transformers. **12 Hrs.**

**Unit-4: Domestic Wiring:** Introduction, Types of Domestic Wiring, Cleat Wiring, Wooden/PVC Casing and Capping Wiring, Toughened Rubber Sheath (TRS or CTS) or Batten Wiring, Conduit Wiring, Specifications of Wires, Size of Conductor, Distribution Board, Types of Cables, Lighting Control Circuits, Earthing System, Fuses and HRC Fuses, Calculation of Fuse Rating.

**Switches:** Definition and application of switch, Brief note on SPST, SPDT, DPST and DPDT, electromagnetic relay, MCB, ELCB, RCCB, Toggle switch, push button, joystick, selector, limit, proximity switches. **12 Hrs.**

#### REFERENCE BOOKS:

1. C L Wadhwa, "Basic Electrical Engineering," 4<sup>th</sup> Ed. New Age Int. 2007.
2. Robert Boylestad, "Introductory circuit analysis," 5th edition, PHI, 2010.
3. Robert Boylestad and Louis Nashelsky, "Electronic Devices and circuit theory," 9<sup>th</sup> Edition, PHI, 2013.
4. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand, New Delhi, 2014.
5. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," Pearson Education India, 2012.

6. I. J. Nagrath, "Electronic Devices and Circuits," PHI Learning Pvt. Ltd., 2007.
7. V. Mittle and Arvind Mittle, "Basic Electrical Engineering," McGraw Hill Companies, 2005.
8. Mitchel E. Schultz, "Basic Electronics," 10<sup>th</sup> Edition, TMH, 2010.

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**OE-2: DOMESTIC EQUIPMENT MAINTENANCE:                      3 Credits      48 Hrs.**

**Course Objectives:** The objectives of the course are

- To enable the students to understand the working principle of domestic equipments.
- Identify the common faults that occurs in the domestic equipment.
- Able to carry out minor repairs in the equipments.
- Understand the technical specifications of the equipments.

**Unit-1: Microwave Oven:** Working, parts, Common faults and their troubleshooting: Microwave does not heat, runs then stops, buttons do not work, plate do not spin, bulb does not turn ON during operation, sparking inside, shuts OFF after few seconds. Demonstrate the working of microwave oven.

**Geyser:** Construction and working, parts and types. Common faults and their troubleshooting: Dripping geyser overflow, overheating, steam or hot water escaping from overflow, water leaking through the ceiling, no hot water, water not hot enough, poor hot water pressure. Demonstrate the working of Geyser. **12 Hrs.**

**Unit-2: Induction Cooker:** Construction and working, parts and types. Common faults and their troubleshooting: Cooker fuse blown, cooker buttons not working, cook top shuts off while cooking, food not get cooked or heated properly, overheating and uneven heating, display keep flashing, weird noises, crackling, fan noise, humming sound, clicking. Demonstrate the working of induction cooker. **12 Hrs.**

**Unit-3: Refrigerator:** Working, electrical wiring diagram, types of refrigerators. Common faults and their troubleshooting: Fridge not cooling, fridge not defrosting, leaking water, freezing food light not working, freezer is cooled but fridge stays warm, dead refrigerator, not enough cooling, keeps running, leakage, makes noise. Replacement procedure for: seal (gasket), evaporator fan motor, PTC relay, thermostat, compressor, bulb. Demonstrate the working of refrigerator. **12 Hrs.**

**Unit-4: Air Conditioner:** Working, electrical wiring diagram, types. Common Faults and their troubleshooting: Faults in following parts of AC: Filter, thermostat, refrigerant leaks, breakers, capacitors, compressor, evaporator coils, condenser coils, warm contactor. General faults : AC unit has an odour, shuts ON and OFF repeatedly, does not blow cold air, repeatedly tripping a circuit breaker, indoor unit is leaking water inside the room, outdoor unit is making an unusually loud sound, room is not getting cold enough, AC not turning ON. Demonstrate the working of air conditioner. **12 Hrs.**



**Unit-2:****14 Hrs.**

**Op-Amp:** Basics of Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop inverting and non-inverting amplifiers, Derivation for voltage gain, definition and expression for op-amp parameters – I/O impedance, offset voltage, CMRR, Slew Rate, concept of virtual ground, Frequency Response.

**Applications of Op-amps:** Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator, and Zero-crossing detector.

**Filters:** Definition and types of filter, active versus passive filters, First and Second order active low pass, high pass and band pass Butterworth filters.

**Oscillators:** Definition and working principle of oscillator, concept of negative feedback, Barkhausen criterion for sustained oscillations, Colpitt's and crystal oscillators, RC-Phase Shift and Wien-bridge oscillator (no derivation for each)

**IC 555 Timer:** Introduction, Block diagram, Circuit diagram and working of Astable and Monostable multivibrator circuits. (Numerical Examples wherever applicable).

**Unit-3:****14 Hrs.**

**Logic Families:** Pulse characteristics, Logic Families-classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology, CMOS NAND Logic, comparison of TTL and CMOS families.

**Combinational Logic Circuits:** Minimisation techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.

**Arithmetic Logic Circuits:** Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4 - bit parallel binary adder, 2 - bit and 4 - bit magnitude comparator.

**Encoder and Decoder:** Decimal to BCD priority encoder, 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder.

**Multiplexer and Demultiplexer:** 4:1 and 8:1 multiplexer, 1:4 and 1:8 demultiplexer, Realization of Full adder and Full Subtractor using Multiplexer and Decoder.

**DAC and ADC:** DAC with binary weighted resistor and R-2R resistor ladder network, Successive approximation-based ADC and the mention of their performance characteristics. (Numerical Examples wherever applicable).

**Unit-4:****14 Hrs.**

**Sequential Logic Circuits:** SR Latch, RS, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Pre-set and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

**Shift Registers and Counters:** Types of Shift Registers, Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (4-bits



only), Synchronous verses asynchronous counters, Ring and Johnson counters, 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, 4-bit Synchronous counter, design of Mod 3, Mod 5 and decade Counters using K-maps.

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### **DSCP-1: ELECTRONIC DEVICES AND CIRCUITS (PRACTICALS): 4 Credits 56 Hrs.**

**Course Objectives:** The objectives of the Course are to enable the students to have hands on training and understanding of the following I-V characteristics of special devices like Principle of operation active devices like, BJT, FET, Op-Amp, UTJ, SCR, etc.,

- ❖ Understand different applications of op-amp,
- ❖ Know about the working of sinusoidal and non-sinusoidal oscillators.
- ❖ Working of Combinational and Sequential Digital circuits.
- ❖ Understand the concept and working of ADC and DAC

#### **LIST OF EXPERIMENTS:**

##### **PART- A**

1. Study the JFET characteristics and obtain the frequency response and calculate band width of single stage JFET amplifier.
2. Study of inverting and non-inverting amplifier, adder, subtractor, and averaging amplifier using Op-amp.
3. Study of differentiator and integrator using op-amp for different input waveforms.
4. Obtain the frequency of oscillations of Colpitt's and RC phase shift oscillator using op-amp.
5. Obtain the frequency response of first order low-pass and high-pass filters using op-amp.
6. Study of astable and monostable multivibrators using IC 555 timer.

##### **PART- B**

1. Study of Half and Full Adder, half and full Subtractor using NAND gates.
2. Study of 4 - bit parallel binary adder and Subtractor using IC.
3. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
4. Study of BCD to decimal decoder using IC, Encoders and priority encoders.
5. Study of Multiplexer and Demultiplexer using ICs.
6. Study of 4-bit asynchronous counter using JK Flip-Flop.
7. Study of 4-bit Shift Register – SISO, modification to ring counter using IC.
8. Study of Digital to Analog Converter using binary weighted resistor method

#### **REFERENCE BOOKS**

1. Robert L Boylestad, and Louis Nashelsky, "Electronic Devices & Circuit Theory," 11th Edition, Pearson Education India, 2018.
2. R. S. Sedha, "A Text book of Applied Electronics," 7 th edition., S. Chand and Company Ltd., 2011.
3. David A. Bell, "Electronic Devices and Circuits," 5th Edition, Oxford Uni. Press, 2015.



4. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuit," 4 th Edition, Pearson Education, 2000.
5. David A. Bell, "Operational Amplifiers and Linear ICs," 3 rd Edition, Oxford University Press, 2011.
6. Thomas L. Floyd, "Digital Fundamentals," 11th Edition, Pearson Education, 2015.
7. A.P. Malvino, D. P. Leach, and Saha, "Digital Principles and Applications," 8 th Edition, TMH, 2014.
8. K. R. Venugopal, K. Shaila, "Digital Circuits and Systems," 1 st Edition, TMH, 2011.

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## Open Elective Courses (OE)

### **OE-3: FUNDAMENTALS OF SEMICONDUCTOR DEVICES: 3 Credits    48 Hrs.**

**Course Objectives:** The objectives of the Course are to enable the student to understand

- Ability to gain the knowledge of Semiconductors devices.
- Ability to get the applications of semiconductor devices.
- Provide students with learning experiences that develop broad knowledge and understanding of semiconductor devices and its applications.

**Unit-1: Introduction to Semiconductors:** Structure of a matter, conductors, insulators and semiconductors with examples to each, Energy band diagrams, intrinsic and extrinsic semiconductors. Definition of doping, dopant, donor, and acceptor, p-type and n-type semiconductors and their comparisons.

**Diode:** Construction, working, symbol, I-V characteristics and mention of application of pn- junction diode. Ideal versus practical diodes, mention of different types of diodes and their symbolic representations.

**Zener Diode:** Construction, working, symbol, I-V characteristics and mention of application of zener diode, Zener and avalanche breakdown.

**LED:** Construction, working, symbol, and mention of application of LED, seven segment display and its applications. **12 Hrs.**

**Unit-2: Rectifiers:** Circuit diagrams, working and waveforms of half wave, full wave center tap and bridge rectifiers. Mention of ripple factor and efficiency to each.

**Filters:** Definition of filter, circuit diagram and working of rectifiers with and without shunt capacitor filter. Mention of ripple factor with and without filter.

**Voltage Regulator:** Definition and applications, Circuit diagram and working of zener diode voltage regulator, load and line regulation. Block diagram of regulator power supply and its applications.

**Wave-shaping Circuits:** circuit diagram and working of positive, negative clippers and clampers. **12 Hrs.**

**Unit-3: BJT:** Construction, working principle, symbol of NPN bipolar junction transistor, Mention of CE, CB, CC configurations, Definition of  $\alpha$ ,  $\beta$  and their interrelations,

Characteristics of a transistor in CE mode. Circuit diagram and working principle of transistor as a switch.

**JFET:** Construction, working principle, symbol of N channel FET, Difference between P and N channel FET, comparison of FET with BJT.

**MOSFET:** Construction, working and symbol of depletion type and enhancement type MOSFET. **12 Hrs.**

**Unit-4: Transistor Biasing:** Need for biasing, DC load line, operating point. Circuit diagram and working of Voltage divider bias circuit.

**Amplifier:** Circuit diagram and working of single stage CE amplifier, frequency response, definition of gain, bandwidth, lower and higher cut-off frequency, application of amplifiers. Block diagram and working of Multistage amplifier and expression for gain.

**Oscillator:** Definition and concept of positive and negative feedback, Barkhausen's criterion for sustained oscillation, Circuit diagram and working of RC phase shift oscillator using transistor. **12 Hrs.**

#### REFERENCE BOOKS:

1. Robert Boylestad, "Introductory circuit analysis," 5th edition, PHI, 2010.
2. Robert Boylestad and Louis Nashelsky, "Electronic Devices and circuit theory," 9<sup>th</sup> Edition, PHI, 2013.
3. B. L. Theraja and A. K. Theraja, "ABC of Electrical Engineering," S Chand Publishers, New Delhi, 2014.
4. R.S. Sedha, "A Text book of Electronics," S Chand and Co., Multicolour, 3<sup>rd</sup> edition, 2012.

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#### **OE-4: RENEWABLE ENERGY AND ENERGY HARVESTING: 3 Credits 48 Hrs.**

**Course Objectives:** The objectives of the course are

- To enable the students to understand the importance of non-conventional energy systems
- Understand the method of energy harvesting using solar energy, wind energy, hydro energy, etc.
- Know the principle of operation of piezoelectric effect and its use in energy harvesting
- Get the knowledge on electromagnetic energy harvesting methods.

**Unit-1: Fossil fuels and Alternate Sources of energy:** Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **12 Hrs.**

**Unit-2: Solar energy:** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems. **12 Hrs.**

**Unit-3: Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

**Geothermal Energy:** Geothermal Resources, Geothermal Technologies. **12 Hrs.**

**Unit-4: Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

**Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications.

**Electromagnetic Energy Harvesting:** Linear generators, physics mathematical models, recent applications. **12 Hrs.**

#### REFERENCE BOOKS:

1. B.H. Khan, "Non-conventional energy sources," 2<sup>nd</sup> Edition, TMH, 2017.
2. Suhas P Sukhative, "Solar energy," 8<sup>th</sup> Edition, TMH, 2008.
3. Godfrey Boyle, "Renewable Energy, Power for a sustainable future," 3<sup>rd</sup> Edition, Oxford University Press, 2012.
4. D.P. Kothari, "Renewable Energy Sources and Emerging Technologies," 2<sup>nd</sup> Edition, PHI, 2011.
5. Jayakumar, P., "Solar Energy Resource Assessment Handbook," Renewable Energy Corporation Network for the Asia Pacific, 2009.
6. John R. Balfour, "Introduction to Photovoltaic System Design," 1<sup>st</sup> Edition, Jones and Bartlett Publishers, 2011.
7. [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy)

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#### **OE-5: PCB DESIGN AND FABRICATION: 3 Credits 48 Hrs.**

**Course Objectives:** Upon the completion of this course, students will demonstrate the ability to:

- Understand basics of PCB designing.
- Apply advance techniques, skills and modern tools for designing and fabrication of

PCBs.

- Apply the knowledge and techniques to fabricate Multilayer, SMT and HDI PCB.
- Understand concepts of Packaging.

**Unit-1: Introduction to Printed circuit board:** Fundamental of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork.

**Design rules for PCB:** Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications. **12 Hrs.**

**Unit-2: Introduction to Electronic design automation (EDA) tools for PCB designing:** Brief Introduction of various simulators, SPICE and PSpice Environment, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silk screen) to design, creating report of design, creating manufacturing data (GERBER) for design. **12 Hrs.**

**Unit-3: Introduction to printed circuit board production techniques:** Photo printing, film- master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations. **12 Hrs.**

**Unit-4: PCB design for EMI/EMC:** Subsystem/PCB Placement in an enclosure, Filtering circuit placement, decoupling and bypassing, Electronic discharge protection, Electronic waste; Printed circuit boards Recycling techniques, Introduction to Integrated Circuit Packaging and footprints, NEMA and IPC standards.

**PCB Technology Trends:** Multilayer PCBs. Multi wire PCB, Flexible PCBs, Surface mount PCBs, Reflow soldering, Introduction to High-Density Interconnection (HDI) Technology. **12 Hrs.**

#### REFERENCE BOOKS:

1. R.S Khandpur, "Printed Circuit Boards - Design, Fabrication, Assembly and Testing," 1<sup>st</sup> Edition, TMH, 2017.
2. Walter C. Bosshart, "Printed Circuit Boards- Design and Technology," McGraw Hill Education, 1983.
3. Clyde F. Coombs, "Printed Circuits Handbook," 6<sup>th</sup> Edition, McGraw Hill Education, 2007.
4. Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor," 2<sup>nd</sup> Edition, Academic Press, 2019.

5. Rao R. Tummala, "Introduction to System-on-Package (SOP): Miniaturization of the Entire System," McGraw Hill, 2008.
6. Mark I. Montrose, "EMC and the Printed Circuit Board-Design, Theory and Layout Made simple," 1<sup>st</sup> Edition, Wiley-IEEE Press, 1998.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60**

Answer any FIVE of the following questions.

5 X 2 = 10

- Q1 a)  
b)  
c)  
d)  
e)  
f)

Answer All of the following

5 x 10 = 50

- Q2 a)  
b)  
OR  
c)  
d)

- Q3 a)  
b)  
OR  
c)  
d)

- Q4 a)  
b)  
OR  
c)  
d)

- Q5 a)  
b)  
OR  
c)  
d)

- Q6 a)  
b)  
OR  
c)  
d)

(Equal weightage be given to all units)

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTERS:****Time: 03 Hours****Max. Marks: 25****Scheme of Evaluation for Practical:**

The student will be evaluated on the basis of skill, comprehension, and recording the results. The student has to compulsorily submit the practical record for evaluation during C1, C2, and C3. For C3, the record has to be certified by the Head of the Department. The duration of the Examination for C3 is 3 hours. The student is evaluated for 10 marks each for C1 and C2 with the weightage of 10 marks for the conduct of experiments during the Practical sessions and 5 marks for Practical Record. Then the marks scored are normalized for 25 marks. For the C3 evaluation, the student is evaluated for 25 marks as per the following scheme:

| <b>Division</b> | <b>Marks</b> |
|-----------------|--------------|
| Experiment Part | 20           |
| Viva            | 05           |
| Total           | 25           |

The Experiment Part evaluation is carried out as per the following scheme.

| <b>Division</b>                                   | <b>Marks</b> |
|---------------------------------------------------|--------------|
| Formula, Circuit, Tabular column, Nature of Graph | 8            |
| Arrangement, Circuit connections                  | 4            |
| Taking and Recording Readings                     | 4            |
| Plotting of Graph and Calculations                | 2            |
| Accuracy of Result                                | 2            |
| Total                                             | 20           |

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# **Bachelor of Science (Basic/Hons.) Degree in Environmental Science**

## **Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020**

**(2021-22 Batch Onwards)**

### **BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Environmental Science and Environmental Studies held on 30<sup>th</sup> October, 2021 in the Department Environmental Science, Yuvaraja College, Mysuru.

| Sl. No. | Members                | Position | Signature/<br>Remarks |
|---------|------------------------|----------|-----------------------|
| 1.      | Dr. S. Suresha         | Chairman | Sd/                   |
| 2.      | Dr. M. R. Janardhana   | Member   | Sd/                   |
| 3.      | Sri. G. Krishna Murthy | Member   | Sd/                   |
| 4.      | Dr. P. G Chandrashekar | Member   | Sd/                   |
| 5.      | Dr. J.S Chandrashekar  | Member   | Sd/                   |
| 6.      | Dr. Pushpa Tuppad      | Member   | Sd/                   |
| 7.      | Sri. Padmananda        | Member   | Absent                |
| 8.      | Dr. G.V. Venkataraman  | Member   | Absent                |

Dr. S. Suresha, Chairman BOS in Environmental Science and Environmental Studies welcomed the members of the BOS to the meeting. The agenda for the BOS meeting is presented to the members and the proceedings of which are as follows:

### **RESOLUTIONS**

- Approval of CBCS NEP 2020 syllabus for I and II Semester B.Sc in Environmental Science along with open electives and AECC papers. Scheme of examinations, skill development question paper pattern for both theory and practical examination etc., in respect of subjects coming under the purview of the board.
  - After detailed discussion, the committee members approved the CBCS syllabus for NEP 2020 syllabus for I and II Semester B.Sc in Environmental Science as per the guidelines of autonomous college and the same is annexed herewith. The approved syllabus with come in to effect from the current academic year that is 2021-22.
  - The committee approved the scheme of examination and question paper pattern (Theory and Practical) for the I and II semester examinations in Environmental Science which is annexed herewith
- Changes, if any, in the existing course of study.



- Committee unanimously decided not to change or modified the proposed curricular frame work for four years graduate Programme in Universities of Karnataka State under NEP 2020 given by the government of Karnataka/ University of Mysore and existing course syllabus.
- 3. Approval of Panel of Examiners for the examination to be held during academic year 2021-22.
  - The committee approved the Panel of Examiners for the academic year 2021-22.
- 4. Any other subjects referred to the Board of Studies by the Academic council of the college for its consideration and opinion.
  - The committee recommended that the students of all the semesters should take part on educational tour/ field visits in all semesters in addition to seminars / assignment for the skill development.
  - It was resolved that the Department Council may decide to give one or more test /assignment to the candidates who abstain themselves for the above, if and only if the council is convinced that the absence of the candidate is on valid grounds. However, the council will allow the candidate to avail this provision within the duration of that semester.
  - It was resolved that the department under the Ability Enhancement Compulsory Course (AECC) will offer Environmental Studies for first semester students of Physical Sciences and BCA students. The same will be offered for the biological science, Integrated Molecular biology and BBA students in the second semester.

Finally, The Chairperson thanked the members and the meeting was concluded

30-10-2021

Mysuru

Chairman

BoS in Environmental Science/Studies

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)                  | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|---------------------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Divisions of Environment (4+0+0)                             | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-1: Water quality analysis (0+0+2)                              | 4                          | 2       | 25                                        | 25                                        |
|           | OE-1: Environmental Conservation Movements (3+0+0)                  | 3                          | 3       | 40                                        | 60                                        |
|           | OE-2: Environment and Sustainable Agriculture (3+0+0)               | 3                          | 3       | 40                                        | 60                                        |
|           | OE-3: Environmental Pollution (3+0+0)                               | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | DSC-2: Ecology – Theory and Practice (4+0+0)                        | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-2: Ecological analysis (0+0+2)                                 | 4                          | 2       | 25                                        | 25                                        |
|           | OE-4: Climate Change and Its Implications (3+0+0)                   | 3                          | 3       | 40                                        | 60                                        |
|           | OE-5: Environment and Public Health in Contemporary Society (3+0+0) | 3                          | 3       | 40                                        | 60                                        |
|           | OE-6: Wildlife and Conservation (3+0+0)                             | 3                          | 3       | 40                                        | 60                                        |

**Programme outcome:** By the end of the Programme the students will be able to develop:

- Disciplinary knowledge in fields related to Environmental Science
- Systemic and critical thinking with reference to environment-people-economic-development attributes
- Problem identification skills and sustainable solution provisioning
- Analytical reasoning and appropriate interpretation skills
- Self-directed learning efficiencies leading to a productive lifelong learning process
- Research-related skills such as review of literature, design of experiments, statistical competence, report writing and prepare target specific communication packages
- Cooperation/Team work
- Reflective thinking
- Multidisciplinary competence catering to environmental sustainability

**Job Opportunities:**

- ❖ Teaching; Pollution Control Board; Environmental manager in industries; ETP Operators in industries; Municipalities, corporation, city developments; Sampling

- Assistant in wastewater treatment plants.
- ❖ Analytical Assistant/Intern analyst in water testing laboratories
- ❖ Laboratory instructor in educational institutions
- ❖ Field Technician in mobile environmental laboratories
- ❖ Field Technician in Research institutions/NGOs involved in environmental monitoring/carbon credit establishment/productivity studies.
- ❖ Sampling and execution assistant in environmental auditing
- ❖ Garden/nursery Supervisor/Entrepreneurship; NGOs/Consultancy; Self-employment
- ❖ Public Health/Waste Management Assistants in Municipalities Incinerator operators in small establishments
- ❖ Self-employment Public Health/Waste Management Assistants in Municipalities Incinerator operators in small establishments

## I SEMESTER

### Programme Specific Objectives:

- To develop competency in understanding the interrelatedness of the divisions of the Environment.
- To instill an introductory knowledge of the divisions of Environment and develop necessary analytical skills to characterise their variations.
- To motivate and inspire to acquire contemporary understanding and skills leading to issue identification.
- To inculcate creativity and innovative spirit in the domain of human-environment interface leading to vocation/entrepreneurial opportunities.

### Programme outcomes:

- ❖ Demonstrate an entry level competence in understanding the environmental divisions and associated processes.
- ❖ Demonstrate the ability to carry out water quality analysis in the laboratory and interpret the results.
- ❖ Ability to understand and appreciate the role of environmental parameters in specific day-to-day activities.
- ❖ Be able to understand the demands and function in work environment dealing with environmental systems.

**Pedagogy:** Theory and course projects. Hands-on-training. Theory, case studies and self-study.

### **DSC-1: DIVISION OF THE ENVIRONMENT (THEORY): 4 Credits    56 Hrs.**

**Unit-1:** Environmental Science: Definition, Aim of study and Scope. Differences between Ecology and Environmental Science; Various approaches of studying Environmental Science. Components of the Environment: Definitions of Atmosphere, Hydrosphere, Lithosphere and Biosphere - their complex interactions and significance. **10 Hrs.**

**Unit-2:** Atmosphere: Evolution of the atmosphere – Principal components – Permanent and variable gases. Structure of the atmosphere on the basis of temperature and composition. Ozone chemistry - Depletion and recovery of stratospheric ozone – monitoring, effects and control measures. Climatology: Differences between weather and climate; Insolation - Factors affecting the distribution. Solar (short-wave) and terrestrial (long-wave) radiations. Earth's Albedo and Heat budget of the earth. Tropical monsoon climate – Tropical cyclones and their impacts. Weather forecasting and modification. El-Nino and La-Nina effect. Global warming, effects and control measures; Global dimming - Definition, causes and implications; Urban Heat Islands. **16 Hrs.**

**Unit-3:** Hydrosphere: Hydrological cycle - process of heat energy transfer - Radiation, Conduction and Convection. Types of lifting and precipitation -Bergeron process – Cloud formation and classification. Forms of condensation; Forms of precipitation. Cloud seeding. Limnology: Definition – Lotic and Lentic environment. Differences between Lotic and Lentic systems. Lotic environment: Springs, Stream profile: Potomac and Rhithron. Lentic environment: Ponds, lakes and estuaries – their types. Photic and thermal stratification of Lentic systems. Marine environment: Zonation, Salinity status of marine environment, biotic communities of oceanic zones, acidification of sea water; ocean currents and tides –significance; Polymetallic nodules. Groundwater: Definition. Zonation; Types of wells. Salinization of groundwater in coastal regions. **15 Hrs.**

**Unit-4:** Lithosphere: Definition. Internal structure of the earth. Endogenic processes: Plate Tectonics – Earthquake and Volcanism –Causes, Effects, and Management. Exogenic processes: River, Sand dunes, Glaciation, Avalanches and Landslides. Mineralogy: Introduction. Outline classification of minerals. Petrology: Introduction. Classification, Igneous, Sedimentary and Metamorphic rocks – their formation – types – uses. Pedology: Soil – definition – formation – soil profile. Types – Alluvial; Black; Red and Laterite; Arid and Desert; Saline and Alkaline; Peaty and Marshy; Grassland, Forest and Mountain Soils. A brief account of Soil biota. **15 Hrs.**

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### **DSCP-1: WATER QUALITY ANALYSIS (PRACTICAL): 2 Credits 56 Hrs.**

#### **LIST OF EXPERIMENTS**

1. Sampling technique of water.
2. Determination of pH – pH metric method
3. Determination of Electrical Conductance – Conductivity meter method
4. Estimation of Turbidity – Nephelometric method
5. TS, TSS & TDS – Gravimetric and Filtration method (3 labs)
6. Estimation of Acidity – Alkalimetric method
7. Estimation of Alkalinity – Acidimetric method
8. Estimation of Hardness – EDTA Complexometric method
9. Estimation of Chlorides – Argentometric method

10. Demonstration of instruments write up their working theory and principle (2 labs)

### REFERENCE BOOKS

1. Allaby, M. (2002). Basics of Environmental Science. Routledge.
2. Barry, G. R. and Chorley, J. R. (2003). Atmosphere, Weather and Climate. Routledge, London.
3. Critchfield, H. J. (1995). General Climatology. Printice Hall of India.
4. Horne, A. J., & Goldman, C. R. (1994). Limnology (Vol. 2). New York: McGraw-Hill.
5. Lutgens, F. K. and Tarbuck, E. J. (1982). Atmosphere – Introduction to Meteorology. Prentice Hall Inc.
6. Manahan, S. E. (2011). Fundamentals of environmental chemistry. CRC press.
7. Miller, G. T., & Spoolman, S. (2015).
8. Environmental Science. Cengage Learning. Miller, Jr. G. T. (1994).
9. Living in the Environment: Principles, Connections and Solutions. Wadsworth Publishing.
10. Miller, R. W. and Donahue, R. L. (1992). Soils – Introduction to Soils and Plant Growth. Prentice Hall of India.
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12. Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
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14. Nandini, N. (2009). Handbook on water quality monitoring and Assessment. Sapna Book House, Bengaluru.
15. Sawyer, C. N. and Mc Carty, P. L. (1978). Chemistry for Environmental Engineering. Mc Graw – Hill International.
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17. Standard Methods for Examination of Water and Wastewater. (2017). APHA – WEF.
18. Trivedi, P. K. and Goel, P. K. (1984). Chemical and Biological Methods of Water Pollution Studies. Environmental Publication.
19. Zhang, C. (2007). Fundamentals of environmental sampling and analysis. John Wiley & Sons.

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### Open Elective Course (OE):

#### OE-1: ENVIRONMENTAL CONSERVATION MOVEMENTS (THEORY):

3 Credits

42 Hrs.

**Unit-1:** Environment: Definition, role of environment in shaping civilizations. Interrelations between civilization and environment – ecological, economic and socio-

cultural. Industrial revolution and environmental pollution. Globalization and environmental pollution. Modern agriculture and environmental degradation. Development: Definition, Growth and development. Population growth and its impact on natural resources, Modernization and population. Causes for industrialization, changing life styles, regulatory aspects of industrialization, overall impact of industrialization on quality of human life, negative impacts of industrialization and urbanization. **14 Hrs.**

**Unit-2:** Development and Environment: Types of development. Sustainable development – Need and relevance in contemporary society. Principles of Sustainable Development: History and emergence of the concept of Sustainable Development, Definitions, Environmental issues and crisis, Resource degradation, greenhouse gases, desertification, invasive species, wildlife depletion and social insecurity. United Nations Sustainable Development Goals. Strategies for implementing eco-development programmes, Sustainable development through - trade, economic growth, carrying capacity and public participation. **14 Hrs.**

**Unit-3:** People movements: Types – Concept of environmental movements, Definition, levels of collective action, the local grassroots movement level; the social movement level; a cycle of protest. Environmental Movements: United Nations Conference on Human Environment, 1972 – 'Limits to Growth'. The Brundtland Commission, 1987 – 'Our Common Future'. The United Nations Conference on Environment and Development, 1992. Environmental Movements of India: Bishnoi Movement, The Chipko Movement, Appiko Movement, Silent Valley Movement, Narmada Bachao Andolan, Jungle Bachao Andolan, Beej Bachao Andolan. Urban-based Environmental Movements – Local case studies. **14 Hrs.**

### REFERENCE BOOKS

1. Bindra, P. S. (2017). The Vanishing: India's Wildlife Crisis. Penguin Random House India.
2. Climate Change: Science and Politics. (2021). Centre Science and Environment, New Delhi.
3. Edwards, Andres R. (2005). The Sustainability Revolution: Portrait of a Paradigm Shift. New Society Publishers.
4. Flanders, L. (1997). The United Nations' department for policy coordination and sustainable development (DPCSD). Global Environmental Change, 7(4), 391-394.
5. McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
6. Nagendra, H., & Mundoli, S. (2019). Cities and canopies: trees in Indian cities. Penguin Random House India Private Limited.
7. Nepal, Padam. (2009). Environmental Movements in India: Politics of Dynamism and Transformations, Authors press, Delhi.
8. Rachel Carson. (2002). Silent spring. Houghton Mifflin Harcourt.
9. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment.

10. Sustainable development in India: Stocktaking in the run up to Rio+20. (2011).

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## **OE-2: ENVIRONMENT AND SUSTAINABLE AGRICULTURE (THEORY):**

**3 Credits**

**42 Hrs.**

**Unit-1:** Environment – Definition, scope and significance. Agriculture – Definition, scope and significance. Environmental basis for agriculture and food. Agricultural patterns in India. Socio-economic pressures on agriculture. Food security and food scarcity. Types of agriculture – rain-fed cultivation and irrigation – water intensive agriculture – Reservoirs and ground water exploitation. Conventional and mechanised agriculture. Natural and chemical agriculture. Subsistence and commercial agriculture. Environmental effects of land use and landscape changes. **14 Hrs.**

**Unit-2:** Environmental determinants of agriculture – role of rainfall, humidity, wind, topography and edaphic factors in crop selection. Animal husbandry – Dairy and poultry – role of transboundary species of cattle in Indian scenario. Pisciculture – Environmental effects of intensive pisciculture. Agricultural biodiversity: Crop diversity – Definition and significance. Polyculture and mono culture. Influences of green revolution on modern agricultural practices of India – Loss of agro biodiversity – Influence of transboundary crops. Agricultural biotechnology – Genetically Modified Crops – Influence on environment. Pollination crisis. Integrated pest management. **14 Hrs.**

**Unit-3:** Environmental impacts of agriculture – Loss of biodiversity – soil salinity – fertiliser and pesticide pollution, Climate change and global warming. Erosion and problems of deposition in irrigation systems. Desertification. Biomagnification – Case studies. Contemporary issues and management – Farmer distress – market mechanisms – natural farming methods/organic farming. Urban agriculture and hydroponics. Ecological principles of farming – Sustainable agriculture – Significance of indigenous crops and cattle varieties. Watershed management. Agricultural policies of India. **14 Hrs.**

## **REFERENCE BOOKS**

1. Altieri, M. A. (2018). Agroecology: the science of sustainable agriculture. CRC Press.
2. Campanhola, C., & Pandey, S. (Eds.). (2018). Sustainable food and agriculture: An integrated approach. Academic Press.
3. de Zeeuw, H., & Drechsel, P. (Eds.). (2015). Cities and agriculture: Developing resilient urban food systems. Routledge.
4. Eric Lichtfouse, Mireille Navarrete, Philippe Debaeke, Souchere Ve'ronique, Caroline Alberola. (2009). Sustainable Agriculture. Springer Science & Business Media.
5. Kazim B. Rahim Debash Sarkar Bidhan Chand. (2012). Sustainable Agriculture and Environment. New Delhi Publishers.
6. Satyanarayana, T., Johri, B. N., & Prakash, A. (Eds.). (2012). Microorganisms in sustainable agriculture and biotechnology. Springer Science & Business Media.
7. Songstad, D. D., Hatfield, J. L., & Tomes, D. T. (Eds.). (2014). Convergence of food security, energy security and sustainable agriculture (Vol. 67). New York: Springer.

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**OE-3: ENVIRONMENTAL POLLUTION (THEORY): 3 Credits 42 Hrs.**

**Unit-1:** Environmental pollution: Definition, Types. Environmental contaminants and environmental pollutants. Classification of pollutants – on the basis of physical properties and forms of their existence. Primary and secondary pollutants, degradable and non-degradable, point and non-point sources of pollution. Xenobiotics and persistent organic chemicals. Characteristics of pollution. – Large production quantities, usage involving leakages, toxicity, persistence and accumulation. Air pollution: Definition, sources of air pollution and their effects on flora, fauna, human-beings and materials. Indoor pollution, automobile pollution, ozone depletion and recovery, global warming and climate change. London smog, Bhopal gas tragedy, Visakhapatnam gas leak and endosulphan tragedy in Karnataka. Air quality standards – NAAQS, AQI, Bharat Stage - VI Emission standards. Air pollution control measures. **14 Hrs.**

**Unit-2:** Water pollution: Definition, sources of water pollution and their effects on flora, fauna, human-beings and materials. Surface water pollution – Dissolved oxygen, biochemical oxygen demand and chemical oxygen demand. Agriculture runoff and detergents as pollutants. Eutrophication. Heavy metal pollution – Minamata episode, Marine water pollution. Groundwater pollution – fluoride, nitrate, Arsenic pollution and their control. Water quality criteria – specifications for drinking and inland surface waters. Water Quality Indices. Soil pollution: Definition, sources and types. Soil pollutants – metals, inorganic ions and salts; and organic substance. Effects of pollution on soil health and productivity. Effects of pesticides on soil. Soil erosion, types and control. **14 Hrs.**

**Unit-3:** Noise pollution: Definition, sources and effects. Noise induced hearing loss. Decibel scale. Noise control measures. Solid waste management: Definition, origin, classification and characteristics of solid waste. Segregation, collection, transportation and disposal of solid waste. Solid waste treatment and disposal – Composting, open dumping, sanitary landfill, incineration, recycling and recovery. E-waste: Definition, sources, composition, recycling and disposal methods. Hazardous waste: Definition, sources, classification, effects and disposal methods. **14 Hrs.**

**REFERENCE BOOKS**

1. Bhatia H. S. (2003). A Textbook on Environmental Pollution and Control. Galgotia Publications Private Limited, Delhi.
2. Mark L. Brusseau, Ian L. Pepper and Charles P. Gerba. (2019). Environmental and Pollution Science. Academic Press.
3. Marquita K. Hill. (2012). Understanding Environmental Pollution. Cambridge University Press
4. Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
5. Peirce, J. J., Vesilind, P. A., & Weiner, R. (1998). *Environmental pollution and control*. Butterworth-Heinemann.

6. Rachel Carson. (2002). Silent spring. Houghton Mifflin Harcourt.
7. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment.
8. Trivedi P. R. (2004). Environmental Pollution and Control. Ashish PublishingHouse - APH Publishing Corporation.
9. Yogendra N Srivastava. (2009). Environmental Pollution. Ashish Publishing House- APH Publishing Corporation.

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## II SEMESTER

### Programme Specific Objectives:

- To develop competency in understanding the ecological principles governing the biosphere.
- To instill a knowledge of the Ecology and develop necessary analytical skills to understand the ecological systems.
- To motivate and inspire to acquire contemporary understanding and skills leading to issue identification.
- To inculcate creativity and innovative spirit in the domain of human-environment interface leading to vocation/entrepreneurial opportunities

### Programme outcomes:

- ❖ Demonstrate an entry level competence in understanding the ecological dynamics and their influence on humans and anthropogenic endeavours.
- ❖ Demonstrate the ability to carry out ecological analysis in field conditions/laboratories and make appropriate judgements.
- ❖ Ability to understand and appreciate the role of ecology and system dynamics in specific habitats/agroecosystems.
- ❖ Be able to understand the demands and function in work environment dealing with environmental systems.

**Pedagogy:** Theory and course projects. Hands-on-training. Theory, case studies and self-study.

### **DSC-2: ECOLOGY – THEORY AND PRACTICE (THEORY): 4 Credits 56 Hrs.**

**Unit-1:** Levels of organization, Ecology: Divisions of Ecology - approaches in studying Ecology. Ecosystems – Definitions. Classification of ecosystem – Terrestrial and Aquatic with their divisions. Structure of the ecosystem - Function of ecosystem - food chain – food web – bio-magnification. Ecological pyramids – Types. Biogeochemical cycles: Classification. Gaseous and Sedimentary cycles – anthropogenic influences on these cycles. Energy flow in an ecosystem – productivity - trophic levels; Study of pond and crop land ecosystems; homeostasis and feedback mechanisms. **14 Hrs.**

**Unit-2:** Biotic and Abiotic factors: Influence Temperature, Wind and Water, Edaphic, Topographic on flora and fauna. Concept of Limiting Factors: Liebig's Law of

Minimum; Shelford's Law of Tolerance and the combined concept. Evolution: Definition – Darwin's postulates – Natural selection – Types – Industrial Melanism – Pesticide resistance. Co-evolution; Mimicry – Batesian and Mullerian mimicry, warning colouration. **14 Hrs.**

**Unit-3:** Ecological succession – Primary and Secondary succession – Natural and man-influenced succession, – Hydrarch and Xerarch – Climax vegetation and their theories; Ecotone and Edge effect; Ecological equivalents; Ecotypes and Ecophenes; Ecological indicators. Ecological Niche: Concept and Types of niches: Spatial, Trophic and Multidimensional – Niche parameters: Form, Position and Width – Niche Partitioning – Realized and Fundamental Niche. Biomes: Definition and concept. Classification of biomes. **14 Hrs.**

**Unit-4:** Community Ecology: Definition, Characteristics of a Community – Species diversity, growth form and structure, dominance, relative abundance, trophic structure. Population Ecology: Definition, Characteristics of Population: Density – Natality – Mortality – Age distribution – Growth form-Population Equilibrium – Biotic potential – Carrying capacity – Dispersal – Dispersion – Population fluctuations – Population regulation. **14 Hrs.**

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**DSCP-2: ECOLOGICAL ANALYSIS (PRACTICAL):                      2 Credits    56 Hrs.**

#### **LIST OF EXPERIMENTS**

1. Sampling technique of phytoplankton
2. Sampling technique of zooplankton
3. Quantitative estimation of phytoplankton – Sedgwick-Rafter method
4. Quantitative estimation of zooplankton – Sedgwick-Rafter method
5. Determination of organic pollution – Palmer's Algal Pollution index
6. Estimation of primary productivity of a pond – Light and Dark bottle method
7. Estimation of primary productivity of terrestrial vegetation – Chlorophyll method
8. Estimation of primary productivity of grasses – Harvest method
9. Study of plant community – Individual count method/Quadrat method
10. Study of animal community – Line transect method
11. Determination of species diversity indices – Simpson and Shannon's Wiener Index
12. Estimation of carbon capture and storage of trees
13. Identification of ecological indicators

#### **REFERENCE BOOKS:**

1. Agarwal, K. C. (1999). Environmental Biology. Agro Botanica.
2. Beck, W. S., Liem, K. F. and Simpson, G. G. (1991). Life – Introduction to Biology. Harper Collins Publications.
3. Chapman, J. L. and Reiss, M. J. (1995). Ecology – Principles and Applications.

- Cambridge University Press.
4. Dash, M. C. (2001). Fundamentals of Ecology. Tata McGraw-Hill Publishing Co.
  - Kormondy, E. J. (1996). Concepts of Ecology. Prentice Hall of India.
  5. Mamta Rawat, Sumit Dookia and Chandrakasan Sivaperuman. (2015). Aquatic Ecosystem: Biodiversity, Ecology and Conservation. Springer publication.
  6. McCleery, Robert A., Moorman, Christopher, Peterson, M. Nils (Eds.). (2014). Urban Wildlife Conservation - Theory and Practice. Springer publication.
  7. Odum, E. P. (1971). Fundamentals of Ecology. W.B. Saunders Co.
  8. Raven, P. H. and Johnson, G. B. (1995). Biology. Wm. C. Brown Publications. Ricklefs,
  9. R. E. and Miller, (1999). Ecology. W.H. Freeman and Co.
  10. Smith, T. M. and Smith, R. L. (2007). Elements of Ecology. Pearson Education. Taylor,
  11. Wallace, R. A. (1990). Biology – The World of Life. Harper Collins Publications.
  12. Michael, P. (1986). Ecological Methods for Field and Laboratory Investigations. Tata Mc Graw-Hill Publishing Co. Ltd.
  13. Rolan, R. G. (1973). Laboratory and Field Investigations in General Ecology. Macmillan Co.
  14. Standard Method for Examination of Water and Wastewater. (2017). APHA – WEF.
  15. Subrahmanyam, N. S. and Sambamurty, A. V. S. S. (2000). Ecology. Narosa Publishing.
  16. Trivedi, P. K. and Goel, P. K. (1984). Chemical and Biological Methods of Water Pollution Studies. Environmental Publications.

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### Open Elective Course (OE):

#### OE-4: CLIMATE CHANGE AND ITS IMPLICATIONS (THEORY): 3 Credits 42 Hrs.

**Unit-1:** Climate Change: Definition, scope and facts of climate change. Origin and evolution of the earth's atmosphere. Composition and thermal structure of atmosphere; Weather and climate; Meteorological parameters - temperature, pressure, precipitation, humidity, wind speed & direction. Introduction to the effects of various anthropogenic activities on earth's atmosphere. Monsoons – Definition, Indian monsoons – seasons: Cold weather season (Winter), the hot weather season (Summer), season of advancing monsoon (The rainy season) and season of retreating monsoon (The transition season). Cyclones of the Indian region; El-Niño, La Nina and their impacts. **14 Hrs.**

**Unit-2:** Greenhouse effect and global warming: Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases; Urban Heat Islands; Ozone layer depletion and recovery, issues and remedies; groundlevel ozone and air pollution; global dimming. Carbon footprint. Impacts of global climate change: Increased surface mean temperature, insect outbreaks, vector borne/zoonotic diseases, forest fire, reduced water availability, influence on agriculture, increase in floods and drought incidences, loss of biodiversity

and extinction of species, sea level rise. Climate change and food security. Vulnerable populations – The Kiribati story. **14 Hrs.**

**Unit-3:** Climate change and policy frameworks – History of international climate change policies. United Nation Framework Convention on climate change (UNFCCC), The United Nations Conference on Environment and Development, Intergovernmental Panel on Climate Change (IPCC), Ministry of Environment, Forests & Climate Change (MoEF&CC), National Action Plan on Climate Change (NAPCC), Agenda 21, The Kyoto protocol, Paris agreement. Overview of Conference of Parties (CoP). Evolution of climate change negotiations. Climate change adaptation and mitigation: Definition, scope and objectives. Linkages between development, climate change impacts, their mitigation and adaptation. Clean Development Mechanisms; Green Climate Fund, The Adaptation Fund. United Nations Sustainable Development Goals. Role of individuals in achieving Sustainable Development Goals. **14 Hrs.**

### REFERENCE BOOKS

1. Abhishek Tiwary and Jerem Colls. (2010). Air Pollution: Measurement, Modelling and Mitigation. III Edition, Routledge Publication.
2. Agarwal K.M, Sikdar P.K. and Deb S.C. (2002). A text book of Environment – MacMiller India Ltd., Calcutta
3. Climate Change: Science and Politics. (2021). Centre Science and Environment,.
4. Donald Ahrens.C. (2008). Essentials of Meteorology: An Invitation to the Atmosphere. Cengage Learning publication.
5. Howard J. Critchfield. (1983). General Climatology (Fourth Edition), Phi Learning Pvt Ltd.
6. IPCC. (2006). Guidelines for National Greenhouse gas Inventories. Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on behalf of the IPCC.
7. John E. Oliver, John J. Hidore. (2002). Climatology: An Atmospheric Science, Second Edition. Prentice Hall publication.
8. John T. Hardy. (2003). Climate Change: Causes, Effects and Solution. John Wiley & Sons publications.
9. Mann, M. E. (2021). The New Climate War: the fight to take back our planet. Hachette UK.
10. Nicholas Stern. (2008). The Economics of Climate Change: The Stern Review. Cambridge University Press. Great Britain.
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12. Roger G. Barry and Richard J. Chorley. (2007). Atmosphere, weather and Climate, 8th Edition, Routledge Publishers.
13. Romm, J. (2018). Climate Change: What Everyone Needs to Know®. Oxford University Press.

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**OE-5: ENVIRONMENT AND PUBLIC HEALTH IN CONTEMPORARY SOCIETY (THEORY):****3 Credits****42 Hrs.**

**Unit-1:** Environment and public health: Definitions of health and disease. Perspectives on individual health: Nutritional, socio-cultural and developmental aspects, Dietary diversity for good health; Human developmental indices for public health. Effect of quality of air, water and soil on human health. Diseases in contemporary society: Need for good health - factors affecting health. Types of diseases - deficiency, infection, pollution diseases - allergies, respiratory, cardiovascular and cancer. Personal hygiene- food- balanced diet. Health effects of smoking, drugs and alcohol consumption. **14 Hrs.**

**Unit-2:** Malnutrition: Vitamin deficiency diseases and Mineral deficiency diseases; Folic acid requirement during pregnancy; Food Safety- Adulterants and preservatives; Pesticide Toxicity: Endosulfan and DDT; Genetically Modified Food. Non-communicable diseases and Lifestyle diseases - Diabetes and Hypertension. Communicable diseases: Definition, mode of transmission – pandemic, epidemic and endemic diseases. Vector borne diseases: Plague and Malaria; emerging diseases: Dengue, Chikungunya, Zika, Ebola, Swine Flu, Bird Flu, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS); Zoonosis- Leptospirosis; Kyasanur Forest Disease (KFD) Toxoplasmosis and Nipah. **14 Hrs.**

**Unit-3:** Occupational health: Sick Building Syndrome; Noise and Radiation; Ergonomics - Stress and Fatigue; Carpal tunnel syndrome (CTS); Methyl mercury and cerebral palsy; Synergistic effect; Irritable bowel syndrome; Crohn's disease. Environmental Sanitation and Hygiene: Safe disposal of human excreta; Solid waste disposal; Sanitation value chain. Drug safeties: Thalidomide Tragedy; Antibiotic stewardship; New Delhi Antibiotic Resistant superbug. **14 Hrs.**

**REFERENCE BOOKS**

1. Akhtar, R. (Ed.). (2019). Extreme weather events and human health: International case studies. Springer Nature.
2. Bedi and Yashpal. (1971). Handbook of Hygiene and Public Health. Atma Ram & Sons, Delhi.
3. Kessel, A. (2006). Air, the environment and public health. Cambridge University Press.
4. Lopez, R. P. (2012). The built environment and public health (Vol. 16). John Wiley & Sons.
5. Nandini N. (2018). Environment and public Health. Sapna Book House, Bengaluru.
6. O'Carroll, P. W., Yasnoff, W. A., Ward, M. E., Ripp, L. H., & Martin, E. L. (Eds.). (2003). Public health informatics and information systems.
7. Park, K. (2009). Park's Textbook of Preventive and Social Medicine, 20th Edition. Misc Publication.
8. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In



Figures. Centre Science and Environment, New Delhi.

9. Van den Bosch, M., & Bird, W. (Eds.). (2018). Oxford textbook of nature and public health: The role of nature in improving the health of a population. Oxford University Press.
10. Walton, M. (2017). One Planet, One Health. Sydney University Press.

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#### **OE-6: WILDLIFE AND CONSERVATION (THEORY): 3 Credits 42 Hrs.**

**Unit-1:** Wildlife: Definition, significance – Values of wildlife: Ecological, Economic, Cultural, Aesthetic, Scientific, Recreational and Medicinal. Biogeographical zones of India. Significant wildlife of India. Causes for wildlife depletion – HIPPO (Habitat destruction, Invasive species, Pollution, Population (human overpopulation), Overharvesting by hunting and fishing. Forest fires and wildlife depletion. Effects of depletion of wildlife – Ecological, Economic Socio-cultural. Urban wildlife. Human-wildlife conflict and management. Categories of Wildlife: IUCN Red data categories - Extinct, Extinct in wild, Critically endangered, Endangered, Vulnerable, Near threatened, Least concerned, Data deficient, Not evaluated. IUCN Red data book. Keystone species, Flagship species, Umbrella species. Priority species, Indicator species. **14 Hrs.**

**Unit-2:** Wildlife conservation: Need for conservation of wildlife. History of wildlife conservation in India. Biosphere reserves, National parks, Wildlife sanctuaries, wildlife reserves, protected areas, privately owned wildlife reserves & Single species/single habitat-based conservation areas, Area of special scientific interest (ASSI). Conservation practices - *Ex-situ* and *in-situ* conservation. Captive breeding - Role of Zoos in conservation. Community conserved areas – *Devarakadu* and *Pavitra Vana*. Case studies: Project tiger, Project elephant. Role of BSI and ZSI in conservation. People and conservation: Traditional knowledge, Traditions and cultures, Women and people's participation in managing protected areas. Role of NGOs in conservation. Conservation Institutions – Bird Life International, GEF, IUCN, UNEP, WCS, WWF; BNHS, WTI. **14 Hrs.**

**Unit-3:** Wildlife tourism and its impacts: Definition, scope and relevance. Role of Zoos and Botanical parks in tourism and awareness creation. Bird and butterfly watching. Positive and negative impacts of wildlife tourism. Conflicts related to wildlife tourism. Wildlife trade and legislation: Wildlife trade and impacts. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Wildlife Trade Monitoring Network (TRAFFIC). Salient features of Indian wildlife act 1972. **14 Hrs.**

#### **REFERENCE BOOKS**

1. Bindra, P. S. (2017). The Vanishing: India's Wildlife Crisis. Penguin Random House
2. Donald Letcher Goddard and Sam Swope. (1995). Saving Wildlife: A Century of Conservation. Wildlife Conservation Society.
3. E.P. Gee. (2002). The Wild Life of India. HarperCollins India.
4. Goutam Kumar Saha, Subhendu Mazumdar. (2017). Wildlife Biology: An Indian



Perspective, PHI Learning Pvt. Ltd. India.

5. Herbert H.T. Prins, Jan Geu Grootenhuis and Thomas T. Dolan. (2000). Wildlife Conservation by Sustainable Use. Springer publication.
6. Jedediah F. Brodie, Eric S. Post, and Daniel F. Doak. (2012). Wildlife Conservation in a Changing Climate. The University of Chicago Press.
7. Manfredo, Michael J. (2008). Who Cares About Wildlife?. Springer publication.
8. Morrison, M.L., Block, W.M., Strickland, M.D., Collier, B.A., Peterson, M.J. (2008). Wildlife Study Design, Springer publication.
9. Nagendra, H., & Mundoli, S. (2019). Cities and canopies: trees in Indian cities. Penguin Random House India Private Limited.
10. Roth, Harald H., Merz, Günter (Eds.). 1997. Wildlife Resources - A Global Account of Economic Use. Springer publication.
11. Underkoffler, Susan C, Adams, Hayley R. (Eds.). (2021). Wildlife Biodiversity Conservation - Multidisciplinary and Forensic Approaches, Springer publication.

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### QUESTION PAPER: THEORY EXAMINATION (Applicable to DSC-1, and DSC-2 Papers)

**Time: 02 Hours**

**Max. Marks: 60**

**Instructions:** Draw neat and labelled diagrams wherever necessary.

#### PART-A

Write a short note on any FIVE questions of the following.

**5 x 2 = 10**

- Q1** a)  
b)  
c)  
d)  
e)  
f)  
g)

#### PART-B

Answer any FOUR of the following

**4 x 5 = 20**

**Q2 - Q7**

#### PART-C

Answer any FOUR of the following

**4 x 5 = 20**

**Q8 - Q12**

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**SCHEME OF PRACTICAL EXAMINATION****I SEMESTER:****DSCP-1: Water Quality Analysis Practical****Time: 03 Hours****Max. Marks: 25****Distribution of Marks**

|                             |          |
|-----------------------------|----------|
| Calculation and preparation | 02 Marks |
| Standardization             | 03 Marks |
| Estimation                  | 15 Marks |
| Viva –Voce                  | 05 Marks |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**II SEMESTER:****DSCP-2: DSCP-1: Ecological Analysis Practical****Time: 03 Hours****Max. Marks: 25****Distribution of Marks**

|                                                   |          |
|---------------------------------------------------|----------|
| Identification of phytoplankton/zooplankton       | 04 Marks |
| Quadrat method of analysis                        | 06 Marks |
| Determination /estimation of primary productivity | 06 Marks |
| Identification of species diversity               | 04 Marks |
| Viva –Voce                                        | 05 Marks |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Food Science & Nutrition**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

The Board of Studies in Food Science & Nutrition (UG) meeting was convened on **30.11.2021** at 10 AM in the Chamber of Head of the Department, Dept. of Food Science & Nutrition, Yuvaraja College, Mysuru.

**AGENDA OF THE MEETING:**

1. Necessary modification if any in the existing UG CBCS syllabus.
2. Approval of list BOE (UG) members.
3. Approval of NEP Syllabus
4. Any other relevant matter, if any.

| Sl. No. | Members                 | Position | Signature/<br>Remarks |
|---------|-------------------------|----------|-----------------------|
| 1.      | Dr. Shekhara Naik R.    | Chairman | Sd/                   |
| 2.      | Dr. Rajeshwari. J       | Member   | Sd/                   |
| 3.      | Dr. Anitha C            | Member   | Sd/                   |
| 4.      | Dr. Naveen S            | Member   | Sd/                   |
| 5.      | Dr. Shobha D            | Member   | Sd/                   |
| 6.      | Smt. Manjula Sheshagiri | Member   | Sd/                   |
| 7.      | Dr. Devaki CS.          | Member   | Absent                |

**PROCEEDINGS:**

The board members, after an elaborate discussion have resolved the following:

1. The existing 2019-20 syllabus CBCS (UG) B Sc. Syllabus – interchange of paper from V to VI – paper titled – “Diet Therapy” and VI to V sem titled “Food Chemistry and Food Biotechnology” is approved – **Annexure I.**
2. Approved the NEP 2020 syllabus with minor modifications in the II sem paper titled – “Fundamentals of Human Nutrition” – **Annexure II.**
3. Panel of examiners list updated and approved for the year 2021-22.
4. As there were no other points, meeting ended with vote of thanks.

30-11-2021  
Mysuru

Chairman,  
BOS in Food Science & Nutrition

**Details of Course of Study: I and II Semesters**

| <b>Sem.</b> | <b>Discipline Core/<br/>Open Elective Paper<br/>(L+T+P)</b> | <b>Teaching<br/>hours/<br/>week</b> | <b>Credits</b> | <b>Internal<br/>Assessment<br/>Marks (C1 + C2)</b> | <b>Semester End<br/>Examination<br/>Marks (C3)</b> |
|-------------|-------------------------------------------------------------|-------------------------------------|----------------|----------------------------------------------------|----------------------------------------------------|
| <b>I</b>    | DSC-1: Human Physiology (4+0+0)                             | 4                                   | 4              | 40                                                 | 60                                                 |
|             | DSCP-1: Human Physiology (0+0+2)                            | 4                                   | 2              | 25                                                 | 25                                                 |
|             | OE-1: Basics of Food Science (3+0+0)                        | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-2: Basics of Nutrition (3+0+0)                           | 3                                   | 3              | 40                                                 | 60                                                 |
| <b>II</b>   | DSC-2: Fundamentals of Human Nutrition (4+0+0)              | 4                                   | 4              | 40                                                 | 60                                                 |
|             | DSCP-2: Fundamentals of Human Nutrition (0+0+2)             | 4                                   | 2              | 25                                                 | 25                                                 |
|             | OE-3: Healthy Lifestyle (3+0+0)                             | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-4: Culinary Science (3+0+0)                              | 3                                   | 3              | 40                                                 | 60                                                 |

**Eligibility:** Students who have passed Pre-University Board of Examination or Equivalent board with science subjects are eligible for admission to B.Sc. in Food Science and Nutrition.

**I SEMESTER**

**Course Outcomes:** At the end of the course the student should be able to:

- Gain the basic knowledge of human anatomy and physiology.
- Define the main structures composing human body.
- Explains structure and functions of cells, tissues and organs, systems of the human body
- Relates structure and functions of tissue.
- Provides excellent preparation for careers in the health professions and/or biomedical research.

**Pedagogy:** Regular lectures, demonstrations, Exercises on observation and follow up with group Discussions, case studies, ICT enabled teaching and learning experiences in terms of video Lessons and documentary film shows.

**DSC-1: HUMAN PHYSIOLOGY (THEORY): 4 Credits; 56 Hrs.**

**Unit-1: Introduction to Human Body:**

**14 Hrs.**

- A** Basic concepts of Organs, tissue and cell      **B** Cellular organelles - structure and functions

**C Musculo- Skeletal System****D Sense Organs****Unit-2: Cardiovascular System and Respiratory Systems: 14 Hrs.**

- |                                                                                                                        |                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| <b>A</b> Blood - Composition, blood groups and Functions                                                               | <b>B</b> Structure and Functions of lymph System                                                              |
| <b>C</b> Cardiovascular System - Structure and functions of heart, Properties of Cardiac Muscle and Functional Tissues | <b>D</b> Cardiac Cycle, Heart Rate, Cardiac Output, Blood Pressure (Systolic & Diastolic Blood pressure), ECG |
| <b>E</b> Respiratory System - Physiological Anatomy of Respiratory Tract, Mechanism of Respiration                     | <b>F</b> Transport of Respiratory Gases in Blood, Gaseous Exchange in Lungs and tissues                       |

**Unit-3: Digestive System and Excretory Systems: 14 Hrs.**

- |                                                                                                                                                                         |                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>A Digestive System-</b> Principal organs of the digestive system: structure & function – Mouth (tongue, Teeth), Esophagus, Stomach, Small Intestine, Large Intestine | <b>B</b> Principal accessory organs: structure & function – Salivary glands, liver, gall bladder, Pancreas |
| <b>C Excretory System-</b> Structure & Function – Excretory system, Kidney, Nephron                                                                                     | <b>D</b> Urine Formation, Glomerular Filtration Rate (GFR), Composition of Urine                           |

**Unit-4: Neuro-Endocrine and Reproductive System: 14 Hrs.**

- |                                                                                                               |                                                                |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <b>A Nervous System</b> - Structure and functions of Neuron, Brain                                            | <b>B</b> Central nervous system, peripheral Nervous System     |
| <b>C Endocrine Systems-</b> Structure and Functions - Pituitary, Thyroid and Parathyroid, Adrenals and Gonads | <b>D</b> Endocrine Functions of Pancreas, Heart, Liver, Kidney |
| <b>E</b> Reproductive System (in Brief)                                                                       |                                                                |

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**DSCP-1 HUMAN PHYSIOLOGY (PRACTICAL): 2 Credits 56 Hrs.****LIST OF EXPERIMENTS**

1. Microscope and its uses
2. Histology of epithelial, connective, muscular and nervous tissues.
3. Enumeration of RBC and WBC count
4. Determination of pulse rate in resting condition and after exercise (30 beats /10 beats method)
5. Determination of blood pressure by Sphygmomanometer (Auscultatory method).
6. Determination of Bleeding Time (BT) and Coagulation Time (CT).
7. Detection of Blood group and Rh Factor (Slide method).
8. Measurement of Hemoglobin level (Sahli's or Drabkin method).
9. Urine Analysis – Albumin & Glucose Tests

**REFERENCE BOOKS**

1. Chatterjee C.C (2016), Human Physiology Volume I, Medical Allied Agency, Kolkata
2. Chatterjee C.C (2004), Human Physiology Volume II, Medical Allied Agency, Kolkata.
3. Sembulingam, K. (2000) Essentials of Medical Physiology, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
4. Chaudhri, K. (1993) Concise Medical Physiology, New Central Book Agency (Parental) Ltd., Calcutta.
5. Kathleen J. W. Wilson, Anne Waugh, Allison Grant. Ross and Wilson Anatomy (2014),
6. Physiology in Health and Illness. 12th Edition, Elsevier Publication, New Delhi
7. Jain A K (2012) Text Book of Physiology volume 1 and Vol.2, APC publications New Delhi.

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**Open Elective Course (OE):****OE-1: BASICS OF FOOD SCIENCE (THEORY): 3 Credits 42 Hrs.****Objectives:**

- Its scope is to help and gain knowledge on Food groups and food commodities,
- To Understand the nutritional composition of foods

**Learning Outcomes:**

- ❖ It helps to know different types of food commodities and their importance.
- ❖ To learn the macro and micronutrients content of food commodities.

**Unit-1:** Introduction, Food groups, Food Pyramid, My Plate. **04 Hrs.****Unit-2:** Cereals, millets & Legumes – type, composition and uses. **12 Hrs.****Unit-3:** Fruits, vegetables and Oil seeds – type, composition and uses. **12 Hrs.****Unit-4:** a) Animal foods- Milk, Meat, Fish, Egg, and poultry, b) Refined Products – Sugar, Jaggery, Fats and Oils **14 Hrs.****REFERENCE BOOKS**

1. Srilakshmi. B. Food Science. New age international Pvt. Ltd. New Delhi, 2001.
2. Shakuntala Manay and Shadakshara Swamy M. foods – facts and principles, 1998.

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**OE-2: BASICS OF NUTRITION (THEORY): 3 Credits 42 Hrs.****Objectives:**

- Its scope is to help and gain knowledge of Nutrients.

**Learning Outcomes:**

- ❖ It helps to know about the use of different nutrients and their functions.

**Pedagogy:** Regular lectures, demonstrations, Exercises on observation and follow up with group Discussions, ICT enabled teaching and learning experiences in terms of video Lessons and documentary film shows.

**Unit-1:** Introduction to nutrition, a) History of nutrition, (b) Relationship of food and health. **06 Hrs.**

**Unit-2:** Nutrients – macro and micronutrients – functions, food sources and deficiency disorders. **20 Hrs.**

**Unit-3:** Nutrient requirements and desirable diets. **16 Hrs.**

### REFERENCE BOOKS

1. Srilakshmi. B. Food Science. New age international Pvt. Ltd. New Delhi, 2001.
2. Shakuntala Manay and Shadakshara Swamy M. foods – facts and principles, 1998.

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## II SEMESTER

**DSC-2: FUNDAMENTALS OF HUMAN NUTRITION (THEORY): 4 Credits; 56 Hrs.**

### Course Outcome:

- Gain knowledge in basic terminology, aspects of nutrition & functions of food in healthy life sustenance
- Understand function of nutrients, dietary sources, consequences of deficiency and excess
- Understand the food composition and concept of energy balance
- Equip with knowledge and understanding on importance of water
- Understand the nutritional management of deficiency disorders.

**Pedagogy:** Regular class teaching, seminars and assignments and Record works related to their Practical works, field visits.

**Unit-1: Definition of food, nutrition, health:** **16 Hrs.**

- |                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>A</b> Introduction: Food &amp; its relation to health, Objectives in the study of nutrition</p> <p><b>C</b> Energy –Definition, forms of energy, units of measurement, physiological fuel values of energy, determination of energy value of foods</p> <p><b>E</b> Water: Functions, requirements, sources</p> | <p><b>B</b> RDA for various nutrients, age, gender, physiological state</p> <p><b>D</b> BMR – definition, Determination and factors affecting, Factors affecting energy requirements, diet induced thermogenesis (SDA)</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Unit-2: Macro Nutrients:** **16 Hrs.**

- |                                                                                                                          |                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>A</b> Protein –Classification, functions, Digestion &amp; absorption (in brief), RDA, sources and deficiencies</p> | <p><b>B</b> Carbohydrate – Classification, functions, Digestion &amp; absorption (in brief), RDA, sources and deficiencies. Dietary fiber- types and functions</p> |
|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|



- C** Fat-Classification, functions,  
Digestion & absorption (in brief),  
RDA, sources and deficiencies

**Unit-3: Micronutrient – Vitamins and Minerals: 12 Hrs.**

- A** Fat-soluble Vitamins (A, D, E & K)- Function, RDA, sources and deficiency and excess
- B** Water soluble vitamins: Thiamin, Riboflavin, Niacin, B12, Folic acid, Biotin and Vitamin C: functions, RDA, food sources, deficiencies and excess

**Unit-4: Micronutrient - Minerals: 12 Hrs.**

- A** Macro minerals- Calcium, Phosphorus and magnesium, Sodium, Potassium, Chlorine: Functions, absorption, RDA, sources and deficiencies
- B** Micro Minerals- Iron, Zinc, Fluorine and Iodine: function, absorption, RDA, sources and deficiency

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**DSCP-2: FUNDAMENTALS OF HUMAN NUTRITION (PRACTICAL):**

**2 Credits**

**56 Hrs.**

**LIST OF EXPERIMENTS**

1. Weights and measures –Household and standard measures used in food science laboratory.
2. Calculation of mean nutritive value of foods
3. Standardization of recipes.
4. Recommended Dietary Allowances/Nutritive values of foods.
5. Enhancing the traditional recipes with specific nutrients (protein, carbohydrate, fat, vitamin A, vitamin C, calcium and iron).

**REFERENCE BOOKS**

1. Food & Nutrition - Dr. M. Swaminathan
2. Food facts & principles – Manay & Shadakshara Swamy
3. Food science – Sumathi Mudambi
4. Fundamentals of food and nutrition, Mudambi & Rajgopal 4th edition 2001
5. Principles of Food Science by Borgstrom and Macmillon
6. Food Science by Potter & Hotchkiss Judith E. Brown, Nutrition Now, 3 rd edition. Wads worth, Thomas learning, 10 Davis drive Belmont C A 94002-3098 USA, 2002
7. Barbara A. Bowmaw and Robert M. Russell, Nutrition, Eighth Edition, ILSI press, Washington, DC, 2001.
8. C. Gopalan, B.V. Ramasastri and S.G. Balasubramaniam, Nutritive value of Indian foods, NIN, ICMR, Hyderabad, 500007, INDIA, 2007.
9. Mehtab S Bamji, N Pralhad Rao, Vinod Reddy, Text Book of Human Nutrition, oxford IBH publishing Co. Pvt. Ltd., New Delhi, Calcutta.

10. Sir Stanley Davidson, R Passmore, Human Nutrition and Dietetics. The English language book society and Churchill livingstone 1969.
11. Kathleen Mahan L., Sylvania Escott-Stump, Krause's food, nutrition and diet therapy (11th edition). Saunders Company, London.
12. Passmore R. and Davidson S. (1986) Human nutrition and Dietetics. Liming stone publishers.
13. Shil's M.E., Alfon J.A., Shike M (1994), Modern nutrition in health and diseases, 8<sup>th</sup> Ed.
14. William S.R., Nutrition and Diet Therapy fourth edition C.V. Mos Company.

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### Open Elective Course (OE):

**OE-3: HEALTHY LIFE STYLE (THEORY):                      3 Credit;            42 Hrs.**

**Course Outcome:** On completion of this course, the students will be able to;

- Gain knowledge on healthy life styles.
- Understand the relationship between different nutrients and their importance.
- Understand the personal hygiene; environmental Hygiene.

#### **Unit-1: Eating for Healthy Life:**

**10 Hrs.**

- |                                                                                                                                                 |                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>A</b> Definition of food, Nutrition, Health and fitness</p> <p><b>C</b> Concept of a desirable diet for nutrition, health and fitness</p> | <p><b>B</b> Interrelationship between Nutrition and health, Significance of balanced diet</p> <p><b>D</b> Interrelationship between Nutrition and health, Significance of balanced diet</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### **Unit-2: Nutrition and Physical Fitness:**

**12 Hrs.**

- |                                                                                                                                                                                         |                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <p><b>A</b> Exercise and fitness-Definition, benefits, components and indicators of fitness</p> <p><b>C</b> Approaches to the management of fitness and health in weight management</p> | <p><b>B</b> Nutrient requirement during Exercise- Micro nutrients, macro nutrients and Fluid balance, body adaptation</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|

#### **Unit-3: Mental Health:**

**12 Hrs.**

- |                                                                                    |                                                                                          |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <p><b>A</b> Stress management and its challenges</p> <p><b>C</b> Healthy sleep</p> | <p><b>B</b> Addiction, drug abuse and alcoholism</p> <p><b>D</b> Balanced life style</p> |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|

**Unit-4: Alternative Systems for Health and Fitness:****10 Hrs.**

- |                                                  |                                                      |
|--------------------------------------------------|------------------------------------------------------|
| <b>A</b> Yoga and meditation, Reiki              | <b>B</b> Ayurveda, Herbal remedies, homeopathy       |
| <b>C</b> Accupunture, acupressure, Aroma therapy | <b>D</b> Hypnotherapy, psychotherapy, spiritual heal |

**REFERENCE BOOKS**

1. Food & Nutrition - Dr. M. Swaminathan
2. Srilaksmi. B. Nutrition Science. New age international Pvt. Ltd. New Delhi, 2001.
3. Robinson C. H. Basic Nutrition and Diet therapy, McMillan Pub.co, New York, 1989
4. Food facts & principles – Manay & Shadakshara Swamy
5. Food science – Sumathi Mudambi
6. Fundamentals of food and nutrition, Mudambi & Rajgopal 4th edition 2001
7. Barbara A. Bowmaw and Robert M. Russell, Nutrition, Eighth Edition, ILSI press.
8. C. Gopalan, B.V. Ramasastry and S.G. Balasubramaniam, Nutritive value of Indian foods, NIN, ICMR, Hyderabad, 500007, INDIA, 2007.
9. Seth V and Singh K (2006). Diet Planning through the Life Cycle: Part 1 Normal
10. Nutrition. A Practical Manual. Elite Publishing House Pvt. Ltd. New Delhi.
11. Chadha R and Mathur P eds. Nutrition: A Lifecycle Approach. Orient Blackswan, New Delhi. 2015.

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**OE-4: CULINARY SCIENCE (THEORY):****3 Credit; 42 Hrs.****Course Outcome:** On completion of this course, the students will be able to;

- Gain knowledge on aims and objectives of cooking.
- Understand the Conservation of nutrients and their importance to life.
- Understand the personal hygiene; environmental Hygiene; food storage and causes of contamination.

**Pedagogy:** Regular lectures, demonstrations, Exercises on observation and follow up with group Discussions, ICT enabled teaching and learning experiences in terms of video Lessons and documentary film shows.

**Unit-1: Introduction to cookery:****14 Hrs.**

- |                                                                                                                                                              |                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A</b> Culinary history, aims and objectives of cooking- Origin of modern cookery; Continental cuisine: Indian cuisine                                     | <b>B</b> Pre- processing of foods- Techniques used in pre-preparation, advantages and disadvantages                                                |
| <b>C</b> Methods of cooking- Methods of heat transfer; Classification; Moist heat methods; Dry heat methods; fat as cooking media, Conservation of nutrients | <b>D</b> Personal Hygiene; Environmental Hygiene; Food storage and causes of contamination; Food borne illnesses; Food poisoning; Garbage disposal |

**Unit-2: Food groups and their nutritional value: 14 Hrs.**

- A** Cereals, pulses, fats and oils      **B** Fruits and Vegetables  
**C** Animal foods and its products      **D** Spices and condiments

**Unit-3: Role of ingredients in cookery and methods of food service: 14 Hrs.**

- A** Types & Uses: Fats and Oils, Salt, Raising Agents, Thickening Agents, Herbs, Flour, Rice, Cereals, Pulses, Milk and Milk Products      **B** Uses of sugar and eggs in cookery-bakery and confectionery  
**C** Preserved products- jam, jelly, juice, pickle, sauce, ketchup etc      **D** Dining services methods, techniques & styles

**REFERENCE BOOKS**

1. Food & Beverage Service – R. Singaravelavan - Oxford University Press
2. Food & Beverage Service - Dennis Lillicrap, John Cousins – Bookpower
3. Food & Beverage – F & B Simplified – Vara Prasad & R. Gopi Krishna – Pearson
4. Food & Beverage Service - Vijay Dhawan
5. The Steward - Peter Dias
6. The Waiter - John Fuller & A.J. Currie – Shroff Publishers
7. Parvinder S Bali, International Cuisine and food production management, 2012
8. Avantina Sharma, text book of food science and technology, CBS publication, 2019

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****Note:** All sections are compulsory**PART-A**

Answer ALL of the following:

**5 x 3 = 15**

- Q1** a)  
b)  
c)  
d)  
e)

**PART-B**

Answer ALL of the following

**5 x 5 = 25****Q2 – Q6****PART-C**

Answer any TWO of the following

**2 x 10 = 20****Q8 – Q11**

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**PRACTICAL EXAMINATION****Note:** Duly certified practical record shall be submitted at the practical examination.

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**Bachelor of Science (Basic/Hons.) Degree in Earth Science  
(Geology)  
Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of online Board of Studies in Earth Science (Geology) held on 6<sup>th</sup> December, 2021 in the Department of Geology, Yuvaraja College, Mysuru.

| Sl. No. | Members                  | Position | Signature/<br>Remarks |
|---------|--------------------------|----------|-----------------------|
| 1.      | Dr. M.R. Janardhana      | Chairman | Sd/                   |
| 2.      | Dr. S. Suresha           | Member   | Sd/                   |
| 3.      | Prof. H.T. Basavarajappa | Member   | Sd/                   |
| 4.      | Dr. R.Y. Budhihal        | Member   | Sd/                   |
| 5.      | Dr. S. Manjunath         | Member   | Sd/                   |
| 6.      | Dr. Chandrakantha G      | Member   | Sd/                   |
| 7.      | Dr. Gangadhar Bhat H.    | Member   | Sd/                   |
| 8.      | Mr. SantoshPrabhu        | Member   | Sd/                   |
| 9.      | Dr. Annapoorna H         | Member   | Sd/                   |
| 10.     | Dr. S. Srikantaswamy     | Member   | Absent                |
| 11.     | Mr. Shibin John          | Member   | Absent                |

The Chairman, BOS in Geology, welcomed the members to the online meeting and presented the agenda. The proceedings of the meeting are as follows.

- 1. Change in the nomenclature of the course:** As per the instruction given orally by the Chairman of the NEP Earth Science Subject Committee, the members unanimously approved the change in the nomenclature of the course from Geology to Earth Science. This comes into effect from the current academic year i.e., 2021-22.
- 2. Syllabus for I and II semesters B.Sc., course in Earth Science under NEP 2020** After a detailed discussion, the board members approved the syllabus prescribed by the NEP 2020 in toto without any modifications.
- 3. Approved Panel of Examiners for the academic year 2021-22.**
- 4. Any other matter with the permission from the chair i).** The board recommended for the opening of Earth Science and Computer Science course from the next academic year 2022-23 as the branches of Earth Science demands knowledge in the computer applications for simulation and modeling of the earth

processes. Further, there is a huge job market for the graduates in the combined fields of Earth and Computer Sciences. The intake for the course may be fixed at 40. ii). The board also recommended for the opening of Earth Science and Environment Science course from the next academic year 2022-23. The components of Earth system and its interactions are better understood with the knowledge of environment science. Further, the students will greatly be benefitted at higher levels with the background of Earth Science and Environment Science. The intake for the course may be fixed at 30.

Chairman thanked the members for their active participation in the discussion.

06-12-2021

Chairman,

**Preamble:** The present Curriculum Framework for B.Sc., degree in Earth Science is intended to facilitate the students to achieve the following:

- To develop an understanding and knowledge of the basic theory and principles of Geology through various branches of Geology – such as Dynamic Geology/Geomorphology, Petrology, Structural Geology, Stratigraphy, Paleontology, Environmental Geology etc.
- To develop the ability to use this knowledge and understanding to analyze, interpret and apply in the geological field.
- To acquire necessary and state-of-the-art skills to take up challenges in the field and also in various geological disciplines such as Mining, Economic Mineral Resources, Remote Sensing, Basin analysis, Watershed development etc.
- The objectives and outcomes are carefully designed to suit to the above-mentioned purpose.
- The ability to decipher the critical issues of nature and hidden natural resources treasures through acquired knowledge and experience.
- To equip with the learnt skills and hands-on training they are able to judge, imagine and interpret in a better way.
- To prepare them as a budding geoscientist.

**Program Outcomes:** Discipline knowledge: After the completion of the BSc Course (Degree/Honors), the students will be learning the basics and important aspects of all branches of Earth Sciences mentioned in the preamble; which will enable them to apply their acquired knowledge.

1. Problem Solving: After going through 6 or 8 semesters curricula the students will be able to understand and decipher majority of the geological processes and their effects.
2. Ethics on Profession, Environment and Society: As the subject Geology is related to Earth its resources and processes the students will be taught to acquire ethics to maintain the integrity while dealing with data collection, compilation, and interpretation and finding solutions.
3. Lifelong Learning and Entrepreneurship: Geology is regarded as a technical

subject one can start their own consultancy so, they will become an independent entrepreneur and hence learning will be lifelong.

4. Motivation to take up Higher Studies: Inspiration to continue towards advanced studies in Geology and Research.

**Open Elective (OE) Courses:** OE courses are offered to the candidates of either the same program or other undergraduate programs as decided by the competent authority of the University of Mysore and the candidate who opts for OE in Earth Science has to choose one OE from the pool in each semester. The OE courses, in addition to enhancing the knowledge on the Earth's processes and helps to acquire skills for entrepreneurship.

Concept note, abbreviation explanation, coding, eligibility for admission to the course, duration of the course, course pattern, medium of instruction, attendance, internal assessment, mode of examination, duration of examination, results of the candidates and carry over are as per the provision made in the NEP regulations of University of Mysore and Yuvaraja's College (autonomous).

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)                 | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|--------------------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Earth System Science - Fundamentals (4+0+0)                 | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-1: Maps, Sediment Soil, Field Visit (0+0+2)                   | 4                          | 2       | 25                                        | 25                                        |
|           | OE-1: Crystallography, Mineralogy and Economic Mineral (3+0+0)     | 3                          | 3       | 40                                        | 60                                        |
|           | OE-2: Pedology (3+0+0)                                             | 3                          | 3       | 40                                        | 60                                        |
|           | OE-3: Basics of Earth System Science (3+0+0)                       | 3                          | 3       | 40                                        | 60                                        |
|           | OE-4: Geohazards and Mitigation Strategies (3+0+0)                 | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | DSC-2: Basics of Crystallography, Mineralogy and Petrology (4+0+0) | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-2: Crystallography, Mineralogy and Petrology (0+0+2)          | 4                          | 2       | 25                                        | 25                                        |
|           | OE-5: Medical Geology (3+0+0)                                      | 3                          | 3       | 40                                        | 60                                        |
|           | OE-6: Industrial Minerals (3+0+0)                                  | 3                          | 3       | 40                                        | 60                                        |
|           | OE-7: Paleobiology (3+0+0)                                         | 3                          | 3       | 40                                        | 60                                        |
|           | OE-8: Gems and Ornamental Stones (3+0+0)                           | 3                          | 3       | 40                                        | 60                                        |



## I SEMESTER

### **DSC-1: EARTH SYSTEM SCIENCE - FUNDAMENTALS (THEORY): 4 Credit; 56 Hrs.**

**Course Outcomes:** At the end of the course the student should be able to:

1. Explain the origin and internal structure of the Earth.
2. Explain the conceptual and dynamic aspects of landform development.
3. Learn the relevance of applied aspects of Geomorphology in various fields.
4. Formulate conceptual and analytical descriptions of geodynamic processes such as volcanism, earthquake and formation of ocean.

**Pedagogy:** Lecturing, Tutorial and Field visits.

#### **Unit-1: Introduction to Earth System Sciences: 14 Hrs.**

Definition and scope of earth system sciences. Branches of Earth Sciences. Systems concepts for earth system science - fundamental concepts of the five spheres (lithosphere, hydrosphere, atmosphere, biosphere and cryosphere). Energy balance. Interactions between the five spheres; hydrologic cycle; Biogeochemical cycles - carbon cycle; Hydrosphere-atmosphere: Oceanic current system and effect of Coriolis force. Concepts of eustasy. Atmospheric circulation. Weather and climatic changes. Interrelationships between biological, geological, climatological, and human systems on continental and global scales. Anthropogenic influences on the Earth systems; Human- environment interactions - policy.

The universe and solar system: Origin of the universe - Big bang theory. Solar system. Members of solar system – planets (Terrestrial and gaseous planets), satellite, comets, asteroids, meteorite. Earth in the solar system. Size, shape, mass and density of the earth.

Origin of the Earth – Gaseous hypothesis, Nebular hypothesis, Planetesimal hypothesis, Tidal hypothesis, Supernova hypothesis, Interstellar or dust or meteoric hypothesis. Evolution of earth. Age of the Earth: Geochronology; Absolute and relative methods; (a) Relative Methods - Sedimentation, Salinity method, varve chronology, Rate of cooling of earth. (a) Radiometric dating, atomic energy, decay scheme, half life, method - K-Ar; Rb-Sr; U-Pb, Pb-Pb. Age of the earth. Earth's internal structures and its composition. Evidence for the Earth's composition and mineralogy – 1. Seismic data, 2. Density studies, 3. Meteorites. Earth's internal layers - Crust, mantle and core. Lithosphere, asthenosphere, mesosphere and barysphere.

#### **Unit-2: Geomorphology-I: 14 Hrs.**

Introduction: Basic concepts of Geomorphology, Definition and scope, Geomorphic agents, Geomorphic processes; endogenetic (epigene) and exogenetic (hypogene). Land forms. Weathering - physical, chemical, biological. Soil - Definition, Formation, Types of soils. Soil Profile. Rivers and fluvial landforms: Introduction, Development of rivers - Drainage system and patterns. Stages of rivers-Davi's concept; youth, mature, old. Geological actions: Erosion - hydraulic action, abrasion, attrition, solution. Erosional landforms – Pot holes, V shaped valleys, gorges and canyons, waterfalls and types, river

meanders, ox-bow lakes, river terraces, structural benches. Transportation - suspension, solution. Deposition and depositional landforms - alluvial fans and cones, flood plains, natural levees, deltas, channel deposits. Wind and Aeolian landforms: Types of wind - Breeze, Gale, Tempest, Cyclone. Geological action of wind: Wind erosion - Deflation, abrasion, attrition. Erosional features - mushroom rocks, yardangs, Hamda, ventifacts, pedestal rocks, zeugen, milletseed sands. Transportation - suspension, saltation, traction. Deposition and depositional landforms - Sand dunes and types, Loess.

### **Unit-3: Geomorphology - II:**

**14 Hrs.**

Glaciers and glacial landforms. Growth and movement of glaciers. Types of glaciers - Mountain or valley glaciers, Piedmont glaciers, continental ice-sheets or ice caps. Glacier imprints. Geological action of glaciers; Erosional work by glaciers - Plucking/Excavation, Frost wedging, Abrasion. Erosional landforms - Whaleback forms. Glacial valley - U shaped valley and V- shaped valley, Crag and Tail, Hanging valley, Cirques, Fiords, Arete, Cols, Horns, Roches Moutonnes. Transportation - glacial drift. Deposition and depositional landforms - Glacial Moraines and types, Drumlins, Kames, Eskers, Outwash plains, Kettles.

Groundwater: Meaning and components of groundwater. Geological action of groundwater: Erosion and erosional landforms (lapis, solution holes and associated features, poljes, caves and caverns: valleys of karst topography, natural bridges). Transportation; solution. Depositional work; concretions, stalactites and stalagmites, Oceans and Coastal landforms: Topography of ocean floor - continental slope, shelf, abyssal zone, mid-oceanic ridges. Geological action of oceans: Agents of coastal erosion; Waves, Tides, Currents and circulation of water. Process of marine erosion, erosional landforms (Headlands and Bays, Sea Cliffs, Wave-cut Terraces, Sea caves, stacks). Transportation. Depositional landforms (Beaches and barriers, wave built terraces, Spits and bars, Tombola). Deep sea water deposits - terrigenous and pelagic deposits. Corals - its types and origin.

### **Unit-4: Geodynamics:**

**14 Hrs.**

Introduction to Geodynamics. Origin of oceans, continents and mountains. Concepts and theories of isostasy. Concept of palaeomagnetism, application of palaeomagnetism. Continental drift. Sea floor spreading. Concept of plate tectonics. Nature and types of plate margins, Midoceanic ridges and trenches. Origin and distribution of Island arcs. Earthquakes: definition, Elements of an earthquake, types of earthquake waves, intensity and magnitude, seismographs and seismometers, causes and prediction of earthquake, Effects of earthquake, Seismic zones of India.

Volcanoes: A typical volcano parts, volcanic activity, types of volcanoes, composition of lava, distribution of volcanoes. Volcanic landforms; depressed landforms: Volcanic cone (Cinder Cone), Volcanic craters, Calderas (Caldera Lake). Landforms due to the accumulation of lava: Volcanic mountains, Volcanic plateaus, Volcanic plains, Volcanic necks.

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**DSCP-1: MAPS, SOIL & FIELD VISIT (PRACTICAL): 2 Credits 56 Hrs.****Course Outcome:**

- Students learn the preparation of various kinds of maps.
- Students learn the skill of detecting the changes in the land use/land cover of a region and study its impacts, suggest remedial measures.
- Students get acquainted with the soil properties, types, characteristics and remediation of soil.

**LIST OF EXPERIMENTS****Part A:**

1. Introduction to maps. Study of maps. Types of maps. Types of scale. Detailed study of topographic sheets. 2 labs.
2. Reading topographical maps of the Survey of India. 1 lab.
3. Preparation of topographical map. 1 lab.
4. Identification of drainage patterns. 1 lab.
5. Preparation of LU/LC maps. 2 lab.
6. Study of soil profile and determination of soil texture. 2 lab.
7. Study of major geomorphic features and their relationships with outcrops through physiographic models and aerial photos using pocket lens stereoscope and mirror stereoscope. 3 lab.

**PART B:** Field visit to a place of geological/geomorphological interest.

**REFERENCE BOOKS**

1. Duff, P. M. D., & Duff, D. (Eds.). (1993). *Holmes' principles of physical geology*. Taylor & Francis.
2. Emiliani, C. (1992). *Planet earth: cosmology, geology, and the evolution of life and environment*. Cambridge University Press.
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5. Ernst, W.G., 2000. *Earth Systems: Processes and Issues*, Cambridge University Press.
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8. Ehlers, E., Krafft, T., 2006. *Earth System Science in the Anthropocene*, Springer.
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10. *The Earth System*, Lee R. Kump, James F. Kasting, and Robert G Crane; Prentice Hall, 2nd Ed., 2004.
11. *Principles of Geology* – Arthur Holmes.
12. *Physical Geology* – Longwell & Flint.

13. General Geology – Radhakrishnan. Y.
14. The Dynamic Earth – Wyllie. P.J.
15. The way earth works - Wyllie. P.J.
16. Physical Geology – Springfield.
17. Geomorphology – Thornbury.
18. Geomorphology – Davies.
19. Physical Geography Today – Muller & Oberlander.
20. Digital Resources: <https://library.iitkgp.ac.in/pages/eSearch2.1/eBooks.php>;  
<https://z-lib.org>;

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### Open Elective Course (OE):

#### **OE-1: CRYSTALLOGRAPHY, MINERALOGY AND ECONOMIC MINERAL (THEORY):** **3 Credits** **42 Hrs.**

##### **Course Outcome:**

- Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.
- The students will be able to identify common rock-forming minerals in hand specimens as well as in thin sections.
- The students get familiarized with the instruments used to analyse inorganic compounds.

**Pedagogy:** Lectures, tutorials Group Discussion and IT based teaching.

**Unit-1:** Crystals, crystalline solids and their formation; Symmetry in crystals; Axial ratio, indices, order of the crystallographic axes; Crystallographic notation (Weiss and Miller indices and convention in notation); Classification of crystals, introduction to 32 classes; The crystal systems and symmetry types; Stereographic representation of crystal symmetry and their uses; Imperfection of crystals and crystal defects; Twinning-causes, effects and genetic types. **14 Hrs.**

**Unit-2:** Isotropic and anisotropic substances; Reflection, refraction and refractive index; Relief, birefringence and Becke line effect; Optically uniaxial and biaxial minerals; Determination of optic sign of uniaxial and biaxial minerals; interference figures; Pleochroism and determination of pleochroic scheme in minerals; X-ray crystallography and Bragg's equation; Application of X-ray diffraction spectrometry in mineral characterization; Application of techniques in mineralogy: Differential Thermal Analysis (DTA), Thermogravimetric Analysis (TGA), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Electron Probe Micro Analyser (EPMA); Application of thermal, magnetic and radioactive properties of minerals. **14 Hrs.**

**Unit-3:** Definition of ore, ore mineral and gangue; Classification of ore deposits; Chemical composition, diagnostic characters, uses and distribution in India of the following

minerals: Gold, Copper, Iron, Manganese, Lead, Zinc, Bauxite, Chromite, magnesite, pyrite, diamond, muscovite, beryl, fluorite, gypsum, barite, halite, phosphorite, talc, kyanite, graphite, asbestos, monazite and corundum; Origin, uses and distribution of coal and petroleum in India. **14 Hrs.**

### REFERENCE BOOKS

1. James D Dana. A Textbook of mineralogy, John Wiley and Sons.
2. Verma, P K (2010), Optical mineralogy. Ane books Pvt. Ltd.
3. Buerger, Elementary crystallography.
4. JAK Tareen and TRN Kutty, (1989) Elemental crystallography.
5. Ram S. Sharma and Anurag Sharma (2013) Crystallography and Mineralogy - Concepts and Methods. Text Book Series, Geological Society of India, Bangalore.
6. Dana, E.S. and Ford, W.E., (2002) A textbook of Mineralogy (Reprints).
7. Flint, Y., (1975) Essential of crystallography, Mir Publishers.
8. Phillips, F.C., (1963) An introduction to crystallography. Wiley, New York.
9. Berry, L.G., Mason, B. and Dietrich, R.V., (1982) Mineralogy. CBS Publ.
10. Read, H.H., (1968) Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby & Co.
11. Berry and Mason, (1961) Mineralogy. W.H. Freeman & Co.
12. Kerr, B.F., (1995) Optical Mineralogy 5th Ed. McGraw Hill, New York.
13. Deer, Howie and Zussman (1996) Introduction to Rock Forming Minerals, Pearson.
14. Wahlstrom E.E. (1971) Optical crystallography, John Wiley and sons.
15. R.N. Hota (2012) Practical approach to Mineralogy and Crystallography, CBS Publications & Distributions.
16. Perkin D. (2010) Mineralogy, Pearson.

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### OE-2: PEDOLOGY (THEORY): **3 Credits      42 Hrs.**

**Course Outcome:** The students will be able to learn the processes of formation of soil, its classification, texture and structure, soil characteristics of each textural and structural class.

**Pedagogy:** Lectures, tutorials Group Discussion and IT based teaching.

**Unit-1:** Soil pedological and edaphological concepts. Composition of earth crust and its relationship with soils; Rocks, minerals and other soil forming materials; Weathering of rocks and minerals; Factors of soil formation soil profile, horizons and their nomenclature. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage- basic concepts. Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability, soil conditioners. Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential. soil classification, soil mineralogy and soil maps – usefulness. **14 Hrs.**

**Unit-2** Soil Erosion and Conservation: History, distribution, identification and description of soil erosion problems in India. Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; Soil survey and its types; soil survey techniques - conventional and modern; soil survey interpretations; soil mapping, thematic soil maps. Soil conservation planning; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged, wet lands and methods agromormic, physical and biological methods).

**14 Hrs.**

**Unit-3:** Soil Management: Area and distribution of problem soils - acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible. Morphological features of saline, sodic and saline- sodic soils; characterization of salt- affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties. Management of salt- affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils. Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management. Reclamation of salt-affected soils; mine land reclamation, afforestation, organic products. Extent, diagnosis and mapping of land degradation by conventional and modern RS-GIS tools; monitoring land degradation by fast assessment, modern tools, land use policy, incentives and participatory approach for reversing land degradation; global issues for twenty first century.

**14 Hrs.**

### REFERENCE BOOKS

1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13<sup>th</sup> Ed. Pears on Edu.
2. Biswas TD & Narayanasamy G. (Eds.) 1996. Soil Management in Relation to Land Degradation and Environment. Bull. Indian Society of Soil Science No. 17.
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9. Greenland DJ & Szabolcs I. 1994. Soil Resilience and Sustainable Land Use. CABI.
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11. Hudson N. 1995. Soil Conservation. Iowa State Univ. Press. Indian Society of Soil Science 2002. Fundamentals of Soil Science. ISSS, New Delhi.



12. Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
13. Lal R, Kimble J, Levine E & Stewart BA. 1995. Soil Management and Greenhouse Effect. CRC Press.
14. Lal R, Blum WEH, Vailentine C & Stewart BA. 1997. Methods for Assessment of Soil Degradation. CRC Press.
15. Middlebrooks EJ. 1979. Industrial Pollution Control. Vol. I. AgroIndustries. John Wiley Interscience.
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17. Ross SM. Toxic Metals in Soil Plant Systems. John Wiley & Sons.
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22. Vesilund PA & Pierce 1983. Environmental Pollution and Control. Ann Arbor Science Publ.
23. Wade FA & Mattox RB. 1960. Elements of Crystallography and Mineralogy. IBH.
24. Wilding LP & Smeck NE. 1983. Pedogenesis and Soil Taxonomy: II. The Soil Orders. Elsevier.
25. Wilding NE & Holl GF. (Eds.). 1983. Pedogenesis and Soil Taxonomy. I. Concept and Interaction. Elsevier.

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### **OE-3: BASICS OF EARTH SYSTEM SCIENCE (THEORY): 3 Credits 42 Hrs.**

**Course Outcome:** At the end of the course the student should be able to:

- ❖ Explain the origin and internal structure of the Earth.
- ❖ Explain the conceptual and dynamic aspects of landform development.
- ❖ Learn the relevance of applied aspects of Geomorphology in various fields.

**Pedagogy:** Lectures, tutorials Group Discussion and IT based teaching.

**Unit-1:** Introduction to Earth Sciences with a special focus to Geology, scope, sub-disciplines and relationship with other branches of sciences. **14 Hrs.**

**Unit-2** Earth in the solar system, origin Earth's size, shape, mass, density, rotational and evolutionary parameters Solar System- Introduction to Various planets - Terrestrial Planets Solar System- Introduction to Various planets - Jovian Planets Internal constitution of the earth - core, mantle and crust. **14 Hrs.**

**Unit-3:** Convections in the earth's core and production of magnetic field Composition of earth in comparison to other bodies in the solar system. Origin and composition of hydrosphere and atmosphere Origin of biosphere Origin of oceans, continents and mountains Age of the earth; Radioactivity and its application in determining the age of the Earth, rocks, minerals and fossils. **14 Hrs.**



**REFERENCE BOOKS**

1. Arthur Holmes, Principles of Physical Geology. 1992. Chapman & Hall.
2. Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.
3. Gross, M.G., 1977. *Oceanography: A view of the Earth*, Prentice Hall.
4. The Dynamic Earth – Wyllie. P.J
5. The way earth works - Wyllie. P.J
6. D.R. Johnson, M. Ruzek, M. Kalb, What is Earth System Science? Proceedings of the 1997 International Geoscience and Remote Sensing Symposium Singapore, August 4 - 8, 1997, pp 688 – 691.
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**OE-4: GEOHAZARDS AND MITIGATION STRATEGIES (THEORY):**  
**3 Credits** **42 Hrs.**

**Course Outcome:** After completing the course, student

- ❖ Can understand the geology behind natural disasters.
- ❖ Will understand the origin and occurrence of geohazards and evaluate the prediction and mitigations.
- ❖ Can understand the causes, threats, impact, magnitude and intensity of the natural hazards.
- ❖ Will be able to qualitatively estimate risk, and envisage risk-appropriate mitigation strategies.

**Pedagogy:** Lectures, tutorials Group Discussion.

**Unit-1: Geohazards:** assessment and planning- Introduction, types of hazards; characteristic features, occurrence and impact of different types, Causes and Strategies for Mitigation of Geological Hazards; Risk assessment, Hazard maps, Land-use planning and hazards. **14 Hrs.**

**Unit-2 Earthquakes, Mitigation Approaches:** Earthquake, its Causes, Specific threats, Community impacts, and Mitigation strategies. Characteristic features; Earthquake Risk Mitigation magnitude and Intensity of earthquake; Major earthquakes; Seismic zoning; Earthquake vulnerability of India; Earthquake risk mitigation – Seismic performance examination of RCC Buildings, retrofitting of vulnerable buildings, Construction of earthquake resistant buildings following proper BIS codes, Earthquake preparedness; Case study – ‘Bhuj Earthquake’.

**Volcanic hazard:** Introduction, Types of volcanoes, Volcanic form and structure, Types of central eruption, Causes of volcanic eruptions, Volcanic products: volatiles, Volcanic products: pyroclasts, Volcanic products: lava flows, Specific threats, Community impacts, Volcanic hazard and prediction Mitigation strategies. **14 Hrs.**

**Unit-3: Tsunami Events, Mitigation Approaches:** An introduction to Tsunami; Magnitude & Intensity of a Tsunami; Types of Tsunami; Features. **Flood and Mitigation Approaches:** Types of floods, Causes of floods, Specific threats, Community impacts. Mitigation strategies: Floodplain Management, Flood Insurance, Flood Mitigation Programs, Property Acquisitions, Retrofitting Flood Prone Residential Structures. **Mass movements:** Soil creep and valley bulging, Causes of landslides, Classification of landslides, Landslides in soils Landslides in rock masses, A brief note on slope stability analysis. Monitoring slopes, Landslide hazard, investigation and mapping, Methods of slope control and stabilization Landslide Specific threats, Community impacts, Mitigation strategies. **14 Hrs.**

#### REFERENCE BOOKS

1. Alexander, D. (1993) Natural Disasters. University College London Press, London
2. Alden, W. C., 1928. Landslide and Flood at Gros Ventre, Wyoming, Focus on Environmental Geology, Tank R., Ed., Oxford University Press, New York (1973), 1928, pp. 146–153.
3. Baker, P.E. (1979) Geological aspects of volcano prediction. Journal Geological Society, 136, 341-346.
4. Bell, F.G., (1999). Geological hazards: their assessment, avoidance, and mitigation. (an imprint of Routledge). E&FN Spon, London, UK, Hardbound, ISBN 0-419-16970-9;631 Pages.
5. Bell, F.G. (1994) Floods and landslides in Natal and notably the greater Durban region, September 1987: a retrospective view. Bulletin Association Engineering Geologists, 31, 59-74.
6. Broms, B. B., Landslides, Foundation Engineering Handbook, Winterkorn, H. F. and Fang, H.-Y., eds., Van Nostrand Reinhold Co.,
7. Bernard, E.N. (Ed.), Developing Tsunami-Resilient Communities: The National Tsunami Hazard Mitigation Program, Reprinted from Natural Hazards, 35:1 (2005) 2005, VI, 186 p., ISBN: 978-1-4020-3353-7.
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11. Forgione, G., Luongo, G. and Romano, R. (1989) Mt Etna (Sicily): Volcanic hazard assessment. In Volcanic Hazards: Assessment and Monitoring, Latter, J.H. (ed.), Springer-Verlag, Berlin, 137-150.
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13. Leeds, D. J., 1973. The Design Earthquake, in Geology, Seismicity and Environmental Impact, Special Publication Association of Engineering Geology, Los

Angeles, CA.

14. Ramesh P. Singh & Darius Bartlett, 2018. Natural Hazards: Earthquakes, Volcanoes, and Landslides. 527 Pages.
15. Sassa, K., Fukuoka, H., Yang, Q.J., and Wang, F.W., 1997. Landslide
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17. Seed, H. B., 1966. A method for earthquake resistant design of earth dams, Proc. ASCE J. Soil Mech. Found. Engrg. Div., 92, 13–41.
18. Thenhaus, P. C. and Campbell, K. W., 2003. Seismic hazard analysis, in Earthquake Engineering Handbook, Chen, W. and Scawthorn, C., Ed. CRC Press, Boca Raton, FL

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## II SEMESTER

### DSC-2: BASICS OF CRYSTALLOGRAPHY, MINERALOGY AND PETROLOGY (THEORY):

4 Credits

56 Hrs.

**Course Outcome:** At the end of the course the student should be able to:

- ❖ To understand the states of matter, atomic arrangement in crystals, and classification of crystals based on crystal symmetry.
- ❖ To understand the characteristics of common rock-forming minerals.
- ❖ To acquire knowledge on different types of rocks, their distinction from each other and the rock cycle.
- ❖ To understand the occurrence and distribution of rocks in India.

**Pedagogy:** Lectures, tutorials Group Discussion and IT based teaching.

**Unit-1:** Crystal morphology and internal structures. Crystal parameters and indices. Crystal symmetry and classification of crystals into six systems and 32-point groups. Stereographic projections of symmetry elements and forms. Introduction to analytical techniques like XRD (X-ray diffraction), SEM (secondary electron microscopy). **14 Hrs.**

**Unit-2:** Elements of crystal chemistry and aspects of crystal structures. Minerals: definition and classification, physical and chemical composition of common rock-forming minerals. Nature of light and principles of optical mineralogy. Introduction to the petrological microscope and identification of common rock forming minerals. **14 Hrs.**

**Unit-3:** Rock associations in time and space. Physical aspects of magma generation in crust and mantle. Physical properties of magmas; igneous cumulates, liquid immiscibility, pneumatolitic action, magmatic assimilation and mixing of magmas. Textures of igneous rocks. Classification of igneous rocks. Igneous rock associations. **14 Hrs.**

**Unit-4:** Origin, classification and occurrence of sedimentary rocks. Siliciclastic Sedimentary Rocks: Sedimentary textures, Sedimentary structures. Sandstones,

Conglomerates, Mudstones and shales. Diagenesis of sandstones and shales, Limestones, Dolomites. Metamorphic rocks- Metamorphism, types of metamorphism, classification of metamorphic rocks, common textures and Structures. **14 Hrs.**

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## **DSCP-2: CRYSTALLOGRAPHY, MINERALOGY AND PETROLOGY (PRACTICAL):**

**2 Credits**

**56 Hrs.**

**Course Outcome:** At the end of the course the student should be able to:

- ❖ To understand the states of matter, atomic arrangement in crystals, and classification of crystals based on crystal symmetry
- ❖ To understand the characteristics of common rock-forming minerals
- ❖ To acquire knowledge on different types of rocks, their distinction from each other and the rock cycle.
- ❖ To understand the occurrence and distribution of rocks in India.

### **LIST OF EXPERIMENTS**

#### **A. Practical Lab**

1. Study of crystals based of geometrical constants. - 1 Practical
2. Measurement of interfacial angle using contact goniometer and Verification of Euler's theorem 1 Practical
3. Study of holohedral forms of six crystal system. 3 Practicals
4. Study of Physical properties of rock forming minerals (list-given below) - 3 Practicals
5. Study of the optical properties of important rock forming minerals using polarizing microscope: Quartz, Plagioclase, Orthoclase, Microcline, Biotite, Hornblende, Augite, Hypersthene, Olivine, Garnet, Calcite. 1 Practical
6. Megascopic studies of common igneous, sedimentary and metamorphic rocks 3 practical

**PART B:** Field visit to a place of geological/geomorphological interest.

| Silicates                                                                              | Non-silicates         |                              |                   |                                                                                                 | Native elements   |
|----------------------------------------------------------------------------------------|-----------------------|------------------------------|-------------------|-------------------------------------------------------------------------------------------------|-------------------|
|                                                                                        | Non-Metallic minerals |                              | Metallic minerals |                                                                                                 |                   |
| These minerals are important rock forming minerals and all are silica bearing minerals | Hydroxides            |                              | Hydroxides        | Bauxite, Psilomelane                                                                            | Sulphur, Graphite |
|                                                                                        | Sulphates             | Barite, Gypsum               | Sulphides         | Chalcopyrite, Galena, Realgar, Orpiment, Spalerite (& dodecahedral), Cinnabar, Pyrite, Stibnite |                   |
|                                                                                        | Oxides                | Corundum                     | Oxides            | Haematite (& botryoidal, micaceous), Magnetite, Pyrolusite, Chromite                            |                   |
|                                                                                        | Carbonates            | Dolomite, Calcite, Magnesite | Carbonates        | Malachite, Azurite                                                                              |                   |
|                                                                                        | Phosphates            | Monazite                     |                   |                                                                                                 |                   |
|                                                                                        | Halides               | Rock salt (Halite),          |                   |                                                                                                 |                   |

|  |  |          |  |  |  |
|--|--|----------|--|--|--|
|  |  | Fluorite |  |  |  |
|--|--|----------|--|--|--|

| *Silicates      |                        | Group                                  | Mineral Name                                 |
|-----------------|------------------------|----------------------------------------|----------------------------------------------|
| Nesosilicates   |                        | Olivine Group                          | Olivine                                      |
|                 |                        | Garnet Group                           | Garnet                                       |
|                 |                        | Al <sub>2</sub> SiO <sub>5</sub> Group | Andalusite, Sillimanite, Kyanite, Staurolite |
|                 |                        | Zircon Group                           | Zircon                                       |
| Sorosilicates   |                        | Epidote Group                          | -                                            |
| Cyclosilicates  |                        | Beryl Group                            | Beryl                                        |
|                 |                        | Tourmaline                             | Tourmaline                                   |
| Inosilicates    | Single Chain Silicates | Pyroxene Group                         | Augite, Hypersthene                          |
|                 | Double Chain Silicates | Amphibole Group                        | Actinolite, Hornblende                       |
| Phyllosilicates |                        | Serpentine Group                       | Serpentine, Asbestos                         |
|                 |                        | Clay Minerals Group                    | Talc, Kaolin                                 |
|                 |                        | Mica Group                             | Muscovite, Biotite, Phlogopite, Vemiculite   |
| Tectosilicates  |                        | Quartz Group                           | Quartz                                       |
|                 |                        | Feldspar Group                         | Orthoclase, Plagioclase, Microcline          |
|                 |                        | Feldspathoid Group                     | Nepheline, Sodalite                          |
|                 |                        | Zeolite Group                          | Zeolite                                      |

### REFERENCE BOOKS

1. James D Dana. A Textbook of mineralogy, John Wiley and Sons
2. Verma, P K (2010), Optical mineralogy. Ane books Pvt. Ltd.
3. Philips, RC, An Introduction to crystallography,
4. Buerger, Elementary crystallography
5. JAK Tareen and TRN Kutty,(1989) Elemental crystallography
6. Tyrrel, T.W Principles of Petrology, Chapman and Hall, UK
7. Turner and Verhoogen (1962), Igneous and metamorphic petrology, Allied publisher, Bombay
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### Open Elective Course (OE):

**OE-5: MEDICAL GEOLOGY (THEORY):                      3 Credits      42 Hrs.**

**Course Outcome:** The course provides a basic understanding of geogenic and anthropogenic distribution of trace elements, its cyclic movement through the abiotic-biotic environment and their toxic effects on human health and that of flora and fauna.

**Pedagogy:** Lectures, tutorials Group Discussion.

**Unit-1: Foundations of medical geology:** Ancient findings, More recent findings, Environmental classification of elements in relation to public health; inorganic poisons affecting public health in addition to pathogens with some examples from India; developments in medical geology.

**Environmental biology:** Distribution of elements in Nature - A chemically variable earth; Mineral chemistry, diversity in the composition of rocks, biogeochemical cycle, establishing geochemical baselines, geochemical baseline map of India, Total composition and bioavailability, integrating epidemiological research with high quality geochemical composition of drinking water and food, agriculture and forest management.

**14 Hrs.**

**Unit-2: Anthropogenic sources of contaminating elements:** Mining, Mineral processing and metal refining; power generation, other industrial activities, waste disposal, agricultural practices, contamination from transport industry, atmospheric deposition of contaminants, contamination in urban environment, treatment and transport of drinking water. Uptake of elements from chemical biological points of view, bioavailability of elements in soil: Gain knowledge about the medicinal value of various minerals by understanding the physical and chemical properties. Study the minerals that have health benefits or cause harm.

**Geological impacts on nutrition:** Geological sources of nutrient elements, quantitative estimates of mineral needs, clinical assessment of mineral status, ecological aspects of mineral nutrients.

**14 Hrs.**

**Unit-3: Pathways of exposure:** Volcanic emissions and health, radon and U in water, Arsenic in water and environment, fluoride in drinking and irrigation water, health effects of hardness of water, selenium and iodine deficiency, selenium toxicity.

**Geophagy;** Soil borne pathogens Natural aerosolic mineral dusts and human health – dust storms, pneumoconioses, lung diseases, silicosis, asbestosis. tuberculosis Quality of groundwater Thresholds for metal and non-metal ions from health point of view: as prescribed by: WHO, Bureau of Indian Standards, other international standards, AERB India, Methods of analysis of risk factors.

**14 Hrs.**

#### REFERENCE BOOKS

1. Selinus, Olle (Ed.), 2013, Essential of Medical Geology, Revised Edition. Springer.
2. Syed E. Hasan, 2020, Medical Geology, PMCID publications.
3. Carlos-Alberto Ríos-Reyes, María-Paula Ríos-Gutiérrez and Santiago Joya-Neira, Archivos de Medicina Volumen, 2021, The importance of minerals in medical geology: impacts of the environment on health. Enero-Junio de.
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7241403/>  
[https://en.wikipedia.org/wiki/Medical\\_geology](https://en.wikipedia.org/wiki/Medical_geology).

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**OE-6: INDUSTRIAL MINERALS (THEORY):****3 Credits 42 Hrs.**

**Course Outcome:** This course is a good opportunity for most of science and social science students not only to know about the mineral resources of India starting the principles of rock formation including minerals genesis during the rock formation and after their formation.

- Students exit with a certificate course will have skills to work in quarrying, mining, rock polishing, cement, silica/glass, sand mining, brick, ceramic, pottery and refractory industries.
- They will be exposed to start their own entrepreneurship. Similarly, students exit with a diploma, to Honors degree will be benefited work/carryout research in the interdisciplinary science to get original ideas and look for new reserves.

**Pedagogy:** Lectures, tutorials Group Discussion.

**Unit-1:** Introduction to minerals and rocks Introduction to rock forming and economically important minerals. Principles of rock cycle, origin and classification of economically important mineral deposits. **14 Hrs.**

**Unit-2:** Properties of minerals and rocks, and their occurrences: Physical properties, chemical composition, and diagnostic criteria for the identification of minerals. Ore minerals and gangue minerals, tenor and grade of the ore for industrial processing of minerals. Selection criteria followed for quarrying of decorative and dimensional rock blocks/slabs. National mineral policy. **14 Hrs.**

**Unit-3:** Properties, occurrences and distribution of the following minerals/rocks in India, with special reference to Karnataka:

| <b>Industry</b>                                       | <b>Minerals</b>                                                                                                                                                                                                                                    |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jewelry                                               | Gold, diamonds, precious minerals, corals, pearl and opals, sapphires, rubies, and emeralds.                                                                                                                                                       |
| Metallic Bauxite                                      | Chromite, ilmenite, magnetite, hematite, sphalerite, galena, chalcopryrite, pyrolusite.                                                                                                                                                            |
| Cement and Refractory minerals                        | Calcite, lime stone, gypsum, clay minerals, magnesite, graphite, chalk, marble, dolomite, zircon, kaolin, magnesia and alumina minerals                                                                                                            |
| Ceramics and glass                                    | Clay minerals, kaolinite, silica sand and bauxite, limestone and feldspar                                                                                                                                                                          |
| Abrasives, rock and mineral polishing                 | Industrial diamond, corundum, garnet and quartz magnesite, pumice, and diatomaceous earth                                                                                                                                                          |
| Strategic/defense                                     | Rare earth elements, Ilmenite, monazite, mica, vanadium from magnetite, poly metallic nodules and rock encrustation in the ocean to extract cobalt and nickel                                                                                      |
| Chemicals and fertilizers                             | Barite, calcite, magnesite, asbestos, diatomite, feldspar, gypsum, kaolinite, phosphorite, mica, talc, zeolite, bauxite, chromite, ilmenite, magnetite, hematite, sphalerite, galena, clay minerals chalcopryrite, pyrolusite, pyrite and monazite |
| Dimensional and decorative rocks & dimensional stones | Marble, granites, gneiss, dolerite, phyllite, slate, sand stones, sand, gravel, pebble and boulders                                                                                                                                                |
| Nanotechnology                                        | Clay minerals, ilmenite, polymorphs of carbon, titanium and                                                                                                                                                                                        |



anhydrous iron oxide minerals and mineral composite for rare mineral substitutes

**14 Hrs.**

### REFERENCE BOOKS

1. Klein, C and Philpotts (2016) Earth Materials Introduction to Mineralogy and Petrology Cambridge University Press.
2. Jensen M.L. and Bateman, A. (2013) Economic Mineral Deposits, John Wiley & Sons; Revised Edition.
3. National Mineral Policy, 2019 approved by Cabinet of the Government of India
4. <https://pib.gov.in/Pressreleaseshare.aspx?PRID=1566733> Mineral Distribution in India.
5. [http://ismenvis.nic.in/KidsCentre/Mineral\\_Distribution\\_in\\_India\\_13948.aspx](http://ismenvis.nic.in/KidsCentre/Mineral_Distribution_in_India_13948.aspx) Jetli, K.N. and Narindar, K.J. (2011) Mineral Resources and Policy in India.
6. Unlocking India's Mineral Wealth  
[https://mines.gov.in/writereaddata/UploadFile/GSI\\_PDAC\\_2013.pdf](https://mines.gov.in/writereaddata/UploadFile/GSI_PDAC_2013.pdf).

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### OE-7: PALEOBIOLOGY (THEORY):

**3 Credits 42 Hrs.**

**Course Outcome:** At the end of the course, students understand the types of invertebrate fossils, their mode of preservation, examination of the fossils, methodologies for the reconstruction of the past through evolutionary studies.

**Pedagogy:** Lectures, tutorials Group Discussion.

**Unit-1:** Modes of preservation of fossils- Cast, moulds, petrification, coalification, Tracks and Trails, Foot prints, Burrowing and Boring. Types of fossils – Index fossil, Synthetic fossil, Persistent fossils.

**14 Hrs.**

**Unit-2:** Invertebrate and Vertebrate fossils. Definition, Classification, and stratigraphic significance of phylum: Mollusca (Pelecypoda, Cephalopoda, Gastropoda).

Phylum: Arthropoda, Class: Trilobita.

**14 Hrs.**

**Unit-3:** Paleobotany and Microfossils classification of plants, plants through geological ages, Gondwana plants, Microfossils- Classification of microfossils. Foraminifera, Ostracoda.

**14 Hrs.**

### REFERENCE BOOKS

1. Clarkson, E.N.K., 1998, Invertebrate Paleontology and Evolution, IV edition, Blackwell.
2. Smith, A.B., 1994, Systematics and the Fossils Record- Documenting Evolutionary Patterns, Publ., Blackwell.
3. Colbert, Introduction to Vertebrate Paleontology.
4. D.J.Jones, 1956. Microfossils.
5. <https://en.wikipedia.org/wiki/Paleobiology> <https://www.nhbs.com/applications-of-palaeontology-book>

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**OE-8: GEMS AND ORNAMENTAL STONES (THEORY): 3 Credits 42 Hrs.**

**Course Outcome:** At the end of the course the student should be able to:

- To understand mineralogy and genesis of gemstones.
- To identify main physical and optical techniques used in the gems characterisation.

**Pedagogy:** Lectures, tutorials Group Discussion.

**Unit-1:** Introduction to Gemology, classification of gemstones, detailed study of different physical characters and Optical properties of minerals with special reference of gem minerals. Physico-optical effects in gem stones. Color and cause of color in gems. **14 Hrs.**

**Unit-2:** Cutting and polishing of gemstones. A detailed study of important precious and semi-precious gem minerals- their characters and occurrences- world occurrences in general and Indian occurrences in particular. Precious Varieties: 1. Diamond, 2. Ruby, 3. Sapphire, 4. Topaz, 5. Emerald ii) Semi-Precious varieties: Garnets, Quartz, Lapislazuli, Turquoise and Organic gems. **14 Hrs.**

**Unit-3:** Ornamental stones: Introduction to petrology, Classification of rocks, Properties of Igneous, Sedimentary and Metamorphic rocks. Suitability of rocks for ornamental purposes. Occurrence and distribution rocks in Indian sub-continent with particular reference to Karnataka. Evaluation, Quarrying, cutting and polishing of rocks. **14 Hrs.**

#### REFERENCE BOOKS

1. Gems and Gem industry in India-GSI Memoir 45- R.V Karanth.
2. Gem and Gem Minerals – EH Kvens and CB Slawson.
3. Encyclopedia of Minerals and Gem stones - Edited by Michael O' Don Oghal.
4. Precious stones - by Max-Bauer Vol. I and II. Publisher Dover publications Ink. New York.
5. Rutley's Elements of Mineralogy- by H.H. Read, CBS publication
6. Dana's Manual of Mineralogy.
7. GEMS by R.Webster - Batter work and co. ltd., London.
8. Gemstones - Herbert Smith - Published by Methuen co. Ltd., London.
9. Introduction to Rock Forming Minerals-Deer, Howie and Zussman.
10. Physical Geology-P.K.Mukherjee.
11. Geology of India-R.Vaidyanathan and M.Ramakrishnan.
12. Geology of Karnataka-B.P.Radhakrishna.
13. Mineral Resources of Karnataka-B.P Radhakrishna.
14. <https://z-lib.org/> <https://library.iitkgp.ac.in/pages/eSearch2.1/eBooks.php>

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****Note:** Draw neat-labelled diagrams and give examples wherever necessary**PART-A**

Answer any FIVE of the following:

**5 x 2 = 10**

- Q1** a)  
 b)  
 c)  
 d)  
 e)  
 f)  
 g)

**PART-B**

Answer any FOUR of the following

**4 x 5 = 20****Q2 -Q7****PART-C**

Answer any THREE of the following (May include sub-questions a, b)

**3 x 10 = 30****Q8 -Q11**

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**SCHEME OF PRACTICAL EXAMINATION**

**Geological Field Report:** As the geological features, structures, rock and mineral occurrence are better understood in the field, there will be a Geological Study Tour to the places of geological interest for a day in the first and second semesters mainly to study the landforms and field occurrence of rocks and minerals which carries weightage during semester end exam. Each student shall submit a study tour report along with the practical record at the end of the semester. However, for those students, who are unable to undertake field study, assignment on a topic of geological interest may be given and evaluated based on the report (internal Assessment component).

**I SEMESTER (Applicable to DSCP-1)****Time: 03 Hours****Max. Marks: 25**

| <b>Distribution of Marks</b>                                                      | <b>Marks</b> |
|-----------------------------------------------------------------------------------|--------------|
| Interpretation of Topo/drainage map                                               | <b>05</b>    |
| Preparation of LU/LC maps using Topomaps                                          | <b>10</b>    |
| Identification and description of Geomorphic features through models/stereoscopes | <b>05</b>    |
| Identification of soil texture and brief report on its characteristics            | <b>05</b>    |
| <b>Total</b>                                                                      | <b>25</b>    |

**II SEMESTER (Applicable to DSCP-2)****Time: 03 Hours****Max. Marks: 25**

| <b>Distribution of Marks</b>                    | <b>Marks</b> |
|-------------------------------------------------|--------------|
| Holohedral forms of crystals – 1 No.            | <b>03</b>    |
| Handspecimen identification of minerals – 5 No. | <b>10</b>    |
| Optical identification of minerals – 1 No.      | <b>03</b>    |
| Handspecimen identification of rocks – 3 Nos.   | <b>09</b>    |
| <b>Total</b>                                    | <b>25</b>    |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Mathematics  
Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020**

**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

The meeting of the Board of Studies in Mathematics (UG) was held on 18/11/2021 started at 11.00 AM at the Department of Mathematics. The Chairperson of BOS welcomed the members and briefed about the purpose of convening the meeting.

| Sl. No. | Members               | Position | Signature/<br>Remarks |
|---------|-----------------------|----------|-----------------------|
| 1.      | Dr. K.Shivashankar    | Chairman | Sd/                   |
| 2.      | Dr. Ruby Salestina M  | Member   | Sd/                   |
| 3.      | Dr. M. Manjunath      | Member   | Sd/                   |
| 4.      | Dr. H. S. Madhusudhan | Member   | Sd/                   |
| 5.      | Dr. Guruprasad P S.   | Member   | Sd/                   |
| 6.      | Sri. Yogananda        | Member   | Absent                |
| 7.      | Sri. Surya S P.       | Member   | Absent                |

The Chairperson welcomed the members to Board of Studies meeting in Biochemistry.

**Agenda and Resolutions**

**Agenda 1:** To discuss the new NEP Syllabus of B. Sc (I & II Semester).

The BOS discussed and approved the new NEP syllabus for I & II semester B.Sc programme to be implemented from the academic year 2021-22.

**Agenda 2:** To approve and update the list of Examiners (UG)

The committee approved the updated panel of examiners of the UG course

15-11-2021

Mysuru

Chairman,  
BoS in Mathematics

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Python /R / Msxima/ Scilab/ Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka. The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Programme outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even though each paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'. A student can select elective paper as per her/his needs and interest. The subject expert committee in Mathematics suggests that the concerned Department/Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)                                                 | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Algebra - I and<br>Calculus - I (4+0+0)                                                     | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Theory based<br>Practical's on Algebra -I<br>and Calculus - I (0+0+2)                      | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Optional<br>Mathematics - I (3+0+0)                                                          | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-2: Business<br>Mathematics - I (3+0+0)                                                          | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-3: Mathematical<br>Aptitude - I (3+0+0)                                                         | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Algebra - II<br>(Number Theory) and<br>Calculus - II (4+0+0)                                | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Theory based<br>Practical's on Algebra -II<br>(Number Theory) and<br>Calculus - II (0+0+2) | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-5: Optional<br>Mathematics - II (3+0+0)                                                         | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-6: Business<br>Mathematics-II (3+0+0)                                                           | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-7: Mathematical<br>Aptitude - II (3+0+0)                                                        | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Programme outcome:** The student graduating with the Mathematics should be able to

- ❖ **Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas such as computer science and other allied subjects.
- ❖ **Communication Skills:** Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
- ❖ **Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing the various aspects of real life problems.
- ❖ **Problem Solving:** The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances student's overall development and also equip them with mathematical modelling ability, problem solving skills.
- ❖ **Research related skills:** The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
- ❖ **Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.
- ❖ **Self - directed learning:** The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.
- ❖ **Moral and ethical awareness/reasoning:** : The student completing this program will develop an ability to identify unethical behavior such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
- ❖ **Lifelong learning:** This programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real word problems.
- ❖ Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

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## I SEMESTER

**Course Outcomes:** This course will enable the students to:

- ❖ Learn to solve system of linear equations.
- ❖ Solve the system of homogeneous and non-homogeneous linear of  $m$  equations in  $n$  variables by using concept of rank of matrix.
- ❖ Students will be familiar with the techniques of integration and differentiation of function with real variables.
- ❖ Students learn to solve polynomial equations.
- ❖ Learn to apply Reduction formulae.
- ❖ Learn *Free and Open Source Software (FOSS)* tools for computer programming.
- ❖ Solve problem on algebra and calculus theory studied in MATDSC1.1 by using FOSS software's.
- ❖ Acquire knowledge of applications of algebra and calculus through FOSS.

### DSC-1: ALGEBRA - I AND CALCULUS - I (THEORY):    4 Credits    56 Hrs.

**Unit-1: Matrix:** Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hrs.**

**Unit-2: Theory of equations:** Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hrs.**

**Unit-3: Polar Co-ordinates:** Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hrs.**

**Unit-4: Successive Differentiation and Integral Calculus-I:**  $n$ th Derivatives of Standard functions  $e^{ax+b}$ ,  $a^x$ ,  $(ax + b)$ ,  $\log(ax + b)$ ,  $\sin(ax + b)$ ,  $\cos(ax + b)$ ,  $e^{ax} \sin(bx + c)$ ,  $e^{ax} \cos(bx + c)$ , Leibnitz theorem and its applications. Recapitulation of definite integrals and its properties. Reduction formulae for  $\int \sin^n x \, dx$ ,  $\int \cos^n x \, dx$ ,  $\int \sin^n x \cos^m x \, dx$ ,  $\int \tan^n x \, dx$ ,  $\int \cot^n x \, dx$ ,  $\int \sec^n x \, dx$ ,  $\int \operatorname{cosec}^n x \, dx$ ,  $\int x^n \sin x \, dx$ ,  $\int x^n \cos x \, dx$ ,  $\int x^n e^{ax} \, dx$ ,  $\int x^n (\log x)^m \, dx$  with definite limits.. **14 Hrs.**

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**DSCP-1: ALGEBRA - I AND CALCULUS – I (PRACTICAL): 2 Credits 56 Hrs.****LIST OF EXPERIMENTS**

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Scilab /Python/R.

Introduction to the software and commands related to the topic.

1. Computation of addition and subtraction of matrices,
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Finding the nth Derivative of  $e^{ax}$ , trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of  $e^{ax} \sin(bx + c)$ ,  $e^{ax} \cos(bx + c)$ .
10. Finding the roots of the equation, factoring.
11. Finding the angle between the radius vector and tangent.
12. Finding the curvatures of the given curves.

**REFERENCE BOOKS**

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices - A R Vasista, Krishna Prakashana Mandir.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S.Chand and Co. Pvt. Ltd., 2013.

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**Open Elective Course (OE):****OE-1: OPTIONAL MATHEMATICS – I (THEORY): 3 Credits 42 Hrs.**

**Course Learning Outcome:** This course will enable the students to;

- ❖ Learn to solve system of linear equations.
- ❖ Solve the system of homogeneous and non-homogeneous m linear equations by using the concept of rank of matrix.

- ❖ Students will be familiar with the techniques of differentiation of function with real variables.
- ❖ Identify and apply the intermediate value theorems and L'Hospital rule. Learn to apply Reduction formulae.

**Unit-1: Matrices:** Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hrs.**

**Unit-2: Theory of equations:** Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra (statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hrs.**

**Unit-3: Polar Co-ordinates:** Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hrs.**

### REFERENCE BOOKS

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices – A. R. Vasista, Krishna Prakashana Mandir.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd.,

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**OE-2: BUSINESS MATHEMATICS-I (THEORY): 3 Credits 42 Hrs.**

**Course Learning Outcome:** This course will enable the students to;

- ❖ Translate the real word problems through appropriate mathematical modelling.
- ❖ Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- ❖ Finding the extreme values of functions.

- ❖ Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

**Unit-1: Algebra** – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics. **14 Hrs.**

**Unit-2: Matrices:** Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants upto third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics. **14 Hrs.**

**Unit-3: Differential Calculus:** Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint. **14 Hrs.**

#### REFERENCE BOOKS

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill, London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

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#### OE-3: MATHEMATICAL APTITUDE-I (THEORY): 3 CREDITS 42 HRS.

**Course Learning Outcome:** This course will enable the students to;

- ❖ Students have a strong base in the fundamental mathematical concepts.
- ❖ Grasp the approaches and strategies to solve problems with speed and accuracy.
- ❖ Gain appropriate skills to succeed in preliminary selection process for recruitment.

**Unit-1:** Number System, Types of Numbers, series (AP and GP), Algebraic operations BODMAS, Divisibility, LCM and HCF, Fraction, Simplification. **14 Hrs.**

**Unit-2:** Time and Distance, Problems based on Trains, Boats and Streams. **14 Hrs.**

**Unit-3:** Time, work and wages, Pipes and Cistern, Problems on Clock, Problems on Calendar. **14 Hrs.**

#### REFERENCE BOOKS

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.

3. Quantitative Aptitude: Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill.

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## II SEMESTER

**Course Learning Outcomes:** This course will enable the students to:

- ❖ Learn the concept of Divisibility.
- ❖ Learn about prime and composite numbers.
- ❖ Learn the concept of congruences and its applications.
- ❖ Identify and apply the intermediate value theorems and L'Hospital rule.
- ❖ Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- ❖ Find the extreme values of functions of two variables. Students learn to find areas and volumes using integration.
- ❖ Learn *Free and Open Source Software (FOSS)* tools for computer programming.
- ❖ Solve problem on algebra and calculus by using FOSS software's.
- ❖ Acquire knowledge of applications of algebra and calculus through FOSS.

### DSC-2: ALGEBRA – II {NUMBER THEORY} AND CALCULUS – II (THEORY):

4 Credits

56 Hrs.

**Unit-1: Number Theory:** Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 Hrs.**

**Unit-2: Differential Calculus-I:** Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule. **14 Hrs.**

**Unit-3: Partial Derivatives:** Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables. **14 Hrs.**

**Unit-4: Integral Calculus-II:** *Line integral:* Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral:* Definition of Double integrals and its conversion to iterated integrals. Evaluation of double

integrals by changing the order of integration and change of variables. Computation of plane surface areas using double integrals. *Triple integral*: Definition of triple integrals and evaluation- change of variables, volume as triple integral. **14 Hrs.**

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**DSCP-2: ALGEBRA – II (NUMBER THEORY) AND CALCULUS – II (PRACTICAL):**

**2 Credits**

**56 Hrs.**

**LIST OF EXPERIMENTS**

**(Practical/Lab Work to be performed in Computer Lab)**

**Suggested Software's:** Maxima/Scilab /Python/R.

1. Programs related to Number Theory.
2. Program to verify Mean value theorems.
3. Program for finding the Taylor's and Maclaurin's expansions of the given functions.
4. Program to verify the Euler's theorem and its extension.
5. Programs to construct series using Maclaurin's expansion for functions of two variables.
6. Program to evaluate the line integrals with constant and variable limits.
7. Program to evaluate the Double integrals with constant and variable limits.
8. Program to evaluate the Triple integrals with constant and variable limits.

**REFERENCE BOOKS**

1. Differential Calculus, Shantinayakan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc.Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinayakan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6<sup>th</sup> edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

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## Open Elective Course (OE):

**OE-4: OPTIONAL MATHEMATICS – II (THEORY): 3 Credits 42 Hrs.**

**Course Learning Outcome:** On completion of this course, the students will be able to;

- ❖ Learn the concept of Divisibility.
- ❖ Learn about prime and composite numbers.
- ❖ Learn the concept of congruences and its applications.
- ❖ Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- ❖ Find the extreme values of functions of two variables.
- ❖ To understand the concepts of multiple integrals and their applications.

**Unit-1: Integral Calculus-II: Number Theory:** Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 Hrs.**

**Unit-2: Partial Derivatives:** Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables. **14 Hrs.**

**Unit-3: Integral Calculus:** *Line integral:* Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral:* Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, *Triple integral:* Definition of triple integrals and evaluation- change of variables, volume as triple integral. **14 Hrs.**

### REFERENCE BOOKS

1. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc.Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shanthinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6<sup>th</sup> edition, McCraw Hill, 2007.



10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Wiley (New York), 1991.

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**OE-5: BUSINESS MATHEMATICS-II (THEORY): 3 Credits      42 Hrs.**

**Course Learning Outcome:** This course will enable the students to;

- ❖ Integrate concept in international business concept with functioning of global trade.
- ❖ Evaluate the legal, social and economic environment of business.
- ❖ Apply decision-support tools to business decision making.
- ❖ Will be able to apply knowledge of business concepts and functions in an integrated manner.

**Unit-1: Commercial Arithmetic:** Interest: Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. **14 Hrs.**

**Unit-2: Measures of central Tendency and Dispersion:** Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M. and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems. **14 Hrs.**

**Unit-3: Correlation and regression:** Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems. **14 Hrs.**

**REFERENCE BOOKS**

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company.
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi

4. Business Mathematics and Statistics, N.G. Das & Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K., Sultan Chand and Sons, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhyaya Parimal New Central Book Agency, Calcutta.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V.K.: S. Chand, New Delhi.

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#### **OE-6: MATHEMATICAL APTITUDE-II (THEORY): 3 Credits      42 Hrs.**

**Course Learning Outcome:** This course will enable the students to;

- ❖ Have a strong base in the fundamental mathematical concepts.
- ❖ Grasp the approaches and strategies to solve problems with speed and accuracy. Gain appropriate skills to succeed in preliminary selection process for recruitment.

**Unit-1:** Percentage, Average, Problems based on Ages, Ratio and Proportion, Partnership and share, Mixtures. **14 Hrs.**

**Unit-2:** Profit, Loss and Discount, Simple Interest, Compound Interest, Shares and Debentures. **14 Hrs.**

**Unit-3:** Permutations and Combinations, Probability, True discount and Banker's discount. **14 Hrs.**

#### **REFERENCE BOOKS**

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude: Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakashan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1, and DSC-2 Papers)**

**Time: 02 Hours**

**Max. Marks: 60**

There will be 04 questions. All questions must be answered. All questions carry 15marks.

**Question 1.** This question covers unit I of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

**Question 2.** This question covers unit II of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-question.

**Question 3.** This question covers unit III of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

**Question 4.** This question covers unit IV of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

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**SCHEME OF PRACTICAL EXAMINATION**

**I and II SEMESTER:**  
**(Applicable to DSCP-1 and DSCP=2 Papers)**

**Time: 03 Hours**

**Max. Marks: 25**

There will be 3 questions each carrying equal marks. The student has to answer any two of the 3 questions. Each student will be subjected to viva-voce examination, based on practical syllabus, for 10% marks.

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Microbiology**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Microbiology held on 26<sup>th</sup> November, 2021 in the Department of Microbiology, Yuvaraja College, Mysuru.

| Sl. No. | Members                                                                                                                 | Position | Signature/<br>Remarks |
|---------|-------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. P.K. Maheshwar, Professor and Head<br>Department of Microbiology, Yuvaraja College,<br>University of Mysore, Mysuru | Chairman | Sd/                   |
| 2.      | Dr. M. Mahadeva Murthy,<br>Department of Microbiology, Yuvaraja College,<br>University of Mysore, Mysuru                | Member   | Sd/                   |
| 3.      | Dr. H.S. Jayanth,<br>Department of Microbiology, Yuvaraja College,<br>University of Mysore, Mysuru                      | Member   | Sd/                   |
| 4.      | Dr. N. Lakshmidevi,<br>DOS in Microbiology, University of Mysore.                                                       | Member   | Sd/                   |
| 5.      | Dr. Avinash P Sattur,                                                                                                   | Member   | Sd/                   |
| 6.      | Dr. M.Y. Sreenivasa,<br>DOS in Microbiology, University of Mysore.                                                      | Member   | Sd/                   |
| 7.      | Dr. D. Rakshith, Department of Microbiology,<br>Yuvaraja College, University of Mysore, Mysuru                          | Member   | Absent                |

The Chairpman welcomed the members of the Board of Studies for the meeting and agenda was placed before them. In the present Board the New Education Policy -2021 syllabi was discussed and approved.

The minutes of proceedings of BOS are as follows:

1. The 100 marks pattern of theory examination (60 main exam + 40 IA) and practical schemes as per NEP guidelines was approved (Annexure-I and II).
2. The Board members opined that NEP syllabus as per Govt. of Karnataka and University of Mysore instructions may be implemented.
3. The Board approved the External and Internal examiners list as well as BOE members list for the next academic year.

26-11-2021  
Mysuru

Chairman,  
BOS in Microbiology

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)                  | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|-------------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: General Microbiology (4+0+0)                   | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: General Microbiology (0+0+2)                  | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Microbial Technology for Human Welfare (3+0+0)  | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Microbial Biochemistry and Physiology (4+0+0)  | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Microbial Biochemistry and Physiology (0+0+2) | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Environmental and Sanitary Microbiology (3+0+0) | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Programme outcome:** By the end of the program the students will be able to:

- Knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries.
- Understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.
- Competent to apply the knowledge gained for conserving the environment and resolving the environmental related issues.
- Learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors.
- Exploring the microbial world and analyzing the specific benefits and challenges.
- Applying the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.
- Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.
- Understanding biochemical and physiological aspects of microbes and developing broader perspective to identify innovative solutions for present and future challenges posed by microbes.
- Understanding and application of microbial principles in forensic and working knowledge about clinical microbiology.
- Demonstrate the ability to identify ethical issues related to recombinant DNA technology, GMOs, intellectual property rights, biosafety and biohazards.

- Demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.
- Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.
- Thorough knowledge and understanding of concepts of microbiology.
- Learning and practicing professional skills in handling microbes.
- Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.

## I SEMESTER

**Programme outcome:**

- Knowledge and understanding of concepts of microbiology.
- Learning and practicing professional skills in handling microbes.
- Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.

## Pedagogy

- ❖ The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.
- ❖ Pedagogy for student engagement is predominantly lectures. However, other pedagogies enhancing better student engagement to be recommended for each course. The list includes active learning/ course projects/ problem or project based learning/ case studies/self-study like seminar, term paper or MOOC.
- ❖ Every course needs to include assessment for higher order thinking skills (Applying/ Analyzing/ Evaluating/ Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for learning).

**DSC-1: GENERAL MICROBIOLOGY (THEORY):**                      **4 Credits**      **56 Hrs.**

**Unit-1: 14 Hrs.**

**Historical development, major contributions, origin of microorganisms and microscopy:** Historical development of microbiology -Theory of spontaneous generation,Biogenesis and Abiogenesis. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Edward Jenner, Alexander Fleming, Martinus Beijerinck, Sergei Winogradsky, Eleri Metchnikoff. Contributions of Indian scientists in the field of Microbiology. Fossil evidences of microorganisms. Origin of life, primitive cells and evolution of microorganisms. Microscopy- working principle, construction and operation of simple and compound microscopes.

**Unit-2:****14 Hrs.**

**Staining, sterilization and preservation of microorganisms:** Staining: Nature of strains, principles, mechanism, methods and types of staining- Simple, Differential-Gram staining, Acid fast staining, staining of capsule, cell wall, endospore, inclusion bodies.

**Sterilization:** Principles, types and techniques, Physical and chemical methods. Preservation of microorganisms: Methods of preservation of microorganisms; slant culture, stab culture, soil culture, mineral oil overlaying, glycerol preservation.

**Unit-3:****14 Hrs.**

**Types, structure, organisation and reproduction of prokaryotic microorganism**

**Overview of Prokaryotic Cell Structure:** Size, shape, arrangement. Diagram of Prokaryotic cell organisation, cell wall structure of Gram positive and negative bacteria, cell membrane; Bacterial and Archaeal, Cytoplasmic matrix- Cytoskeleton, ribosome, inclusion granules: Composition and function. Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials. Components external to cell wall- capsule, slime, s- layer, pili, fimbriae, flagella; structure, motility, chemotaxis. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination. Reproduction in bacteria and bacterial cell cycle.

**Unit-4:****14 Hrs.**

**Types, structure, organisation and reproduction of eukaryotic microorganisms:**

Over view of eukaryotic cell structure: General structure and types of cells; External cell coverings and cell membrane. Structure and function of Cytoplasmic matrix- cytoskeleton: Structure and function; single Membrane organelles- Endoplasmic reticulum, Golgi complex, Lysosomes, Vesicles and Ribosomes; Double Membrane organelles- Nucleus, Mitochondrion and Chloroplast: Structure and Functions; Peroxisomes; Organelles of motility- Structure and movement of flagella and cilia.

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**DSCP-1: GENERAL MICROBIOLOGY (PRACTICAL):      2 Credits      56 Hrs.**

**LIST OF EXPERIMENTS**

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, Vortex, Magnetic stirrer).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
7. Demonstration of bacterial motility by hanging drop method.
8. Simple staining.



9. Negative staining.
10. Differential staining - Gram staining.
11. Acid fast staining.
12. Structural staining - Flagella and Capsule.
13. Bacterial endospore staining.
14. Staining of reserved food materials.
15. Staining of fungi by Lactophenol cotton blue

### REFERENCE BOOKS

1. General Microbiology 1<sup>st</sup> Edition, 2020, Linda Bruslind, Oregon State University
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearsons.
7. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987,Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr, Chan, Krieg, International ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology.John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley andSons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub. Sudbury, 835 pp.
13. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press,Cambridge, 655 pp.
14. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. PearsonEducation Pte. Ltd., San Francisco. 958pp.

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## Open Elective Course (OE):

### OE-1: MICROBIAL TECHNOLOGY FOR HUMAN WELFARE (THEORY):

3 Credits

42 Hrs.

**Unit 1:** Food and Fermentation Microbial Technology: Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods. Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks. **14 Hrs.**

**Unit 2:** Agricultural Microbial Technology: Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production. **14 Hrs.**

**Unit 3:** Pharmaceutical Microbial Technology: Microbial Drugs – Types and Development of Drug Resistance Antibiotics – Types, Functions and Antibiotic Therapy Vaccines – Types, Properties, Functions and Schedules. **14 Hrs.**

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## II SEMESTER

**Programme outcome:** Thorough knowledge and understanding of concepts of microbiology and its application in different microbiological industries.

**Pedagogy:** The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counselling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

### DSC-2: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY (THEORY): 4 Credits 56 Hrs.

**Unit-1:** **14 Hrs.**

**Biochemical Concepts:** Basic Biochemical Concepts: Major elements of life and their primary characteristics, atomic bonds and molecules – bonding properties of carbon, chemical bonds- covalent and non-covalent, Hydrogen bonds and Vander Waal Forces.

**Biological Solvents:** Structure and properties of water molecule, Water as a universal solvent, polarity, hydrophilic and hydrophobic interactions, properties of water, Acids, bases, electrolytes, hydrogen ion concentration, pH, buffers and physiological buffer system, Handerson – Hasselbatch equation.

**Unit-2:** **14 Hrs.**

**Macromolecules** – Types, Structure and Properties

**Carbohydrates:** Definition, classification, structure and properties.

**Amino acids and proteins:** Definition, structure, classification and properties of amino acids, Structure and classification of proteins.

**Lipids and Fats:** Definition, classification, structure, properties and importance of lipids.

**Porphyrins and Vitamins:** Definition, structure, properties and importance of chlorophyll, cytochrome and haemoglobin.

### Unit-3:

**14 Hrs.**

**Microbial Physiology:** Microbial Growth: Definition of growth, Mathematical expression, Growth curve, phases of growth, calculation of generation time and specific growth rate. Synchronous growth, Continuous growth (chemostat and turbidostat), Diauxic growth. Measurement of Growth: Direct Microscopic count - Haemocytometer; Viable count, Membrane filtration; Electronic Counting; Measurement of cell mass; Turbidity measurements - Nephelometer and spectrophotometer techniques; Measurements of cell constituents. Growth Yield (definition of terms). Influence of environmental factors on growth. Microbial growth in natural environments. viable non-culturable organisms. Quorum sensing.

**Microbial Nutrition:** Microbial nutrients, Classification of organisms based on carbon source, energy source and electron source, Macro and micronutrients.

**Membrane Transport:** Structure and organization of biological membranes, Types of Cellular transport, Passive, Facilitated, Active, Group Translocation, Membrane bound and binding protein transport system, Carrier models, Liposomes, Ion transduction  $\text{Na}^+$ , ATPase.

### Unit-4:

**14 Hrs.**

**Microbial Physiology**-Bioenergetics, Microbial Respiration, Microbial Photosynthesis.

**Bioenergetics:** Free energy, Enthalpy, Entropy, Classification of high energy compounds, Oxidation reduction reactions, equilibrium constant, Redox potential, Law of thermodynamics.

**Microbial Respiration:** Respiratory electron transport chain in bacteria, oxidation – reduction reactions, protein translocation, oxidative and substrate level phosphorylation – inhibitors and mechanism, chemiosmotic coupling. Fermentation reactions (homo and hetero).

**Microbial Photosynthesis:** Light reaction: Light harvesting pigments Photophosphorylation,  $\text{CO}_2$  fixation pathways: Calvin cycle, C<sub>4</sub> pathway, Reductive TCA pathway.

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## DSCP-2: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY (PRACTICAL):

**2 Credits**

**56 Hrs.**

### LIST OF EXPERIMENTS

1. Preparation of Solution: Normal and Molar solutions.
2. Calibration of pH meter and determination of pH of natural samples.
3. Preparation of Buffer Solutions.
4. Qualitative determination and identification of Carbohydrates.
5. Qualitative determination and identification of Proteins.

6. Qualitative determination and identification of Amino Acids.
7. Qualitative determination and identification of Fatty Acids.
8. Quantitative estimation of Reducing Sugar by DNS method.
9. Quantitative estimation of Proteins by Biuret and Lowry's method.
10. Determination of lipid saponification values of fats and iodine number of fatty acids.
11. Determination of bacterial growth by spectrophotometric method & calculation of generation time.
12. Effect of pH, temperature and Salt concentration on bacterial growth.
13. Effect of Salt concentration on bacterial growth.
14. Effect of Temperature on bacterial growth.
15. Demonstration of aerobic and anaerobic respiration in microbes.

#### REFERENCE BOOKS

1. Cohen, Georges N, 2014, Microbial Biochemistry, Springer Netherlands.
2. Felix Franks, 1993; Protein Biotechnology, Humana Press, New Jersey.
3. Stryer L, 1995; Biochemistry, Freeman and Company, New York.
4. Voet & Voet, 1995; Biochemistry, John Wiley and Sons, New York.
5. Nelson and Cox, 2000; Lehninger Principles of Biochemistry, Elsevier Publ.
6. Harper, 1999; Biochemistry, McGraw Hill, New York.
7. Palmer T. (2001), Biochemistry, Biotechnology and Clinical Chemistry, Harwood Publication, Chichester.
8. Boyer R. (2002), Concepts in Biochemistry 2<sup>nd</sup> Edition, Brook/ Cole, Australia.
9. Moat A. G., Foster J.W. Spector. (2004), Microbial Physiology 4<sup>th</sup> Edition Panama BookDistributors.
10. Caldwell, D. R. (1995) – Microbial Physiology and Metabolism. Brown Publishers.
11. Lodish H, T. Baltimore, A. Berck B.L. Zipursky, P. Mastysdaire and J. Darnell. (2004) –Molecular Cell Biology, Scientific American Books, Inc. Newyork.

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### Open Elective Course (OE):

#### OE-2: ENVIRONMENTAL AND SANITARY MICROBIOLOGY (THEORY):

**3 Credits**

**42 Hrs.**

**Pedagogy:** The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

**Unit 1: Soil and Air Microbiology:** Soil and Air as a major component of environment. Types, properties and uses of soil and air. Distribution of microorganisms in soil and air.

Major types of beneficial microorganisms in soil. Major types of harmful microorganisms in soil. **14 Hrs.**

**Unit 2: Water Microbiology:** Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies. Standard qualities of drinking water. **14 Hrs.**

**Unit 3: Sanitary Microbiology:** Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Airborne microbial infections, waterborne microbial infections, Food borne microbial infections. Epidemiology of microbial infections, their detection and control. **14 Hrs.**

#### REFERENCE BOOKS

1. Diana Marco, 2019, Microbial Ecology: Current advances from Genomics, Metagenomics and other omics, Caister Academic Press.
2. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7<sup>th</sup> International, edition 2008, McGraw Hill.
3. Foundations in Microbiology, K. P. Talaro, 7<sup>th</sup> International edition 2009, McGraw Hill.
4. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1<sup>st</sup> edition, 1999, S.Chand & Company Ltd.
5. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12<sup>th</sup> edition, Pearson International edition 2009, Pearson Benjamin Cummings.
6. Microbiology–An Introduction, G.J.Tortora, B.R. Funke, C.L. Case, 10<sup>th</sup> Ed.2008, Pearsons.
7. General Microbiology, Stanier, Ingraham et al, 4<sup>th</sup> and 5<sup>th</sup> Ed. 1987, Macmillan education limited.
8. Microbiology- Concepts and Applications, Pelczar Jr, Chan, Krieg, International Ed, McGraw Hill.
9. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
10. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
11. Black, J.G. 2008. Microbiology principles and explorations. 7<sup>edn</sup>. John Wiley and Sons Inc., New Jersey 846 pp.
12. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub. Sudbury, 835 pp.
13. Schlegel, H.G. 1995. General Microbiology. Cambridge University Press, 655pp.
14. Tortora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. Pearson Education Pte. Ltd., San Francisco. 958pp.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1, and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****Note:** Draw neat-labelled diagrams and give examples wherever necessary**PART-A**

Answer any SIX of the following:

**6 x 2 = 10**

- Q1** a)  
 b)  
 c)  
 d)  
 e)  
 f)  
 g)  
 h)

**PART-B**

Answer any TWO of the following

**2 x 6 = 12****Q2 -Q4****PART-C**

Answer any TWO of the following

**2 x 6 = 12****Q5 -Q7****PART-D**

Answer any TWO of the following

**2 x 6 = 12****Q8 -Q10****PART-E**

Answer any TWO of the following

**2 x 6 = 12****Q11 -Q13**

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTERS (Applicable to DSCP-1 and DSCP-2)****Time: 03 Hours****Max. Marks: 25****Distribution of Marks****Marks**

|                                    |           |
|------------------------------------|-----------|
| Major question                     | <b>08</b> |
| Minor question                     | <b>05</b> |
| Identification and comment (2 X 4) | <b>08</b> |
| Viva voce                          | <b>04</b> |
| Total                              | <b>25</b> |

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**Bachelor of Science (Basic/Hons.) Degree in Physics**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

The BOS (UG) Physics meeting was held on 4<sup>th</sup> Of October 2021 at Department of Physics, Yuvaraja's college, Mysore. The Chairman welcomed all the distinguished members for the meeting and requested to prepare the syllabus (CBCS) of 5<sup>th</sup> and 6<sup>th</sup> semester for the academic year 2021-22. The committee prepared the syllabus after through discussion. The following resolutions were made:

1. Syllabus under CBCS is framed for 5<sup>th</sup> and 6<sup>th</sup> semester and SEC Papers.
2. Updated the panel of examiners
3. Experiments were designed for 5<sup>th</sup> and 6<sup>th</sup> semester.
4. Question paper pattern for the revised syllabus, which follows the same scheme/ pattern as earlier semester (I to IV), is drafted and passed.

| Sl. No. | Members                                                                                              | Position | Signature/<br>Remarks |
|---------|------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Sri. T Sadashivaiah, Associate Professor and Head<br>Department of Physics, Yuvaraja College, Mysuru | Chairman | Sd/                   |
| 2.      | Dr. H C Devaraje Gowda,<br>Department of Physics, Yuvaraja College, Mysuru                           | Member   | Sd/                   |
| 3.      | Dr. H Somashekarappa,<br>Department of Physics, Yuvaraja College, Mysuru                             | Member   | Sd/                   |
| 4.      | Dr. B C Manjunath,<br>Department of Physics, Yuvaraja College, Mysuru                                | Member   | Sd/                   |
| 5.      | Sri C Nagesh Babu,<br>Department of Physics, Yuvaraja College, Mysuru                                | Member   | Sd/                   |
| 6.      | Dr. S R Kumara Swamy<br>Maharani's Science College for Women, Mysuru                                 | Member   | Sd/                   |
| 7.      | Mr. Thomas Gunasheelan,<br>Department of Physics, GFGC, K.R. Nagar-571601                            | Member   | Sd/                   |
| 8.      | Dr. Annie Mathew, Terresian College, Mysuru                                                          | Member   | Sd/                   |
| 9.      | Sri Kumar R, Delivery Manager, TCS.                                                                  | Member   | Sd/                   |
| 10      | Dr. Kamsali Nagaraja, Bangalore University, Bengaluru                                                | Member   | Sd/                   |

The BOS also unanimously decided to implement NEP syllabus for B.Sc. (I & II sem) on par with the syllabus to be adopted by University of Mysore for the academic year 2021-2022.

Finally, Chairman thanked all the members for their support.

04-10-2021  
Mysuru

Chairman,  
BOS in Physics



### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)            | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|-------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Mechanics & Properties of Matter (4+0+0) | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Physics-1 (0+0+2)                       | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Energy Sources (2+1+0)                    | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-2: Climate Science (2+1+0)                   | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Electricity and Magnetism (4+0+0)        | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Physics-2 (0+0+2)                       | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-3: Astronomy and Astrophysics (2+1+0)        | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | OE-4: Medical Physics (2+1+0)                   | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Course Objective:** In this course, we aim to provide a solid foundation in various aspects of Physics, to show a broad spectrum of modern trends in Physics, to develop experimental and mathematical skills of students. The syllabi are framed in such a way that it bridges the gap between the Pre-University and Post graduate levels of Physics, by providing a complete and more logical frame work of basic Physics. The systematic and planned curriculum from first and second semester shall motivate and encourage the students for pursuing higher studies in Physics, engage in research activities and become self-reliant.

**Course Outcomes:** By the end of the first and second semester, the students would have been introduced to powerful tools for tracking a wide range of topics in **Mechanics & Properties of Matter and Electricity & Magnetism**. Further developed their experimental skills through a series of experiment which illustrates major themes of the lecture courses.

### I SEMESTER

**DSC-1: MECHANICS AND PROPERTIES OF MATTER (THEORY): 4 Credits; 56 Hrs.**

**Unit-1:**

**13 Hrs.**

**Chapter 1: Units and measurements:** System of units (CGS and SI), measurement of length, mass and time, dimensions of physical quantities, dimensional formulae. Minimum deviation, errors.

**Chapter 2: Momentum and Energy:** Work and energy, Conservation of momentum (linear). Conservation of energy with examples. Motion of rockets.

**Chapter 3: Special Theory of Relativity:** Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

**Self-Study:** Laws of Motion: Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass. (Ref: 1-4,9,10).

**Activity 1:** Students can measure diameters of small balls of different size and estimate their volumes. Students can measure lengths of nails of different size. Students can measure volume of a liquid. Students can measure distances and put the result both in CGS and SI units in 2, 3 and 4 significant figures. Ask them to mention the precession of the measurement. Students can estimate standard deviations wherever possible.

**Activity 2:** Students can try and understand conservation of energy in every day examples. For example: What happens in solar conservation panels. Pushing an object on the table it moves. Moving car hits a parked car causes parked car to move.  
i. In these cases, energy is conserved. How? Understand and verify if possible.

## Unit-2:

**13 Hrs.**

**Chapter 4: Laws of Motion:** Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass.

**Chapter 5: Dynamics of Rigid bodies:** Rotational motion about an axis, Relation between torque and angular momentum, Rotational energy. moment of inertia: M I of a rectangular Lamina and solid cylinders. Flywheel, Theory of compound pendulum and determination of g.

**Chapter 6: Gravitation:** Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's laws (statements). Satellite in a circular orbit.

**Self-Study:** Geosynchronous orbits. Basic idea of global positioning system (GPS). (Ref: 1-4,9,10).

**Activity 3:** Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body and it is proportional to the product of the square of radius,  $r$  of the body and its mass,  $m$ . Students by referring to websites, can construct and perform simple experiments to verify that  $MI \propto mr^2$ . [Reference: [www.khanacademy.org](http://www.khanacademy.org), [www.pinterest.com](http://www.pinterest.com), [www.serc.cerleton.edu](http://www.serc.cerleton.edu)].

**Activity 4:** Prepare suitable charts and give seminar talks in the class.

## Unit-3:

**13 Hrs.**

**Chapter 7: Elasticity:** Hooke's law - Stress-strain diagram, elastic moduli-relation between elastic constants, Poisson's Ratio-expression for Poisson's ratio in terms of elastic constants. Work done in stretching and work done in twisting a Wire-Twisting couple on a cylinder. Torsional Pendulum-Determination of rigidity modulus and moment of inertia -  $q$ ,  $\eta$  and  $\sigma$  by Searle's method.

**Activity 5:** Arrange a steel spring with its top fixed with a rigid support on a wall and

a meter scale alongside. Add 100 g load at a time on the bottom of the hanger in steps. This means that while putting each 100g load, we are increasing the stretching force by 1N. Measure the extension for loads upto 500g. Plot a graph of extension versus load. Shape of the graph should be a straight line indicating that the ratio of load to extension is constant. Go for higher loads and find out elastic limit of the material.

**Activity 6:** Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit. Plot and interpret.

**Chapter 8: Dynamics of Rigid bodies:** Rotational motion about an axis, Relation between torque and angular momentum, Rotational energy. moment of inertia:  $M I$  of a rectangular Lamina and solid cylinders. Flywheel, Theory of compound pendulum and determination of  $g$ .

**Chapter 9: Gravitation:** Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's laws (statements). Satellite in a circular orbit.

#### Unit-4:

**13 Hrs.**

**Chapter 10: Surface tension:** Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface example, excess pressure inside spherical liquid drop, angle of contact.

**Chapter 11: Viscosity:** Streamline flow, turbulent flow, equation of continuity, determination of coefficient of viscosity by Poiseuille's method, Stoke's method. Problems.

**Self-Study:** Capillarity determination of surface tension by drop weight method. Ref: 6,7,9,10.

**Activity 7:** Measure surface tension of water and other common liquids and compare and learn. Why water has high ST? think of reasons. Check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST. Plot ST versus  $T$  and learn how it behaves. Mix some quantity of kerosene or any oil to water and measure ST. Check whether ST for the mixture is more or less than pure water. List the reasons.

**Activity 8:** Collect a set of different liquids and measure their viscosity. Find out whether sticky or non-sticky liquids are most viscous. List the reasons. Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration. Do the above experiment by mixing sticky liquid to the non-sticky liquid. Find out change in viscosity with increase of concentration of sticky liquid. List the applications where concept of Viscosity plays a dominant role.

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**DSCP-1: PHYSICS-1 (PRACTICAL):      2 Credits;      56 Hrs.**

#### LIST OF EXPERIMENTS

1. Determination of  $g$  using bar pendulum ( $L$  versus  $T$  and  $L$  versus  $LT^2$  graphs).
2. Determination of moment of inertia of a Fly Wheel.

3. Determination of rigidity modulus using torsional pendulum.
4. Modulus of rigidity of a rod – Static torsion method.
5. Determination of elastic constants of a wire by Searle's method.
6. Young's modulus by Koenig's method.
7. Viscosity by Stoke's method.
8. Verification of Hook's law.
9. Determination of surface tension of a liquid and the interfacial tension between two liquids using drop weight method.
10. Study of motion of a spring and to calculate Spring constant, g and unknown mass.
11. Determination of Young's modulus of a bar by the single cantilever method.
12. Determination of Young's modulus of a bar by uniform bending method.
13. Radius of capillary tube by mercury pellet method.
14. Verification of parallel and perpendicular axis theorems.

(Minimum EIGHT experiments have to be carried out)

#### REFERENCE BOOKS:

1. D. S. Mathur, Mechanics by, New Edition S. Chand & Co. 2000.
2. Vidwan SinghSoni, Mechanics and Relativityby 3<sup>rd</sup> Edition, PHI Learning Pvt.Ltd.
3. Charles Kittel, *et.al.* Mechanics Berkeley Physics Course, Vol.1: Tata McGraw-Hill 2007.
4. Brijlal & Subramanyam, Properties of Matter.
5. Resnick, Halliday & Walter, Physics. 9<sup>th</sup> Edn, Wiley 2010.
6. Halliday and Resnick, Physics Vol-I.
7. B. Saraf, Physics through experiments. Vikas Publications, 2013.
8. A lab manual of Physics for undergraduate classes, 1<sup>st</sup> Edition, Vikas Publications.
9. CL Arora, BSc Practical Physics Revised Ed, S.Chand & Co. 2007.
10. D. Chatopadhyay, PC Rakshit, B.Saha, An advanced course in practicalphysics. New Central Book Agency Pvt Ltd. 2002

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#### Open Elective Course (OE):

##### OE-1: ENERGY SOURCES (THEORY):

3 Credits 39 Hrs.

##### Unit-1: Non-Renewable energy sources

13 Hrs.

**Chapter-1: Introduction-** Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.

**Chapter-2: Conventional energy sources** - Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics-

consumption & necessity. Need of eco-friendly & green energy & their related technology.

## **Unit-2: Renewable energy sources**

**13 Hrs.**

**Chapter-3: Introduction:** Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

**Chapter 4: Solar energy:** Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

## **Unit-3:**

**13 Hrs.**

**Chapter-5: Wind and Tidal Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.

**Chapter-6: Geothermal and hydro energy:** Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, power consumption.

### **Activity for tutorial classes 01 lectures/week**

- Demonstration of on Solar energy, wind energy, etc, using training modules at Labs.
- Conversion of vibration to voltage using piezoelectric materials.
- Conversion of thermal energy into voltage using thermoelectric (using thermocouples or heat sensors) modules.
- Project report on Solar energy scenario in India
- Project report on Hydro energy scenario in India
- Project report on wind energy scenario in India
- Field trip to nearby Hydroelectric stations.
- Field trip to wind energy stations like Chitradurga, Hospet, Gadag, etc.
- Field trip to solar energy parks like Yeramaras near Raichur.
- Videos on solar energy, hydro energy and wind energy.

### **REFERENCE BOOKS**

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.

4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009
6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. [http://en.wikipedia.org/wiki/Renewable\\_energy](http://en.wikipedia.org/wiki/Renewable_energy).

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**OE-2: CLIMATE SCIENCE (THEORY):****3 Credits; 39 Hrs.**

**Unit-1: Atmosphere:** Atmospheric Science (Meteorology) as a multidisciplinary science. Physical and dynamic meteorology, some terminology, difference between weather and climate, weather and climate variables, composition of the present atmosphere: fixed and variable gases, volume mixing ratio (VMR), sources and sinks of gases in the atmosphere. Greenhouse gases. Structure (layers) of the atmosphere. Temperature variation in the atmosphere, temperature lapse rate, mass, pressure and density variation in the atmosphere. Distribution of winds. **13 Hrs.**

**Unit-2: Climate Science:** Overview of meteorological observations, measurement of: temperature, humidity, wind speed and direction and pressure. Surface weather stations, upper air observational network, satellite observation. Overview of clouds and precipitation, aerosol size and concentration, nucleation, droplet growth and condensation (qualitative description). Cloud seeding, lightning and discharge. Formation of trade winds, cyclones. Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction. Limitations of the models. R and D institutions in India and abroad dedicated to climate Science, NARL, IITM, CSIR Centre for Mathematical Modeling and Computer Simulation, and many more. **13 Hrs.**

**Unit-3: Global Climate Change:** Greenhouse effect and global warming, Enhancement in concentration of carbon dioxide and other greenhouse gases in the atmosphere, Conventional and non-conventional energy sources and their usage. EL Nino/LA Nino Southern oscillations. Causes for global warming: Deforestation, fossil fuel burning, industrialization. Manifestations of global warming: Sea level rise, melting of glaciers, variation in monsoon patterns, increase in frequency and intensity of cyclones, hurricanes, tornadoes. Geo-engineering as a tool to mitigate global warming? Schemes of geo-engineering. **13 Hrs.**

**Activities to be carried out on Climate Science:**

- Try to find answer to the following questions: (a) imagine you are going in a aircraft at an altitude greater than 100 km. The air temperature at that altitude will be greater than 200°C. If you put your hands out of the window of the aircraft, you will not feel hot. (b) What would have happened if ozone is not present in the stratosphere.
- Visit a nearby weather Station and learn about their activities.



- Design your own rain gauge for rainfall measurement at your place.
- Learn to determine atmospheric humidity using wet bulb and dry bulb thermometers.
- Visit the website of Indian Institute of Tropical Meteorology (IITM), and keep track of occurrence and land fall of cyclone prediction.
- Learn about ozone layer and its depletion and ozone hole.
- Keep track of melting of glaciers in the Arctic and Atlantic region through data base available over several decades.
- Watch documentary films on global warming and related issues (produced by amateur film makers and promoted by British Council and BBC).

### REFERENCE BOOKS

1. Basics of Atmospheric Science – A Chndrashekar, PHI Learning Private Ltd. New Delhi,
2. Fundamentals of Atmospheric Modelling- M.Z. Jacobson, Cambridge University Press, 2000.

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## II SEMESTER

### DSC-2: ELECTRICITY & MAGNETISM (THEORY): 4 Credits; 56 Hrs.

#### Unit-1:

13 Hrs.

**Chapter 1:** Electric charge and field. Coulomb's law, electric field strength, electric field lines, point charge in an electric field and electric dipole, work done by a charge (derivation of the expression for potential energy).

**Chapter 2:** Gauss's law and its applications (electric fields of a (i) spherical charge distribution, (ii) line charge and (iii) an infinite flat sheet of charge).

**Chapter 3:** Electric potential, line integral, gradient of a scalar function, relation between field and potential. Potential due to point charge and distribution of charges (Examples: potential associated with a spherical charge distribution, infinite line charge distribution, infinite plane sheet of charges). Constant potential surfaces, Potential due to a dipole and electric quadrupole.

**Self-Study:** *Constant potential surfaces - for self-learning Work out problems listed in the reference.*

**Activity 1:** Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. A small project report on production of electricity as a source of energy: Different methods.

**Activity 2:** Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures.



**Unit-2:****13 Hrs.**

**Chapter 4:** Conductors in electrostatic field. Conductors and insulators, conductors in electric field. Capacitance and capacitors, calculating capacitance in a parallel plate capacitor, parallel plate capacitor with dielectric, dielectrics: an atomic view. Energy stored in a capacitor, Dielectric and Gauss's law.

**Chapter 5:** Electric currents and current density. Electrical conductivity and Ohm's law. Physics of electrical conduction, conduction in metals and semiconductors, circuits and circuit elements: Variable currents in capacitor circuits, Resistor, inductor and capacitor and their combination. Force on a moving charge.

**Self-Study:** Currents and voltage in combination of R, L and C circuits.

**Activity 3:** Learn about electrical appliances which work with AC and DC electricity. Learn about types of resistors and their colour codes and types of capacitors (electrolytic and non-electrolytic).

**Activity 4:** Learn about power transmission: 3-phase electricity, voltage and phase. Visit a nearby electrical power station. Interact with line men, Electrical engineers and managers. Discuss about power loss in transmission. How to reduce it? Prepare a small project report on street lighting and types of electrical bulbs.

**Unit-3:****13 Hrs.**

**Chapter 6:** Magnetism: Definition of magnetic field, Ampere's law and Biot-Savart law (magnetic force and magnetic flux), Magnetic force on a current carrying conductor, Hall effect. Electromagnetic induction, conducting rod moving in a magnetic field, law of induction and mutual inductance, self inductance and energy stored in a magnetic field.

**Chapter 7:** Alternating current circuits: Resonant circuit, alternating current, quality factor, RL, RC, LC, LCR circuits, admittance and impedance, power and energy in AC circuits.

**Self-Study:** Hall Effect.

**Activity 5:** Prepare a small project report on street lighting and types of electrical bulbs. Learn the measurement of electric current using a tangent galvanometer.

**Activity 6:** Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.

**Unit-4:****13 Hrs.**

**Chapter 8:** Electromagnetic waves: Equation of continuity, Maxwell's equations, displacement current, electromagnetic wave, energy transported by electromagnetic waves. Electromagnetic waves in different frames of reference, Field of a current loop, magnetic moment, Electric current in atoms, electron spin and magnetic moment, magnetization and magnetic susceptibility.

**Chapter 9:** Types of magnetic materials: diamagnetic, paramagnetic and ferromagnetic materials. B-H hysteresis curves.

**Self-Study:** B-H curves and its characteristics, Ferrites.

**Activity 7:** Prepare a small project report on production of magnetic field: Permanent magnets, electromagnets and superconducting magnets. Learn the principle of working of a Gauss meter to measure magnetic field.

**Activity 8:** Model the earth's magnetic field with a diagram. Explain the effect of tilt of the earth's axis and reasons for the change in the tilt of the earth's axis over thousands of years.

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**DSCP-2: PHYSICS-2 (PRACTICAL): 2 Credits; 56 Hrs.**

#### LIST OF EXPERIMENTS

1. Experiments on tracing of electric and magnetic flux lines for standard configuration.
2. Determination of components of earth's magnetic field using a Ballistic galvanometer.
3. Determination of capacitance of a condenser using B.G.
4. Determination of high resistance by leakage using B.G.
5. Determination of mutual inductance using BG.
6. Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements).
7. Series and parallel resonance circuits (LCR circuits).
8. Impedance of series RC circuits- determination of frequency of AC.
9. Study the characteristics of a series RC and RL Circuit.
10. Determination of self-inductance of a coil.
11. Verification of laws of combination of capacitances and determination of unknown capacitance using de - Sauty bridge.
12. Determination of BH using Helmholtz double coil galvanometer and potentiometer.

(Minimum EIGHT experiments have to be carried out)

#### REFERENCE BOOKS

1. David Halliday and Robert Resnick, Physics-Part-II, Wiley Eastern Limited, 2001.
2. Edward M Purcell, Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition, Tata Mc Graw-Hill Publishing Company Ltd, New Delhi, 2008.

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#### Open Elective Course (OE):

**OE-3: ASTRONOMY (THEORY): 3 Credits; 39 Hrs.**

**Unit-I: History and Introduction 13 Hrs.**

**Chapter 1:** Ancient Astronomy, Greek Observations, Sumerian Observations, Mayan Observations, Arabic Observations, Chinese Observations.

**Chapter 2:** Indian Astronomy, Vedic Astronomy, Ancient Astronomy – Aryabhata, Varahamihira, Bhaskara Astronomy in Indian Scriptures, Precession of the Equinox,

Celebrations of Equinox.

**Chapter 3:** Medieval & Modern Astronomy, Invention of Telescopes, Models of the Solar System & Universe, Observations by Tycho Brahe, Kepler, Galileo, Herschel and Other, Modern Astronomy.

**Chapter 4:** Optical tools for Astronomy, Pin Hole, Binoculars, Telescopes & Imaging.

**Chapter 5:** Mathematical Methods of Observations, Angular Measurement, Trigonometric functions, Stellar Parallax.

**Chapter 6:** Observational Terminologies, Cardinal Directions, Azimuth, Altitude, Measurements using Compass and Hand. Equatorial Co-ordinates, Light years, Magnitude, Colors etc.

## **Unit-2: Observations of the Solar System**

**13 Hrs.**

**Chapter 7:** The Sun, Ecliptic and the Orientation of the Earth, Seasons - Solstices and Equinox, Observations of the Sun from Earth during seasons. Eclipses, Zero-shadow day, Sunspots.

**Chapter 8:** The Moon; Earth-Moon system – Phases, Lunar Eclipses, Ecliptic and Lunar Orbital Plane – Nodes, Lunar Month, Full Moon Names.

**Chapter 9:** Inner Planets: Mercury & Venus; Observational History, Observational Windows, Appearance, Apparitions, Elongations, Superior Conjunctions, Inferior Conjunctions, Transits.

**Chapter 10: Outer Planets: Mars, Jupiter & Saturn;** Observational History. Observational Windows, Appearance, Frequency of Oppositions, Conjunctions, Moons Eclipses. Galilean Moons, Saturn's Rings.

## **Unit-3: Major Astronomy Observations**

**13 Hrs.**

**Chapter 11:** March to June; Prominent Stars and Constellations Visible during this period, Methods of Spotting.

**Chapter 12:** June to September; Prominent Stars and Constellations Visible during this period, Methods of Spotting.

**Chapter 13:** September to December; Prominent Stars and Constellations Visible during this period, Methods of Spotting.

**Chapter 14:** December to March; Prominent Stars and Constellations Visible during this period, Methods of Spotting.

### **Activities**

- ❖ Measuring Seasons using Sun's Position.
- ❖ Measuring Distance using Parallax
- ❖ Estimation of the Stellar Diameter using Pin Hole
- ❖ Measuring Height of an Object Using Clinometer.
- ❖ Star spotting using constellation maps
- ❖ Constellation spotting using Skymaps
- ❖ Estimation of 'Suitable Periods' to observe deep sky objects using Planisphere.
- ❖ Estimation of the Size of the Solar System in using Light Years.
- ❖ Identification of Lunar Phases across a year.

- ❖ Measuring Constellation of the Sun using Night Skymaps or Planispheres.

### REFERENCE BOOKS

1. The Stargazer's Guide - How to Read Our Night Sky by Emily Winterburn.
2. A guide to the Night Sky – Beginner's handbook by P.N. Shankar.
3. The Complete Idiot's guide to Astronomy by Christopher De Pree and Alan Axelrod.
4. P. N. SHANKAR A GUIDE TO THE NIGHT SKY.
5. <https://www.arvindguptatoys.com/arvindgupta/nightskyshankar.pdf>.
6. Biman Basu, Joy of Star Watching, National Book Trust of India 2013.
7. Christopher De Pree: The Complete Idiot's Guide to Astronomy, Penguin USA, 2008.
8. E. Winterburn, The Stargazer's Guide: How to Read Our Night Sky, Constable and Robinson, 2008,

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### OE-4: MEDICAL PHYSICS (THEORY): 3 Credits; 39 Hrs.

**Unit-I: Human Anatomy and Physiology:** Overview of human anatomy - cells, cell structure, type of cells and their functions, tissues, organs, and their functions. Different systems in the human body, their structure and function, physiological properties of the circulatory system, digestive system, respiratory system, reproductive system, excretory system, endocrine system and nervous system. **13 Hrs.**

**Unit-2: Physics of Medical Diagnostics:** Principle of production of X-rays. Use of X-rays in medical diagnosis, X-ray imaging systems. Computed Tomography (CT): principle and generation of CT. Magnetic Resonance Imaging (MRI): basic principle and image characteristics. Ultrasound Imaging: Interaction of sound waves with body tissues, production of ultrasound, transducers, acoustic coupling, image formation, modes of image display and color Doppler. **13 Hrs.**

**Unit-3: Physics of Radiotherapy:** Clinical aspects of radiation therapy: Biological basis of radiotherapy, radiation sources, radiation dose, time dose fractionation. External beam radiation therapy, radiation therapy modalities, production of radioisotopes, use of radioisotopes in therapy, particle and ion beam radiotherapy. Brachytherapy - principle of brachytherapy and classification of brachytherapy techniques. **13 Hrs.**

#### Class Room Activities:

- Students can demonstrate the shape, size, positions and functions of different organs in the body with the help of models.
- The use of X-rays in the diagnosis of the fractured bone can be demonstrated with the help of a gamma source and a gamma ray survey meter. As the density of materials between the source and the detector changes the reading on the meter (or intensity of the beeping sound) changes.
- (i) Students can be asked to list out different type of cancers and possible causative factors. They can be asked to list out the healthy practices to reduce the

risk of cancers. (ii) As there will be students from different disciplines in the OE course, group discussion can be arranged to discuss about their programme and outcome. This will be an opportunity for the students to know about other disciplines.

#### **Other related activities/projects:**

- ❖ Visit to nearby hospitals/diagnostic centers to study the working of X-ray machines.
- ❖ Visit to ultrasound diagnostic centers to study the principle and use of ultrasound in diagnosis.
- ❖ Project on principle and use of X-ray films in imaging.
- ❖ Visit to radiotherapy centers to study the modalities of radiotherapy.

#### **REFERENCE BOOKS**

1. C. H. Best and N. B. Taylor. A Text in Applied Physiology. Williams and Wilkins Company, Baltimore, 1999.
2. C. K. Warrick. Anatomy and Physiology for Radiographers. Oxford University Press, 2001.
3. Jerrold T. Bushberg. The Essential Physics for Medical Imaging (2nd Edition). Lippincott Williams & Wilkins, 2002.
4. Jean A. Pope. Medical Physics: Imaging. Heinemann Publishers, 2012.
5. Faiz M. Khan and Roger A. Potish. Treatment Planning in Radiation Oncology. Williams and Wilkins, USA, 2003.
6. D. Baltas. The physics of modern brachytherapy for oncology. Taylor and Francis, 2007.
7. J. R. Brobek. Physiological Basis of Medical Practice. Williams and Wilkins, London, 1995.
8. Edward Alcamo, Barbara Krumhardt. Barron's Anatomy and Physiology the Easy Way. Barron's Educational Series, 2004.
9. Lippincott, Anatomy and Physiology. Lippincott Williams & Wilkins, 2002.
10. W. E. Arnould Taylor. A textbook of anatomy and physiology, Nelson Thornes, 1998.
11. G. S. Pant. Advances in Diagnostic Medical Physics. Himalaya Publishing House, 2006.
12. Sabbahaga, Diagnostic Ultrasound applied to OBG. Maryland, 1980.
13. Faiz M Khan. The Physics of Radiation Therapy (3rd edition). Lippincott Williams & Wilkins, USA, 2003.
14. Jatinder R. Palta and T. Rockwell Mackie. Intensity Modulation Radiation Therapy. Medical Physics publishing, Madison, Wisconsin, 2003.
15. AAPM Report No. 72. Basic Applications of Multileaf collimators, AAPM, USA, 2001.
16. AAPM Report No. 91. Management of Respiratory motion in radiation oncology, 2006.
17. CA Joslin, A. Flynn, E.J. Hall. Principles and Practice of Brachytherapy. Arnold publications, 2001.

18. Peter Hoskin, Catherine Coyle. Radiotherapy in Practice. Oxford University Press.
19. W. R. Handee. Medical Radiation Physics. Year Book Medical Publishers Inc., London.
20. Donald T. Graham, Paul J. Cloke. Principles of Radiological Physics. Churchill Livingstone, 2003.
21. Thomas S. Curry. Christensen's Physics of Diagnostic Radiology (4th Edition). Lippincott Williams & Wilkins, 1990.
22. Madison. MRI – Perry Sprawls – Medical Physics Publishing. Wisconsin, 2000.
23. Steve Webb. The Physics of Three-Dimensional Radiotherapy. Institute of Physics Publishing, Bristol and Philadelphia, 2002.
24. Radiation oncology physics: A Handbook for teachers and students. IAEA publications, 2005.
25. F. M. Khan. The Physics of Radiation Therapy (3rd Edition), Lippincott Williams and Wilkins, U.S.A., 2003.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to DSC-1 and DSC-2 Papers)**

**Time: 02 Hours****Max. Marks: 60****PART-A**

Answer any ONE question of the following (questions from unit-1)

**1 x 10= 10****Q1****Q2****PART-B**

Answer any ONE question of the following (questions from unit-2)

**1 x 10= 10****Q3****Q4****PART-C**

Answer any ONE question of the following (questions from unit-3)

**1 x 10= 10****Q5****Q6****PART-D**

Answer any ONE question of the following (questions from unit-4)

**1 x 10= 10****Q7****Q8****PART-E**

Answer any FOUR questions of the following (Numerical Problems:

**5 x 4= 20**

Minimum of one question from each unit to be answered)

**Q9 – Q14**

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTERS (Applicable to DSCP-1, and DSCP-2 Papers).****Time: 03 Hours****Max. Marks: 25**

| <b>Distribution of Marks (C3)</b>                 | <b>Marks</b> |
|---------------------------------------------------|--------------|
| Formula with proper units with explanation        | 04           |
| Setting up of the apparatus / circuit connections | 04           |
| Taking readings, tabulating and number of trails  | 05           |
| Calculations and Graph                            | 05           |
| Result with accuracy                              | 02           |
| Viva                                              | 05           |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Sericulture  
Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceeding of the meeting of the Board of Studies in Sericulture (UG) held on 1-12-2021 at 10.00 AM in the Chamber of the Head, Department of Sericulture, Yuvaraja College, Mysuru.

| Sl. No. | Members                                                                              | Position | Signature/<br>Remarks |
|---------|--------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. H. B. Mahesha, Head, Department of Sericulture, Yuvaraja College, Mysuru         | Chairman | Sd/                   |
| 2.      | Dr. L.H. Shivashankarappa, Department of Sericulture, Maharani's College, Bangalore. | Member   | Sd/                   |
| 3.      | Prof. S. Chandrashekar, G K V K, Bangalore.                                          | Member   | Sd/                   |
| 4.      | Prof. Rohith L. Shankar, Department of Sericulture, Yuvaraja College, Mysuru.        | Member   | Sd/                   |
| 5.      | Dr. Ananth R, Department of Sericulture, Yuvaraja College, Mysuru.                   | Member   | Sd/                   |
| 6.      | Prof. Jagadish kumar T S, Department of Sericulture, MGM-6                           | Member   | Sd/                   |
| 7.      | Prof. M. Raju, V C Farm, Mandya.                                                     | Member   | Absent                |
| 8.      | Mr. Jagadish K, Keeranagere Chawki Rearing Center, Kanakapura.                       | Member   | Absent                |

The chairman welcomed all the members to the meeting. The agenda was placed before the board.

1. The Board approved the panel of examiners for the examinations 2021-22.
2. The Board approved the syllabus, model question paper and scheme of practical examination under NEP - 2020 regulations.

Finally, the Chairman thanked all the members for their active participation.

01-12-2021  
Mysuru

Chairman,  
BOS in Sericulture

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)              | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|---------------------------------------------------|----------------------------|----------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Fundamentals of Sericulture (4+0+0)        | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-1: Fundamentals of Sericulture (0+0+2)       | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-1: Science of Sericulture (3+0+0)              | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |
| <b>II</b> | DSC-2: Mulberry Biology and Cultivation (4+0+0)   | <b>4</b>                   | <b>4</b> | <b>40</b>                                 | <b>60</b>                                 |
|           | DSCP-2: Mulberry Biology and Cultivation (0+0+2)  | <b>4</b>                   | <b>2</b> | <b>25</b>                                 | <b>25</b>                                 |
|           | OE-2: Mulberry Crop Production Technology (3+0+0) | <b>3</b>                   | <b>3</b> | <b>40</b>                                 | <b>60</b>                                 |

**Pre-requisite course:** Students must have studied Biology or any other equivalent subjects in Class 12.

**Program Outcomes:** By the end of the program the students will be able to:

- Acquire competency in the discipline with sound knowledge and skill to secure B.Sc. (Basic) or B.Sc. (Hons) degree in Sericulture.
- Know the different components and chain link of sericulture industry.
- Understand concepts of sericulture industry and demonstrate interdisciplinary skills acquired in mulberry plant cultivation, silkworm rearing, diagnosis of diseases and pest of mulberry and silkworm and their prevention and its relevance in Seri-farmer's livelihood.
- Demonstrating the Laboratory and field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects.
- Competent to transfer the knowledge and technical skills to the Seri-farmers.
- Critically analyze the environmental issues and apply in management of mulberry garden and silkworm rearing at field.
- Demonstrate comprehensive innovations and skills in improvement of mulberry and silkworm varieties for betterment of sericulture industry and human welfare.
- Apply knowledge and skills of seribiotechnology for development new mulberry variety and silkworm breeds suitable for varied agro-climatic zones.
- Apply tools and techniques of biostatistics for critical analysis and interpretation of data accrued.
- Use bioinformatics tools and techniques for the analysis and interpretation of biomolecular data for better understating mulberry and silkworm.
- Aptly demonstrate communication skills, scientific writing, data collection and

interpretation abilities in all the fields of seribiotechnology.

- Thorough knowledge and application of good laboratory and good manufacturing practices in sericulture and biotech industries.
- Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.

## I SEMESTER

**Course outcome:** At the end of the course the student should be able to:

- Acquire sound knowledge on different components of sericulture industry,
- Gain skill with hands on training on mulberry cultivation and carry forward to field,
- Gain skill with hands on training on silkworm egg production and support grainage activity,
- Acquire knowledge and develop skill in silkworm rearing and support silkworm farming.
- With the knowledge and skill acquired students may not only acts as resource personnel to sericulture industry but also emerged as potential entrepreneur.

**Program Outcomes (POs):**

- ❖ Students would gain brief background on different components of Sericulture.
- ❖ They will have awareness on the origin, growth and status of sericulture industry across the globe.

**Pedagogy:** Lectures/ Seminars/Field work/ Assignment/ Group discussion with farmers/ Problem Solving by interacting with scientists.

**DSC-1: FUNDAMENTALS OF SERICULTURE (THEORY):      4 Credits      56 Hrs.**

**Unit-1: Introduction to Sericulture:      14 Hrs.**

Origin and history of Sericulture. Silk road – Sericulture practicing countries of the World and status. Sericulture map of India and World. Sericulture organization in India and Karnataka; role of state departments of Sericulture, CSB, Universities and NGOs in Sericulture development. Sericultural practices in tropical and temperate climate. Employment generation in Sericulture-Role of women in sericulture, SWOT Analysis. Textile fibres: Types- natural and synthetic fibres- types of silk produced in India and their importance.

**Unit-2: Importance of soil for mulberry cultivation:      14 Hrs.**

Definition of soil, soil structures, soil textures and soil profile. Types of soils in India and Soil Sickness. Soil air, Soil Water and Soil organisms. Soil analysis- soil sampling, soil pH, organic carbon and NPK level. Soil conservation methods and Reclamation. Importance of soils fertility with reference to mulberry cultivation.

**Unit-3: Components of sericulture:      14 Hrs.**

Introduction to Mulberry and non-mulberry sericulture. Introduction to mulberry cultivation. Introduction to silkworm rearing. Introduction to silkworm seed production.

Introduction to post cocoon technology. Mulberry Species and Varieties under cultivation in India. Popular silkworm races of India.

**Unit-4: Entrepreneurship and rural development in sericulture: 14 Hrs.**

Entrepreneurship development programme (EDP): Emergence and objectives of EDP, essential qualities to become an entrepreneur; selection of a potential entrepreneur. EDP in raising mulberry saplings (Kisan nursery) and mechanization in mulberry cultivation. EDP in composting and vermicomposting for the management of mulberry garden and rearing wastes. EDP in chawki rearing centers, silkworm egg production and silkworm rearing, silk reeling and handicrafts from cocoons. Contract farming and its scope in sericulture and Occupational health hazards in sericulture. By-products of sericulture industry and their utilization.

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**DSCP-1: FUNDAMENTALS OF SERICULTURE (PRACTICAL): 2 Credits 56 Hrs.**

**LIST OF EXPERIMENTS**

1. Sericulture map of the World map and Silk Road
2. Sericulture map of India
3. Sericulture map of Karnataka.
4. Sericulture map of non-mulberry silkworms.
5. Identification of different types of Indian soils and Soil sickness.
6. Soil analysis- soil sampling and testing.
7. Determination of pH and NPK in different soil samples.
8. Determination of water holding capacity in different soil samples.
9. Studying of different soil organisms (Microscopic culture).
10. Identification of mulberry varieties.
11. Identification of different non-mulberry food plants.
12. Identification of silkworm breeds and cocoons.
13. Identification of different types of silk fibers-Raw silk, Bleached silk, Dyed Silk
14. Handicrafts making from cocoons.

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**Open Elective Course (OE):**

**OE-1: SCIENCE OF SERICULTURE (THEORY): 3 Credits 42 Hrs.**

**Unit-1:** Introduction to textile fibres; types – natural and synthetic fibres and their properties; importance of silk fibre. Types of silk produced in India. History, development and status of mulberry and non-mulberry sericulture in India. Silk production in India and other countries; export and import. Characteristic features and advantages of sericulture; scope of sericulture in India vis-à-vis other agricultural crops - employment potential and income generation; role of women in sericulture. Sericulture organization in India. Sericulture extension: Extension systems - Central Silk Board, state sericulture departments, universities and voluntary organizations. **14 Hrs.**

**Unit-2:** Host plants of mulberry and non-mulberry silkworms. Mulberry cultivars - tropical and temperate regions, irrigated and rainfed conditions. Importance of soils fertility with reference to mulberry cultivation, soil structures, soil textures and soil profile, types of soils, and Problematic Soils and its reclamation. Propagation and establishment of mulberry garden, Package of practices for mulberry cultivation under rainfed and irrigated conditions. Pruning, harvesting, transportation and preservation of mulberry. Pests and diseases of mulberry and their management. **14 Hrs.**

**Unit-3:** Silkworm seed organization and its significance; seed areas and rearers. General account of silkworm egg production and demand. Silkworm races/ breeds, Grainage building and equipments. Grainage activities - procurement and preservation of seed cocoons, sex separation, eclosion, pairing and depairing, oviposition – sheet and loose egg preparation, mother moth examination, acid treatment, surface sterilization, washing, packing and sale of eggs. Life cycle of *Bombyx mori*. Rearing houses and equipments; disinfection, incubation and black boxing of silkworm eggs. Rearing operations - brushing, young and late-age silkworm rearing, moulting, mounting, spinning, cocoon harvesting and marketing. Characteristics of cocoons. Cocoon stifling and cooking. Silk reeling: Charaka, cottage basin and multi-end. Silk exchanges; weaving and dyeing. **14 Hrs.**

#### REFERENCE BOOKS

1. Sericulture Manual-2 (Silkworm rearing) (1972); Food and Agriculture Organization of the United Nations, Rome.
2. Sericulture Manual-1 (Mulberry cultivation) (1972); Food and Agriculture Organization of the United Nations, Rome.
3. Sericulture Manual-3 (Silk reeling) (1972); Food and Agriculture Organization of the United Nations, Rome.
4. Hand Book of Silkworm rearing (1972); Fuji Publishing Co., Ltd., Tokyo, Japan.
5. Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers 4- 2-24, Hiroo, Sibuya-ku, Tokyo, Japan.
6. Charles J. Huber (1929); The Raw silk Industry of Japan. The Silk Association of America, Inc.
7. Chaudhury S.N. (1981); Muga Silk Industry, Directorate of Sericulture and Weaving, Government of Assam, Gowhati, Assam.
8. Sarkar D.C. (1980); Sericulture in India, Central Silk Board, Government of India, Bangalore.
9. Sainosuka Omura (1973); Silkworm rearing Techniques in Tropics, Overseas Technical Co-operation Agency, Tokyo, Japan.
10. Tanaka Y. (1964); Sericology, Central Silk Board Publication, Bangalore.
11. Devaiah M.C *et al.* (2001); Advances in Mulberry Sericulture. Dept. of Sericulture, UAS, Bangalore.

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## II SEMESTER

**Course outcome:** At the end of the course the student should be able to:

- Program outcomes that the course addresses: Students would know all about mulberry plant and cultivars in the field.
- They would gain knowledge and acquire skill in cultivation of mulberry plants in the garden.

**Pedagogy:** Lectures/ Seminars/Field work/ Assignment/ Group discussion with farmers/ Problem Solving by interacting with scientists.

### **DSC-2: MULBERRY BIOLOGY AND CULTIVATION (THEORY): 4 Credits    56 Hrs.**

#### **Unit-1: Taxonomy of Mulberry: 14 Hrs.**

Salient features, economic importance of the family Moraceae. Phytogeography and systematics of the genus *Morus* L. and its species. Botanical description and morphology of mulberry. Floral biology of mulberry: Structure of male and female flowers, Catkins. Anther and ovule in mulberry; micro- and megasporogenesis; development of male and female gametophytes; Pollination, fertilization; development of endosperm, embryo and seed in mulberry. Polyembryony and parthenocarpy in mulberry. Anatomy of mulberry internal structure of stem, root, petiole and leaf lamina; secondary growth in root and stem. Structure and organization of shoot and root meristems.

#### **Unit-2: Establishment of mulberry garden: 14 Hrs.**

Propagation of mulberry- seedling, sapling, grafting and layering. Establishment of mulberry garden (Bush and tree plantation): Areas under mulberry cultivation in India, General Descriptions, Climatic requirements, Soil conditions, mulberry cultivation under rain-fed and irrigated conditions, mulberry cultivation in hilly areas, mixed farming with special references to tree plantations. Raising of commercial nursery; Application of root inducing hormones. Estimation of leaf yield: Importance of leaf quality. Utilization of mulberry in various fields and its medicinal properties.

#### **Unit-3: Mulberry cultivation: 14 Hrs.**

Farm implements utilized in mulberry cultivation. Intercultivation and Mulching practices: Purpose, methods, time and frequency. Irrigation: Importance, Source, methods, periodicity and quantity of irrigation, over-irrigation and its effects. Pruning- Objectives, Importance and methods. Leaf harvesting: harvesting methods (leaf and shoot harvests); transportation and preservation of harvested leaf and shoots. Weeds of Mulberry Garden, classification, characteristics and effect on crop plants. Integrated weed management. Weeding methods.

#### **Unit-4: Fertilizers application in mulberry: 14 Hrs.**

Introduction to different types of Manures and fertilizers: Introduction to Biofertilizers and its application in mulberry cultivation. Introduction to Foliar nutrients and Plant nutrients (macro and micronutrients) and their application in mulberry cultivation. Introduction to Plant Hormones and their application in mulberry production.

Introduction to Composting and vermi-composting and their utilization in mulberry production.

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## **DSCP-2: MULBERRY BIOLOGY AND CULTIVATION (PRACTICAL): 4 Credits 56 Hrs.**

### **LIST OF EXPERIMENTS**

1. Taxonomic description of mulberry.
2. Mounting of Pollen grains, Ovule and Embryo.
3. Anatomy of petiole,
4. Anatomy of leaf lamina,
5. Anatomy of primary and secondary stem
6. Anatomy of primary and secondary root.
7. Mulberry Farm implements.
8. Preparation of land, pits and rows; preparation of rooting media (fieldwork).
9. Raising of sapling and seedling (field work).
10. Intercultivation, mulching, irrigation, pruning and estimation of leaf yield. (Demonstration and exercise).
11. Grafting and Layering in mulberry.
12. Harvesting and preservation techniques; leaf selection for different instars.
13. Weeds of Mulberry garden, classification, weeding methods.
14. Study and identification of different types of fertilizers.

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### **Open Elective Course (OE):**

#### **OE-2: MULBERRY CROP PRODUCTION TECHNOLOGY (THEORY):**

**3 Credits**

**42 Hrs.**

**Unit-1:** Taxonomy and systematics of mulberry. Reproductive biology of mulberry: male and female flowers and fruit of mulberry. Anatomy of root, stem and leaf of mulberry. Popular mulberry cultivars and their characteristics features. Climatic factors required for mulberry growth and productivity. Soils for mulberry cultivation: Soil profile and properties; soil sampling and testing; problematic soils and their reclamation. **14 Hrs.**

**Unit-2:** Propagation of mulberry through cuttings, grafting and layering. Raising of nursery for large scale production of saplings (Kisan nursery). Establishment and maintenance of mulberry gardens; package of practices for mulberry gardens under rainfed and irrigated conditions. Plant nutrient management: Essential nutrients, organic manures, inorganic fertilizers and bio-fertilizers and its application. Irrigation and inter-cultivation of mulberry garden. Weeds of mulberry garden their management. **14 Hrs.**

**Unit-3:** Pruning, leaf harvesting: harvesting methods (leaf and shoot harvests); transportation, preservation of leaf and shoots. Assessment of mulberry leaf yield and quality. Diseases of mulberry: Causal organism, symptomatology, seasonal incidence, disease cycle, yield and quality loss and their management. Pests of mulberry: Life cycle,



symptoms of attack, seasonal occurrence, nature of damage and their management. By-Products and medicinal importance of mulberry. **14 Hrs.**

### REFERENCE BOOKS

1. Sericulture Manual-1 (Mulberry cultivation) (1972); FAO, Rome.
2. Sericulture Manual-2 (Silkworm rearing) (1972); FAO, Rome.
3. Sericulture Manual-3 (Silk reeling) (1972); FAO, Rome.
4. Hand Book of Silkworm rearing (1972); Fuji Publishing Co., Ltd., Tokyo, Japan.
5. Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers 4- 2-24, Hiroo, Sibuya-ku, Tokyo, Japan.
6. Charles J. Huber (1929); The Raw Silk Industry of Japan. The Silk Association of America.
7. Sainosuka Omura (1973); Silkworm rearing Techniques in Tropics, Overseas Technical Co-operation Agency, Tokyo, Japan.
8. Devaiah M.C *et al.* (2001); Advances in Mulberry Sericulture. Dept. of Sericulture, UAS, Bangalore.

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### QUESTION PAPER: THEORY EXAMINATION (Applicable to DSC-1 and DSC-2 Papers)

**Time: 02 Hours**

**Max. Marks: 60**

#### PART-A

- 1** Answer ALL of the following **5 x 1 = 5**
- a)
  - b)
  - c)
  - d)
  - e)

#### PART-B

- 2** Write short notes on any **FIVE** of the following **5 x 3 = 15**
- a)
  - b)
  - c)
  - d)
  - e)
  - f)
  - g)

#### PART-C

- Answer any **FOUR** of the following **4 x 5 = 20**
- Q3 - Q8**

#### PART-D

- Answer any **TWO** of the following **2 x 10 = 20**
- Q9 - Q11**

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTER****DSCP-1: Fundamentals of Sericulture Practical****Time: 03 Hours****Max. Marks: 25****DISTRIBUTION OF MARKS**

- |          |                                                                                                          |         |
|----------|----------------------------------------------------------------------------------------------------------|---------|
| <b>1</b> | <b>Determine the soil pH/water holding capacity</b>                                                      |         |
|          | Procedure with tabular column and Result                                                                 | 5 Marks |
|          | To conduct Experiment                                                                                    | 4 Marks |
| <b>2</b> | <b>Prepare sericulture map of World/India/Karnataka</b>                                                  |         |
|          | Preparation of chart with data                                                                           | 5 Marks |
|          | Explanation                                                                                              | 3 Marks |
| <b>3</b> | Identify and comment on the spots A, B, C and D. (any four from the practical syllabus/2 marks for each) | 8 Marks |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

**DSCP-2: Mulberry Biology and Cultivation Practical****Time: 03 Hours****Max. Marks: 25****DISTRIBUTION OF MARKS**

- |          |                                                                                                                                                                       |         |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>1</b> | <b>Identification of the mulberry by taxonomic description/anatomy of petiole/primary and secondary leaf/ primary and secondary stem / primary and secondary root</b> |         |
|          | Labeled Diagram                                                                                                                                                       | 4 Marks |
|          | Preparation of slide                                                                                                                                                  | 4 Marks |
|          | Identification                                                                                                                                                        | 1 Mark  |
| <b>2</b> | <b>Mounting of pollen grain/ovule/embryo/grafting/layering</b>                                                                                                        |         |
|          | Procedure/Description                                                                                                                                                 | 4 Marks |
|          | To conduct Experiment                                                                                                                                                 | 4 Marks |
| <b>3</b> | Identify and comment on the spots A, B, C and D. (any four from the practical syllabus/ 2 marks for each)                                                             | 8 Marks |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Statistics**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Biochemistry held on 27-11-2021 in the Department of Statistics, Yuvaraja College, Mysuru.

**Agenda:**

1. The syllabus prepared by the members of the departmental council and finalize the syllabus as per new NEP-2020 regulations, which is effective from 2021-2022 under CBCS scheme, taking suggestions from the members of the Board.
2. Discussion on continuous assessment of C1 and C2 components.
3. Preparation of Panel of Examiners for B.Sc. Examinations 2021-22
4. Preparation of Panel of BOE in Statistics
5. Any other subject with the permission of the Chairperson

| Sl. No. | Members                                                                                                                                | Position | Signature/<br>Remarks |
|---------|----------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. Bhat Satish Shankar, Professor and Head<br>Department of Statistics, Yuvaraja College,<br>University of Mysore, Mysuru             | Chairman | Sd/                   |
| 2.      | Prof. R. Vidya,<br>Department of Statistics, Yuvaraja College,<br>University of Mysore, Mysuru                                         | Member   | Sd/                   |
| 3.      | Prof. S. Ravi, DOS in Statistics,<br>University of Mysore, Manasagangotri, Mysuru                                                      | Member   | Sd/                   |
| 4.      | Dr. B.K Shivanna. Assistant Professor and Head,<br>Department of Statistics,<br>Maharanis Science College for women, Mysuru-05         | Member   | Sd/                   |
| 5.      | Dr. Mohini Bhat, Assistant Professor,<br>Department of Statistics, Christ College, Bangaluru.                                          | Member   | Sd/                   |
| 6.      | Sri. M. N. Mallik, Senior lead,<br>Infosys Ltd, Bangaluru                                                                              | Member   | Sd/                   |
| 7.      | Sri. Yoganand, Consultant,<br>Risk Management Solutions, Bengaluru.                                                                    | Member   | Sd/                   |
| 8.      | Dr. T. Raveendra Naika, Assistant Professor and<br>Head, Department of Statistics,<br>Maharanis Science College for women Bangaluru-01 | Member   | Absent                |

**Proceedings:**

- Discussing and finalizing the syllabus prepared by the members of the departmental council: The syllabus is prepared for introducing the NEP-2020 Choice Based Credit System (CBCS) with effect from the academic year 2021-22.

- The meetings of the board of studies in statistics of Yuvaraja's College, Mysuru, started with a warm welcome from the chairperson, BOS (UG) in Statistics. The Chairperson briefed the members of the BOS about
- The proposal of the college in introducing the NEP-2020 CBCS system in the new format in all undergraduate programmes of Yuvaraja's college effective from the Academic year 2021-22. The Chairperson also briefed the features of NEP-2020 system and the uniformity expected as per new NEP-2020 CBCS regulations in all programmes of Yuvaraja's College, Mysuru. The Chairperson also informed the members that keeping in view of the guideline proposed by the college departmental council of the college the new syllabus is prepared and circulated. The Chairperson invited the members to provide suggestions on the syllabus to improve as same expected to serve the student community in the larger prospectus of their carrier.
- The members of the BOS discussed the syllabus in detail and did a thread bear analysis. All suggestions and modifications are incorporated. The proposed syllabus is thorough revised.

### **Resolution:**

1. After Thorough revision the syllabus is accepted.
2. Discussion on continuous assessment of C1 and C2 components. The Chairperson briefed the members of BOS on continuous assessment of C1 and C2 components.
3. Preparation of panel of examiners for B. Sc. Examinations 2021-22. The Chairperson requested the BOS members to suggest the names of faculty members who could be empanelled as members of examiners for B.Sc. statistics Examinations from the academic year 2021-22, keeping in-view that the B.Sc. programme would be offered under NEP-2020 CBCS.

As per the request of the Chairperson, BOS members prepared and approved the panel of Examiners for B.Sc. Statistics Examination' 2021-22.

4. Preparation of Panel of BOE in Statistics. The Chairperson requested the BOS members to suggest the names of faculty members who could be Chairperson and member's as required for conducting BOE in Statistics'2021-22.

As per the request of the Chairperson, BOS members prepared and approved the panel of board of examiners (BOE) for B.Sc. Statistics Examinations'2021-22, keeping seniority and UGC and Non-UGC professors in framing the committee.

The meeting Concluded with Vote of Thanks by the Chairperson.

### **Suggestions from the Members of BOS**

The members have suggested that Statistics should also go with Computer Science, and all other major subjects (Physical Science) for UG level as per NEP-2020 regulations, however required mathematics portion should be taught as and when required.

27-11-2021  
Mysuru

Chairman,  
BOS in Statistics

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)               | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Descriptive Statistics (4+0+0)              | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-1: Descriptive Statistics (0+0+2)             | 4                          | 2       | 25                                        | 25                                        |
|           | OE-1: Statistical Methods its applications (3+0+0) | 3                          | 3       | 40                                        | 60                                        |
|           | OE-2: Business Statistics (3+0+0)                  | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | DSC-2: Probability and Distributions-I (4+0+0)     | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-2: Probability and Distributions-I (0+0+2)    | 4                          | 2       | 25                                        | 25                                        |
|           | OE-3: Applied Statistics (3+0+0)                   | 3                          | 3       | 40                                        | 60                                        |
|           | OE-4: Bio-Statistics (3+0+0)                       | 3                          | 3       | 40                                        | 60                                        |

#### Programme objectives:

- Graduates will demonstrate competence in respective domain as they apply skills to conduct scientific research and contribute to quality education.
- Graduates will be recognized as experts in educational and research institutes as well as industries in identifying and solving global challenges.
- Graduates will become leading researchers and professors who create and disseminate new knowledge in scientific and allied fields.

**Programme outcome:** The student graduating with the Statistics should be able to

- ❖ **Discipline Knowledge:** Use knowledge of science and apply to relevant areas.
- ❖ **Problem analysis:** Identify, formulate and analyze complex scientific problems using first principles of respective discipline.
- ❖ **Problem solving:** Execute a solution process using first principles of science to solve problems related to respective discipline.
- ❖ **Conduct investigations:** Conduct investigations of issues using research methods and research-based discipline knowledge including design of experiments, data collection, interpretation and analysis to arrive at valid conclusions.
- ❖ **Modern tool usage:** Identify, select and use modern scientific, Software/programming languages tool or technique for modeling, prediction, data analysis and solving problems in the areas of their discipline
- ❖ **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and design sustainable solutions.
- ❖ **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.

- ❖ **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
- ❖ **Communication:** Communicate effectively with the stakeholders with emphasis on communicating with scientific community, comprehend scientific reports, write research papers and projects proposals and reports, deliver effective presentations, and give and receive clear instructions.
- ❖ **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
- ❖ **Lifelong Learning:** Identify knowledge gaps and engage in lifelong learning in the context of changing trends in respective discipline.

**Course Outcomes:** At the end of the semesters courses the student should be able to:

- ❖ Acquire knowledge of introductory statistics, its scope and importance in various areas such as Medical, Engineering, Agricultural and Social Sciences etc.
- ❖ Learn various types of data, their organization and descriptive statistics such as presentations in tabular form graphs and summary measures such as measures of central tendency and dispersion etc.
- ❖ Learn correlation, curve fitting, regression analysis, regression diagnostics, partial and multiple correlations.
- ❖ Learn different types of data reflecting independence and association between two or more attributes.
- ❖ Conceptualize the probabilities of events including frequentist and axiomatic approach. Simultaneously, they will learn the notion of conditional probability including the concept of Bayes' Theorem and able to solve problems on these topics.
- ❖ Learn concept of discrete and continuous random variables and their probability distributions including expectation and moments.
- ❖ Learn Standard univariate discrete and continuous distributions and their applications in disciplines of science.
- ❖ Learn basics of R-programming and able to write and execute R codes in descriptive statistics, probability models and fitting of suitable distributions to the given data set, applications of normal and other standard distributions.

**Pedagogy:**

- The course is taught using traditional chalk and talk method using problem solving through examples and exercises.
- Students are encouraged to use resources available on open sources.

## I SEMESTER

**DSC-1: DESCRIPTIVE STATISTICS (THEORY):**

**4 Credits**

**56 Hrs.**

**Unit – 1: Introduction to Statistics:**

**13 Hrs.**

Statistics: Definition and scope. Concepts of statistical population and sample (SRS, Stratified, Systematic and Cluster sampling methods Definitions only). Data: quantitative and qualitative, cross sectional and time-series, discrete and continuous. Scales of

measurement: nominal, ordinal, interval and ratio. Presentation of data: tabular and graphical. Frequency distributions, cumulative frequency distributions and their graphical representations. Stem and leaf displays.

**Unit – 2: Univariate Data Analysis: 18 Hrs.**

Concept of measures of central tendency and measures of dispersion. Mean, weighted mean, trimmed mean, Median, Mode, Geometric and harmonic means, properties, merits and limitations, relation between these measures. Range, Quartile deviation, Mean deviation, Standard deviation and their relative measures. Gini's Coefficient, Lorenz Curve. Moments, Skewness and Kurtosis. Quantiles and measures based on them. Box Plot. Outliers. Chebyshev's inequality, normal datasets.

**Unit – 3: Bivariate Data Analysis: 15 Hrs.**

Bivariate Data, Scatter plot, Correlation, Karl Pearson's correlation coefficient, Rank correlation: Spearman's and Kendall's measures. Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination.

**Unit – 4: Multivariate Data Analysis: 10 Hrs.**

Analysis of Categorical Data: Contingency table, independence and association of attributes, measures of association - odds ratio, Pearson's and Yule's measure, Multivariate Frequencies, Multivariate Data Visualization, mean vector and dispersion matrix, Multiple linear regression, multiple and partial correlation coefficients. Residual error variance.

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**DSCP-1: DESCRIPTIVE STATISTICS (PRACTICAL): 2 Credits 56 Hrs.**

**LIST OF EXPERIMENTS**

(Carrying-out all the practicals manually as well as using Excel spread sheet)

1. Presentation of data by frequency tables, diagrams and graphs, stem and leaf, partition values.
2. Arithmetic Mean (AM), geometric mean, harmonic mean, weighted AM, trimmed mean, corrected mean.
3. Mode, median, partition values.
4. Absolute and relative measures of dispersion, Box plots.
5. Problems on moments, skewness and kurtosis.
6. Fitting of curves by least squares method.
7. Product moment correlation coefficient and rank correlation.
8. Regression of two variables.
9. Multivariate Descriptive statistics, mean Vector, dispersion matrix correlation matrix, Partial and Multiple correlation.
10. Problems on Association of attributes.



**REFERENCE BOOKS**

1. Agresti, A. (2010). Analysis of Ordinal Categorical Data, 2nd Edition, Wiley.
2. Anderson T.W. and Jeremy D. Finn (1996). The New Statistical Analysis of Data, Springer
3. Freedman, D., Pisani, R. and Purves, R. (2014). Statistics, 4th Ed. W.W. Norton & Company.
4. Gupta, S.C. (2018). Fundamental of Statistics, Himalaya Publishing House, 7th Edition.
5. Gupta S.C. and V.K. Kapoor (2020). Fundamental of Mathematical Statistics, Sultan Chand and Co. 12th Edition.
6. Hogg, R. V. McKean J. W. and Craig, A. T. (2012). Introduction to Mathematical Statistics, Pearson 7th Edition.
7. Joao Mendes Moreira, Andre C P L F de Carvalho, Tomas Horvath (2018). General Introduction to Data Analytics, Wiley.
8. Johnson, R.A. and Bhattacharyya, G.K. (2006). Statistics: Principles and methods. 5<sup>th</sup> Edition, John Wiley & Sons, New York.
9. Medhi, J. (2005). Statistical Methods, New Age International.
10. Ross, S.M. (2014). Introduction to Probability and Statistics for Engineers and Scientists, 5th Edition, Academic Press.
11. Tukey, J.W. (1977). Exploratory Data Analysis, Addison-Wesley Publishing Co.

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**Open Elective Course (OE):****OE-1: STATISTICAL METHODS ITS APPLICATIONS (THEORY): 3 Credits 42 Hrs.****Course Objectives:**

- This is an open elective course for other than statistics students.
- The students will learn the elements of descriptive statistics, probability, statistical methods such as tests of hypotheses, correlation and regression.

**Course Outcome:** On completion of this course, the students will be able to;

- ❖ Acquire knowledge of statistical methods.
- ❖ Identify types of data and visualization, analysis and interpretation.
- ❖ Learn elementary probability and probability models.
- ❖ Learn to apply test procedures for given data set.

**Pedagogy:** The course is taught using traditional chalk and talk method using problem solving through examples and exercises. Students are encouraged to use resources available on open sources.

**Unit – 1: Introduction:****10 Hrs.**

Definition and scope of Statistics. Data: quantitative and qualitative, attributes, variables, scales of measurement: nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives. Concepts of statistical population and sample. Sampling from finite population. Simple random sampling, Stratified and systematic

random sampling procedures (definitions and methods only). Concepts of sampling and non-sampling errors.

**Unit – 2: Univariate and Bivariate Data Analysis: 10 Hrs.**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis. Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

**Unit – 3: Probability and Distributions: 12 Hrs.**

Probability: Random experiment, trial, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable. Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

**Unit – 4: Sampling Distributions and Testing of Hypothesis: 10 Hrs.**

Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications. Statistical Hypothesis: null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation. Test for single mean, equality of two means, single variance, and equality of two variances for normal populations.

**REFERENCE BOOKS**

1. Daniel, W. W. (2007) Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley.
2. T.W. Anderson and Jeremy D. Finn (1996). The New Statistical Analysis of Data, Springer.
3. Mukhyopadhyaya P (1999). Applied Statistics, New Central book Agency, Calcutta.
4. Ross, S.M. (2014) Introduction to Probability and Statistics for Engineers and Scientists.
5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, New Delhi.

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**OE-2: BUSINESS STATISTICS (THEORY): 3 Credits 42 Hrs.**

**Course Objectives:**

- Provide an introduction to basics of statistics within a financial context.
- To enable students to use statistical techniques for analysis and interpretation of business data.

**Course Outcome:** On completion of this course, the students will be able to;

- ❖ Frame and formulate management decision problems.
- ❖ Understand the basic concepts underlying quantitative analysis.
- ❖ Use sound judgment in the applications of quantitative methods to management decisions.

**Pedagogy:** The course is taught using traditional chalk and talk method using problem solving through examples and exercises. Students are encouraged to use resources available on open sources.

**Unit – 1: Statistical Data and Descriptive Statistics: 12 Hrs.**

Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross-sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles).

Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

**Unit – 2: Simple Correlation and Regression Analysis: 10 Hrs.**

Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; rank correlation. Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

**Unit – 3: Index Numbers: 10 Hrs.**

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall-Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.

**Unit – 4: Time Series Analysis: 10 Hrs.**

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time

series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives' method, Cyclical variation definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

### REFERENCE BOOKS

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.
2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P.K. Viswanathan, BusinessStatistics: A First Course, Pearson Education.
3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education.
4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.
5. Vohra N. D., Business Statistics, McGraw Hill Education.
6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc-Graw Hill Education.
7. Gupta, S.C. Fundamentals of Mathematical Statistics. Himalaya Publishing House.
8. Gupta, S.C. Fundamentals of applied Statistics. Himalaya Publishing House.
9. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning.

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## II SEMESTER

**DSC-2: PROBABILITY AND DISTRIBUTIONS-I (THEORY): 4 Credits 56 Hrs.**

**Unit – 1: Introduction to Probability: 14 Hrs.**

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

**Unit – 2: Random variables, Mathematical Expectation and Generating Functions: 13 Hrs.**

Univariate Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Mathematical Expectation and Generating Functions: Expectation of single random variables and its properties. Moments and cumulants, moment generating function, cumulant generating function probability generating functions (p.g.f.).

**Unit – 3: Discrete Probability distributions: 14 Hrs.**

Standard discrete probability distributions: Rectangular, Bernoulli, Binomial, Poisson, distributions, Standard continuous probability distributions: uniform, normal, exponential and applications of discrete and continuous distributions, and their moments and cumulants, moment generating function.

**Unit – 4: Data Analysis Using R:****14 Hrs.**

Introduction to R: Installation, command line environment, overview of capabilities, brief mention of open-source philosophy. R as a calculator: The four basic arithmetic operations. Use of parentheses nesting up to arbitrary level. The power operation. Evaluation of simple expressions. Quotient and remainder operations for integers. Standard functions, e.g., sin, cos, exp, log. The different types of numbers in R: Division by zero leading to Inf or -Inf. NaN. NA. No need to go into details. Variables. Creating a vector using c(), seq() and colon operator. How functions map over vectors. Functions to summarize a vector: sum, mean, sd, median etc. Extracting a subset from the vector (by index, by property). R as a graphing calculator: Introduction to plotting. Plot(), lines(), abline(). No details about the graphics parameters except colour and line width. Barplot, Pie chart and Histogram. Box plot. Scatter plot and simple linear regression using lm(y~x). Problems on discrete and continuous probability distributions.

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**DSCP-2: PROBABILITY AND DISTRIBUTIONS-I (PRACTICAL): 2 Credits 56 Hrs.****LIST OF EXPERIMENTS**

(Computing all the practicals manually and as well using Excel/R)

1. Descriptive statistics-1 (Presentations, Summarizations, Graphs).
2. Descriptive statistics-2 (Measures of central tendency and dispersions).
3. Bivariate and Multivariate Analysis.
4. Regression: Simple and Multiple regression analysis.
5. Computing probability: using addition and multiplication theorems. Conditional probability and Bayes' theorem.
6. Problems on pmf, CDF, expectation, variance, quantiles, skewness, kurtosis. Plots of pmf, pdf, cdf, quantiles.
7. Fitting of binomial, Poisson, negative binomial distributions.
8. Application problems based on binomial, Poisson, geometric, Hypergeometric, negative binomial distributions.
9. Fitting of exponential, normal distribution when parameters are given/known.
10. Application based problems using exponential, normal distributions.

**REFERENCE BOOKS**

1. Dudewitz. E.J. and Mishra. S. N. (1998). Modern Mathematical Statistics. John Wiley.
2. Goon A.M., Gupta M.K., Das Gupta. B. (1991), Fundamentals of Statistics, Vol. I, World Press, Calcutta.
3. Hogg R.V. McKean J.W. and Craig, A.T (2019). Introduction to mathematical Statistics, 8<sup>th</sup> Edition, Pearson Education, New Delhi.
4. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009). Probability and Statistical Inference, Seventh Edition, Pearson Education, New Delhi.
5. Mood, A.M., Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics, 3rd Edition. (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
6. Ross, S. (2002), A First Course in Probability, Prentice Hall.

7. Sudha G. Purohit, Sharad D. Gore, Shailaja R Deshmukh, (2009). Statistics Using R, NarosaPublishing House.
8. Emmanuel Paradis (2005). R for Beginners ([https://cran.rproject.org/doc/contrib/Paradisrdebuts\\_en.pdf](https://cran.rproject.org/doc/contrib/Paradisrdebuts_en.pdf)).

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### Open Elective Course (OE):

**OE-3: APPLIED STATISTICS (THEORY): 3 Credits      42 Hrs.**

#### Course Objectives:

- To enable the students to use statistical tools in finance, industries, population studies and health sciences.
- To acquire knowledge about sampling methods for surveys.

**Course Outcome:** On completion of this course, the students will be able to;

- ❖ Understand the Price and Quantity Index numbers and their different measures, understand the applicability of cost-of-living Index number.
- ❖ Know the components and Need for Time series, understand the different methods of studying trend and Seasonal Index.
- ❖ Study the concept of vital statistics, sources of data, different measures of Fertility and Mortality, Understand the Growth rates- GRR and NRR and their interpretations.
- ❖ Know the concept of Population, Sample, Sampling unit, sampling design, sampling frame, sampling scheme, need for sampling, apply the different sampling methods for designing and selecting a sample from a population, explain sampling and non-sampling errors.
- ❖ Describe the philosophy of statistical quality control tools as well as their usefulness in industry and hence develop quality control tools in a given situation.

**Pedagogy:** The course is taught using traditional chalk and talk method using problem solving through examples and exercises. Students are encouraged to use resources available on open sources.

#### Unit – 1: Economic Statistics: 12 Hrs.

**Index numbers:** Definition, Criteria for a good index number, different types of index numbers. Construction of index numbers of prices and quantities, consumer price index number. Uses and limitations of index numbers. Consumer price index number: construction of consumer price index numbers. Applications of consumer price index numbers.

**Time Series Analysis:** Components of time series, Decomposition of time series- Additive and multiplicative model with their merits and demerits, Illustrations of time series. Measurement of trend by method of free-hand curve, method of semi-averages and method of least squares (linear). Measurement of seasonal variations by method of ratio to trend.



**Unit – 2: Vital Statistics:****10 Hrs.**

Sources of demographic data, errors in data. Measurement of mortality: crude death rate, specific death rates, and standardized death rates, infant mortality rate, maternal mortality rate, neo natal mortality rates, merits and demerits and comparisons of various mortality rates. Measurement of Fertility and Reproduction: Fecundity, fertility, measurement of fertility, crude birth rate, general fertility rate, age specific fertility rate and total fertility rates, merits and demerits of each measure of fertility, comparative study of these measures of fertility, Growth rates: Gross reproduction rate and Net reproduction rates.

**Unit – 3: Sampling Methods:****10 Hrs.**

Population and Sample. Need for sampling, Complete Enumeration versus Sample Surveys, Merits and Demerits, Non-Probability and Probability Sampling, Need and illustrations. Use of random numbers, principal steps in sample survey. Requisites of a good questionnaire. Pilot surveys, Sampling and non – sampling errors, Description of SRS, simple random sampling with and without replacement procedures, Merits and demerits of Simple random sampling. Need for stratification, stratifying factors, Merits and demerits of stratified random sampling. Systematic random sampling procedure of obtaining sample, Merits and demerits of systematic random sampling.

**Unit – 4: Statistical Quality Control:****10 Hrs.**

Concept of quality and its management Causes of variations in quality: chance and assignable. General theory of control charts, Control charts for variables: X- bar and R- charts. Control charts for attributes: p and c- charts. Acceptance Sampling Plans (Product control): Basic terminologies: AQL, LTPD, AOQ, AOQL, ASN, OC curve, producer's risk, and consumer's risk. Single sampling plan, double sampling plan.

**REFERENCE BOOKS**

1. J. Medhi (1992) Statistical Methods. New Age International (P) Ltd. New Delhi.
2. M.N. Das (1993) Statistical Methods and Concepts. Wiley Eastern Ltd.
3. Irwin Miller, John E Freund and Richard A Johnson (1992) Probability and Statistics for Engineers. Prentice Hall of India New Delhi.
4. D.C. Montgomery (1996) Introduction to Statistical Quality Control.
5. Cochran, W G. (1984) Sampling Techniques, Wiley Eastern, New Delhi.
6. Mukhopadhyaya P (1998) Theory and Methods of Survey Sampling. Prentice Hall of India.
7. Mukhopadhyay P. (2011): Applied Statistics, 2nd ed. Revised reprint, Books and Allied.
8. Kendall M.G. (1976): Time Series, Charles Griffin.
9. Chatfield C. (1980): The Analysis of Time Series –An Introduction, Chapman & Hall.

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**OE-4: BIO-STATISTICS (THEORY): 3 Credits 42 Hrs.**

### Course Objectives:

- To enable the students to identify the variables of biological studies and explore the tools of classification and presentation.
- To study the probability notion, models and their applications in the study of biological phenomenon.
- To acquire knowledge on sampling distribution and testing of hypotheses.

**Course Outcome:** On completion of this course, the students will be able to;

- ❖ After studying the course, the student will be able to apply statistical tools and techniques in dataanalysis of biological sciences.

**Pedagogy:** The course is taught using traditional chalk and talk method using problem solving through examples and exercises. Students are encouraged to use resources available on open sources.

**Unit – 1: Introduction to Bio-Statistics: 10 Hrs.**

Definition and scope of Statistics. Scales of Measurement: nominal, ordinal, interval and ratio. Collection, classification and tabulation of data, construction of frequency table for grouped and ungrouped data, graphical representation of data by histogram, polygon, ogive curves and Piediagram.

**Unit – 2: Descriptive Statistics: 12 Hrs.**

Measures of Central Tendency: Arithmetic mean, Median and Mode- definition, properties, merits and limitations. Measures of Dispersion: Range, Standard deviation and Coefficient of Variation. Correlation and Regression Analysis: Relation between two variables, definition of correlation, types of correlation, Scatter diagram, Karl-Pearson's coefficient of linear correlation and its properties, Spearman's Rank Correlation coefficient. Regression- Simple linear regression, fitting of regression equations by method of Least Squares, linear regression coefficients and their properties.

**Unit – 3: Probability and Distributions:** **10 Hrs.**

Probability: Random experiment, sample space, events-mutually exclusive and exhaustive events. Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes' theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable. Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

**Unit – 4: Sampling Distributions and Statistical Inference: 10 Hrs.**

Concepts of random sample and statistic, distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications. Estimation of population mean, population standard deviation and population proportion from the sample counter parts. Statistical hypothesis: null and alternative hypothesis. Type I and Type II errors, size, level of significance, power test, critical

region, P- value and its interpretation. Test for single mean, equality of two means, paired t-test, equality of two variances for normal Populations, Chi-square test of Independence of attributes, Analysis of Variance-One-Way and Two-Way.

### REFERENCE BOOKS

1. Dutta, N. K. (2004), Fundamentals of Biostatistics, Kanishka Publishers.
2. Gurumani N. (2005), An Introduction to Biostatistics, MJP Publishers.
3. Daniel, W. W. (2007), Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley.
4. Rao, K. V. (2007), Biostatistics - A Manual of Statistical Methods for use in Health Nutrition and Anthropology.
5. Pagano, M. and Gauvreau, K. (2007), Principles of Biostatistics.
6. Rosner Bernard (2010), Fundamentals of Biostatistics, 6th Edition, Duxbury.

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### QUESTION PAPER: THEORY EXAMINATION (Applicable to DSC-1, and DSC-2 Papers)

**Time: 02 Hours**

**Max. Marks: 60**

#### PART-A

Answer any FIVE of the following:

**5 x 2 = 10**

- 1**
- a)
  - b)
  - c)
  - d)
  - e)
  - f)
  - g)
  - h)

#### PART-B

Answer any FIVE of the following:

**5 x 10 = 50**

**Q2 -Q9**

Sub question like a), b) OR a), b), c) be given from questions 2-9

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**SCHEME OF PRACTICAL EXAMINATION****I and II SEMESTER (DSCP-1 and DSCP-2 Papers)****Time: 03 Hours****Max. Marks: 25****Distribution of Marks****Answer any THREE mains from the following****Marks: 20**

1. on Unit-1
2. on Unit-2
3. on Unit-2
4. on Unit-3
5. on unit-3 & 4
6. on Unit-4

[Here each of the question may be of (a, b) subdivisions or only single main]

Results Verification through MS Excel/R-language

**Marks: 05**

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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**Bachelor of Science (Basic/Hons.) Degree in Zoology**  
**Choice Based Credit System (CBCS) With Multiple Entries**  
**And Exit Options under New Education Policy (NEP) – 2020**  
**(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the annual meeting of the Board of Studies in Zoology (UG) held on Saturday 27<sup>th</sup> November 2021 at 11 AM in the Chambers of Head of the Department of Zoology, YCM.

| Sl. No. | Members                                                                                                   | Position | Signature/<br>Remarks |
|---------|-----------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. M. Mahadevaswamy, Professor and Head<br>Department of Zoology, Yuvaraja College, Mysuru               | Chairman | Sd/                   |
| 2.      | Dr. Chandavar R. Vidya<br>Department of Zoology, Yuvaraja College, Mysuru                                 | Member   | Sd/                   |
| 3.      | Dr. S. C. Jayaramu<br>Department of Zoology, Yuvaraja College, Mysuru                                     | Member   | Sd/                   |
| 4.      | Dr. M. Prathibha<br>Department of Zoology, Yuvaraja College, Mysuru                                       | Member   | Sd/                   |
| 5.      | Dr. J. S. Ashadevi<br>Department of Zoology, Yuvaraja College, Mysuru                                     | Member   | Absent                |
| 6.      | Dr. S. Basavarajappa<br>DOS in Zoology. University of Mysore, Mysuru.                                     | Member   | Sd/                   |
| 7.      | Dr. N.M. Shamsundar<br>Anatomy Dept, J.S.S. Medical College, Mysuru                                       | Member   | Sd/                   |
| 8.      | Dr. Sudha M.C. Department Zoology. Govt First Grade<br>College (Autonomous), Hassan                       | Member   | Sd/                   |
| 9.      | Dr. Shivakumar. P. Department of Zoology.<br>Maharani's Science College for women, Mysore                 | Member   | Sd/                   |
| 10      | Mr. Pradeep M. Scientific Officer, Planet earth,<br>ornamental fisheries, Hebbal Industrial area, Mysuru. | Member   | Sd/                   |

**AGENDA:**

- Discussion of B.Sc., Hons. Zoology NEP syllabus-2021.
- Changes, if any in the B.Sc., Hons. Zoology NEP Syllabus, scheme of examination, skill development etc.
- Minor changes if any in B.Sc. old CBCS Scheme of II & III year Theory & Practical.
- Approval of Panel of Examiners of Zoology.
- Enlisting the reference books for Zoology (UG).
- Any other matter from the permission of the chairman, BOS.

The Chairman welcomed all the Members, Board of Studies in Zoology to the meeting. After critically going through the B.Sc. Hons. Zoology NEP syllabus-2021, following resolutions are passed by the board:

- I & II Semester, B.Sc. Hons. New NEP Scheme is framed and recommended for approval by the board for forth coming academic years.
- The scheme of examination and internal assessment of theory and practicals for III, IV, V & VI semesters old CBCS Scheme is corrected and unanimously approved.
- The scheme of examination and internal assessment for theory and practical of I & II Semester B.Sc. Hons under new NEP Scheme is framed and unanimously approved.
- The Board prepared and approved Panel of Examiners in Zoology for the academic year 2021-2022.
- Suggested new books which are suitable to new NEP syllabus -2021 of Zoology.

27-11-2021  
Mysuru

Chairman,  
BOS in Zoology

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)       | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | DSC-1: Cytology, Genetics & Infectious Diseases (4+0+0)  | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-1: Cytology, Genetics & Infectious Diseases (0+0+2) | 4                          | 2       | 25                                        | 25                                        |
|           | OE-1: Economic Zoology (3+0+0)                           | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | DSC-2: Biochemistry and Physiology (4+0+0)               | 4                          | 4       | 40                                        | 60                                        |
|           | DSCP-2: Biochemistry and Physiology (0+0+2)              | 4                          | 2       | 25                                        | 25                                        |
|           | OE-2: Parasitology (3+0+0)                               | 3                          | 3       | 40                                        | 60                                        |

### I SEMESTER

#### Learning/Course outcome:

**Cell biology:** After studying this portion of syllabus students are able to learn and understand the fundamentals of Cell biology like;

- Cell organelles, Cytoskeleton, Cellular transport, Cell-extracellular matrix interaction, Cell division, and Protein trafficking etc.,
- Students will be able to understand the structures and basic components of Prokaryotic and Eukaryotic cells, especially Macromolecules, Membranes, and Organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells
- Be able to know the basic elements of intercellular signal transduction pathways, including nuclear receptors and cell surface receptors.

- To demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology.
- Cells house the biological machinery that makes the proteins, chemicals, and signals responsible for everything that happens inside our bodies.
- The learner will understand the importance of cell as a structural/functional unit of life.
- The dynamism of bio membranes indicates the dynamism of life. Its working mechanism and precision are responsible for our performance in life.
- To acquire knowledge of principles and working mechanisms of simple and compound Microscopes.
- Be able to understand the mechanism of Mitosis and Meiosis.
- To gain knowledge about slide preparation to observe Giant chromosome, Epithelial, Nerve cell, Muscle cells and Blood cells.

**Genetics:** Upon completion of this portion the students will be able to understand the;

- ❖ Principles of Mendelian Inheritance, variation from Mendelian principles and Human genetics.
- ❖ Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels.
- ❖ Students will test and deepen their mastery of Genetics by applying their knowledge in a variety of problem-solving situations.
- ❖ To understand how genetic concepts, affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
- ❖ Be able to describe the structure, function and replication of DNA as the genetic material.
- ❖ To gain the knowledge about chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during Mitosis and Meiosis.
- ❖ Be aware of different laboratory techniques to investigate genetic material and their advantages and limitations.
- ❖ To understand that genes are the units of inheritance for individual characteristics and also may contribute to susceptibility to certain diseases.
- ❖ Students will be able to know the number of chromosomes that make up the human genome and where they are located within the cell.
- ❖ Be able to understand the role of the X and Y chromosomes in determining sex and how they are inherited.
- ❖ To acquire the knowledge of skill development and observation of blood group identification and pedigree chart preparations.

**Infectious diseases:** After the study of this portion;

- Students will be able to distinguish Infectious and Non-infectious diseases.
- Study helps to describe the characteristics of Parasites, Bacteria, and Viruses.
- To understand different infectious agents, their modes of transmission among humans and the diseases they cause.

- Understand and be able to describe the ecology and modes of disease causation of infectious agents such as bacteria, viruses, parasites, and fungi.
- To describe the current understanding of host immune response to infection and understand the role of vaccination in infectious disease control.
- Be able to understand the influence of space/geography, insect vectors, toxic plants and other toxin sources, as well as infectious agents on infectious disease and food safety.
- To develop and demonstrate effective strategies to communicate public health/infectious disease issues to a variety of audiences.

#### **Laboratory experiments:**

- To use simple and compound microscopes.
- To prepare stained slides to observe the cell organelles.
- To be familiar with the basic principle of life, how a cell divides leading to the growth of an organism and also reproduces to form new organisms.
- The chromosomal aberrations by preparing Karyotype.
- How chromosomal aberrations are inherited in humans by pedigree analysis in families. The antigen-antibody reaction.
- Understood the mechanism of phenotypic expression in wild and mutant types of *Drosophila melanogaster*.
- To gain genetic knowledge on the observation of specimens and models.

### **DSC-1: CYTOLOGY, GENETICS & INFECTIOUS DISEASES (THEORY):**

**4 Credits**

**56 Hrs.**

#### **Unit-1:**

**14 Hrs.**

**Chapter 1: Structure and Function of Cell Organelles - I in Animal cell** (Ultra structure of animal cell).

**Plasma membrane:** (Fluid mosaic model) Chemical structure – lipids, Proteins, carbohydrates and their role in maintaining structural integrity. (Functions of Plasma membrane – Cell permeability, diffusion, passive transport, active transport).

**Endomembrane system:** (Endoplasmic reticulum, Golgi apparatus, Lysosomes). Protein targeting and sorting, transport, endocytosis and exocytosis.

#### **Chapter 2: Structure and Function of Cell Organelles - II in Animal cell.**

**Cytoskeleton:** Structure and functions of - Microtubules, microfilament intermediate filaments.

**Mitochondria:** Structure and functions. Oxidative phosphorylation; electron transport system.

**Peroxisome:** Structure and functions.

**Ribosome:** Types – (Prokaryotic & Eukaryotic), Structure and functions.

#### **Unit-2:**

**14 Hrs.**

#### **Chapter 3: Nucleus and Chromatin Structure.**

**Ultra structure of Nucleus** - Nuclear envelop, Nuclear pore complex, Nucleoplasm, Ultra-structure of nucleolus and functions.



**Chemical structure** and base composition of DNA and RNA.

**Nucleosome model**, DNA super coiling, Chromatin organization, Structure of chromosomes (Fine structure).

**Types of DNA** and RNA.

#### **Chapter 4: Cell cycle, Cell Division and Cell Signaling.**

Introduction to Cell cycle and its regulation, Apoptosis.

**Cell division:** Mitosis (Mitotic stages and Significance of Mitosis) and Meiosis (Stages of Meiosis, Synaptonemal complex, Crossing over and Chiasma formation. Significance of Meiosis).

**Signal transduction:** Intracellular signaling and Cell surface receptors, via G-protein linked receptors. **Cell-cell interaction:** Cell adhesion molecules, Cellular junctions.

**Unit-3:**

**14 Hrs.**

#### **Chapter 5: Mendelism and Sex Determination.**

**Basic principles of heredity:** Mendel's laws - Monohybrid cross and Dihybrid cross. Complete and Incomplete Dominance (Ex. *Mirabilis jalpa*). Penetrance and Expressivity.

**Genetic Sex Determining Systems** (XX- XY, XX – XO, ZZ – ZW), Environmental Sex Determination (*Bonelia viridis*), Sex Determination and Mechanism in *Drosophila melanogaster* (*Genic balance theory*).

**Dosage Compensation** - Barr body, Lyon's hypothesis.

#### **Chapter 6: Extensions of Mendelism, Genes and Environment.**

**Extensions of Mendelism:** Multiple Alleles (Inheritance of ABO blood group in Humans and Rh factor), Gene Interaction (Supplementary, Complementary and Dominant Epistasis).

**The Interaction between Sex and Heredity:** Sex-Influenced characteristics (Male pattern baldness in humans, horns in sheep) and Sex-Limited Characteristics (Plumage pattern, milk production and Moustache and Beard in Males)

**Cytoplasmic Inheritance** (Kappa particles in *Paramecium*), Genetic Maternal Effects (Shell coiling in *Limnaea*).

**Interaction between Genes and Environment** (Himalayan albino rabbit, Human twins), Environmental Effects on Gene Expression (Norm of reaction), Inheritance of Continuous Characteristics (Polygenic Inheritance - Skin colour in Man).

**Unit-4:**

**14 Hrs.**

#### **Chapter 7: Human Chromosomes and Patterns of Inheritance.**

**Patterns of Inheritance:** Autosomal dominance (Huntington's chorea, PTC), Autosomal recessive (Sickle cell anemia, Albinism), X-linked recessive (Colour blindness, Hemophilia), X-linked dominant (Vitamin D resistance Ricketts, Coffin Lowry syndrome).

**Chromosomal Anomalies:** Structural (Deletion, Duplication, Inversion, Translocation with examples) and Numerical aberrations (Turner's syndrome, Klinefelter's syndrome). Autosomal anomalies - Down syndrome and Cri-du-chat syndrome.

**Human Karyotyping** and Pedigree analysis (Autosomal dominant, Autosomal recessive, X – linked dominant, X – linked recessive).

### **Chapter 8: Infectious Diseases.**

**Introduction to Pathogenic Organisms:** Viruses, Bacteria, Fungi, Protozoa and Worms. Structure, Life cycle, Pathogenicity, including diseases, causes, symptoms and control of common parasites: *Trypanosoma*, *Giardia* and *Wuchereria*.

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### **DSCP-1: CYTOLOGY, GENETICS & INFECTIOUS DISEASES (PRACTICAL): 2 Credits 56 Hrs.**

#### **LIST OF EXPERIMENTS**

1. Understanding of Simple and Compound Microscopes.
2. To study different cell types such as Buccal epithelial cells, Neurons, Striated muscle cells using Methylene blue/any suitable stain (virtual / slaughtered tissue).
3. To study the different stages of Mitosis in root tip of *Allium cepa*.
4. To study the different stages of Meiosis in Grasshopper testis (virtual).
5. To check the permeability of cells using salt solution of different concentrations.
6. Study of parasites in humans (e.g. Protozoans, Helminthes in compliance with examples being studied in theory) permanent micro slides.
7. To learn the Procedures of Preparation of Temporary (Spicules) and Permanent (Fish Scale) stained slides, with available mounting material.
8. Study of wild *Drosophila melanogaster* (male & female) and Mutant Phenotypes of *Drosophila* sp, –White eye, bar eye, sepia eye, vestigial wing & ebony body. (From Cultures or Photographs).
9. Study of Polytene chromosomes (*Chironomus* larva or *Drosophila* larva).
10. Preparation of human Karyotype and study (identification) of the chromosomal structural (Deletion, duplication Inversion and translocation) and numerical aberrations (Turner's, Klinefelter's and Down's syndrome) from the pictures provided. (Virtual / Optional).
11. To prepare family pedigrees (Autosomal dominant, Autosomal recessive, X – linked dominant, X – linked recessive)
12. <https://www.vlab.co.in>
13. <https://zoologysan.blogspot.com>
14. [www.vlab.iitb.ac.in/vlab](http://www.vlab.iitb.ac.in/vlab)
15. [www.onlinelabs.in](http://www.onlinelabs.in)
16. [www.powershow.com](http://www.powershow.com)
17. <https://vlab.amrita.edu><https://sites.dartmouth.edu/>

#### **REFERENCE BOOKS:**

1. Lodish *et al*: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts *et al*: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).

4. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
5. Lewin B. Genes VIII. Pearson (2004).
6. Watson et al. Molecular Biology of the Gene. Pearson (2004).
7. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman (2007).
8. Delves Peter J., Martin Seamus J., Burton Dennis R., Roitt Ivan M. Roitt's Essential Immunology, 13<sup>th</sup> Edition. Wiley Blackwell (2017).
9. Principles of Genetics by B. D. Singh.
10. Cell-Biology by C. B. Pawar, Kalyani Publications.
11. Economic Zoology by Shukla and Upadhyaya.
12. Imms, A.D (1977). A general text Book of Entamology; Chapman and Hall, U.K.
13. Pedigo, L. P. 2002; Entamology and Pest Management. Prentice Hall Publication.
14. Essentials of Medical Parasitology: 2014; Apurba Shankar Sastry. Jaypee Brothers Medical Publishers.
15. Paniker's Text book of Medical Parasitology. 2018. Jaypee Brothers Medical Publishers.
16. Parasitology. An integrated approach. Gunn and Pitt. 2013. Willey- Blackwell publishers.
17. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
18. Alberts et al: Molecular Biology of the Cell: Garland (2002).
19. Cooper: Cell: A Molecular Approach: ASM Press (2000).
20. Karp: Cell and Molecular Biology: Wiley (2002). Pierce B. Genetics. Freeman (2004).
21. Thomas J. Kindt, Richard A. Goldsby, Barbara A. Osborne, Janis Kuby- Kuby Immunology. W H Freeman (2007).
22. Kesar, Saroj and Vasishta N.2007 Experimental Physiology: Comprehensive Manual. Heritage Publishers, NewbDelhi.

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### Open Elective Course (OE):

**OE-1: ECONOMIC ZOOLOGY (THEORY):                      2 Credits              42 Hrs.**

**Course outcome:** At the end of the course the student will be able to:

- Gain knowledge to define the concepts of the applied subjects like Fisheries, Aquaculture, Sericulture, Apiculture, Vermiculture, Lac culture, Dairy, Poultry etc.,
- Gain knowledge about Silkworms rearing and their products.
- Gain knowledge in Bee keeping equipment and Apiary management.
- Acquaint knowledge on dairy animal management, the breeds and diseases of cattle and learn the testing of egg and milk quality.
- Acquaint knowledge about the culture techniques of fish and poultry.
- The student will be able to identify, freshwater, marine water fishes.

- To understand the physiology and reproductive mechanisms of important fishes.
- Attained knowledge about important cultivable fin fishes, shell fishes and importance of value added fishery products.
- Be able to gain knowledge to explain the tools and techniques used in aquaculture, agriculture, apiculture and sericulture practices.
- Students will be able to categorize economically important fish species.
- Be able to describe the economic importance of honeybee and silkworm.
- Acquaint the knowledge about basic procedure and methodology of Vermiculture.
- Learn various concepts of lac cultivation.
- Students can start their own business i.e. self-employments.
- Get employment in different applied sectors.

**Unit - 1:****14 Hrs.**

**Chapter 1: Sericulture:** History and present status of Sericulture in India. Mulberry and non-mulberry species in Karnataka and India. Mulberry cultivation. Morphology and life cycle of *Bombyx mori*. Silkworm rearing techniques: Processing of cocoon, reeling. Silkworm diseases and pest control.

**Chapter 2: Apiculture:** Introduction and present status of Apiculture. Species of honey bees in India, Life cycle of *Apis indica*. Colony organization, Division of labour and Communication. Bee keeping as an Agro based Industry: Methods and Equipments; Indigenous methods, Extraction appliances, Extraction of honey from the comb and processing. Bee pasturage, honey and bees wax and their uses. Pests and diseases of bees and their management.

**Unit - 2:****14 Hrs.****Chapter 3: Live Stock Management:**

**Dairy:** Introduction to common dairy animals and techniques of dairy management. Types, loose housing system and conventional barn system; advantages and limitations of dairy farming. Establishment of dairy farm and choosing suitable dairy animals-cattle. Cattle feeds, milk and milk products. Cattle diseases.

**Poultry:** Types of breeds and their rearing methods. Feed formulations for chicks. Nutritive value of egg and meat. Disease of poultry and control measures.

**Chapter 4: Aquaculture:**

**Aquaculture in India:** An overview and present status and scope of aquaculture.

**Types of Aquaculture:** Pond culture: Construction, Maintenance and Management; Carp culture, Shrimp culture, Shellfish culture. Composite Fish culture and Pearl culture.

**Unit- 3:****14 Hrs.****Chapter 5: Fish culture:**

Common fishes used for culture. Fishing crafts and gears.

**Ornamental Fish Culture:** Fresh water ornamental fishes - Biology, Breeding techniques. **Construction and Maintenance of Aquarium:** Construction of home aquarium, Materials used, setting up of freshwater aquaria, Aquarium plants,

Ornamental objects, Cleaning the aquarium, Maintenance of water quality. Control of Snail and Algal growth.

Modern techniques of fish seed production.

#### **Chapter 6: Prawn culture:**

Culture of Fresh and Marine water prawns. Preparation of farm.

Preservation and processing of Prawn, Export of Prawn.

#### **Chapter 7: Vermiculture:**

Scope of Vermiculture. Types of Earthworms.

Habit categories - Epigeic, Endogeic and Anecic; Indigenous and Exotic species.

Methodology of Vermicomposting: Containers for culturing, Raw materials required, Preparation of bed, Environmental pre-requisites, Feeding, Harvesting and Storage of vermicompost. Advantages of Vermicomposting. Diseases and pests of Earthworms.

**Chapter 8: Lac Culture:** History of lac and its organization, lac production in India. Life cycle, host plants and strains of lac insect. Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. Lac composition, processing, products, uses and their pests.

#### **REFERENCE BOOKS:**

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Ganga, G. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R. Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, Kindle Edition.
7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers.
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian & Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants.
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lacculture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt. Ltd 2014.
17. Economics of Aquaculture – Singh (R.K.P) - Danika Publishing Company 2003.
18. Applied and Economic Zoology (SWAYAM).
19. web [https://swayam.gov.in/nd2\\_cec20\\_ge23/preview](https://swayam.gov.in/nd2_cec20_ge23/preview).

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## II SEMESTER

### Learning/Course outcome:

**Biochemistry:** Study of biochemistry help student to understand the chemical structure of carbohydrates, proteins and lipids and also mechanism of their metabolism. This course lays the foundation for other advanced courses like physiology, molecular biology and immunology. The student at the completion of the course will learn;

- The importance of chemical foundation in living organisms to attain the knowledge of macromolecule such as carbohydrates, protein and fat, their types and significance.
- Correlate how the large biomolecules such as proteins, carbohydrates, lipids, nucleic acids are made from the simple precursors.
- Interpret the structure-function relationships of the proteins, carbohydrates, lipids, and nucleic acids.
- Be able to familiar with the enzymes (biocatalysts), and their salient attributes including unique conformation and amazing catalytic properties.
- To recognize how the catabolic breakdown of the substances is associated with release of free energy; whereas, free energy is utilized during synthesis of biomolecules i.e., anabolic pathways.
- Comprehended the energy source, chemical bonds and the principles of thermodynamic understood the importance of acid base balance.

**Physiology:** This course is designed to impart knowledge of functioning of circulatory, respiratory, digestive, muscular and excretory system. After successfully completing this programme;

- ❖ Students will be able to aware the molecular and cellular basis of physiological functions in animals.
- ❖ The course will aid to understand the basics of excretory system like structure of nephron, glomerular filtration, reabsorption and tubular secretion, homeostatic regulation of water and electrolyte.
- ❖ To learn and understand the fundamentals of Respiratory system & chemical regulation of respiration.
- ❖ Be able to illustrate the physiological adaptations, development, reproduction and behaviour of different forms of life.
- ❖ Students will be able to understand about the composition of food and mechanism of digestion, absorption and assimilation.
- ❖ To described the mechanism of circulation and composition of blood.
- ❖ Students will acquire knowledge of neuromuscular coordination and the mechanism of Osmoregulation in animals and endocrine system and their function.

**Practicals:** At the end of the course the student should be able to understand the:

- ❖ Basic structure of biomolecules through model making.
- ❖ Develop the skills to identify different types of blood cells.
- ❖ Enhance basic laboratory skill like keen observation, analysis and discussion.
- ❖ Learn the functional attributes of biomolecules in animal body.



- ❖ Know uniqueness of enzymes in animal body and their importance through enzyme kinetics.

**DSC-2: BIOCHEMISTRY & PHYSIOLOGY (THEORY): 4 Credits 56 Hrs.**

**Unit-1: 14 Hrs.**

**Chapter 1: Structure and Function of Biomolecules:**

**Structure and Biological importance of Carbohydrates** (Classification with examples: Monosaccharide, disaccharides, Polysaccharides and Glyco-conjugates).

**Lipids:** Classification and biological importance (Saturated and Unsaturated Fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids and Steroids). Clinical importance of lipids: HDL and LDL, TG and Cholesterol.

**Proteins:** Structure, Classification and General Properties of  $\alpha$ -amino acids; Essential and non-essential amino acids, Levels of organization in proteins (primary, secondary, tertiary and quaternary structure with hemoglobin as example); Simple and conjugate proteins. Clinical importance of proteins: Kwashiorkor and Marasmus diseases.

**Chapter 2: Enzyme Action and Regulation:**

Nomenclature and Classification of Enzymes; Co-factors; Specificity of enzyme action. Isozymes. Chemical nature of Enzymes and Mechanism of enzyme action.

**Enzyme Kinetics:** Factors affecting rate of enzyme-catalyzed reactions; Equation of Michaeli's -Menten Concept of  $K_m$  and  $V_{max}$ , Enzyme inhibition, Allosteric enzymes and their kinetics; Regulation of enzyme action.

**Unit-2: 14 Hrs.**

**Chapter 3: Metabolism of Carbohydrates and Lipids:**

**Metabolism of Carbohydrates:** Glycolysis, Citric acid cycle, Gluconeogenesis, Phosphate Pentose Pathway; Glycogenolysis and Glycogenesis.

**Lipids:** Biosynthesis of Palmitic acid; Ketogenesis;  $\beta$  - oxidation and Omega - oxidation of saturated fatty acids with even and odd number of carbon atoms.

**Chapter 4: Metabolism of Proteins and Nucleotides:**

**Catabolism of amino acids:** Trans-amination, De-amination, Urea cycle, Nucleotides and vitamins.

**(Anabolism)-** Peptide linkages.

**Unit-3: 14 Hrs.**

**Chapter 5: Digestion and Respiration in Humans:**

**Digestion:** Structural Organization and Functions of Gastro-intestinal tract and associated glands. Mechanical and Chemical digestion of food; Absorptions of Carbohydrates, Lipids, Proteins, Water, Minerals and Vitamins.

**Respiration:** Physiology of trachea and Lung. Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of Oxygen and Carbon dioxide in blood, Respiratory pigments, Dissociation curves and the factors influencing it; Control of respiration.



**Chapter 6: Circulation and Excretion in Humans:**

Components of blood and their functions; Hemopoiesis. Blood clotting: Blood clotting system, Blood groups: Rh-factor, ABO and MN. Structure of Mammalian heart.

**Cardiac cycle:** Cardiac output and its regulation, Electrocardiogram, Blood pressure and its regulation. Structure of Kidney and its functional unit; Mechanism of Urine formation.

**Unit-4:**

**14 Hrs.**

**Chapter 7: Nervous System and Endocrinology in Humans.**

Structure of Neuron, Resting membrane potential (RMP). Origin of action potential and its propagation across the myelinated and Un-myelinated nerve fibers. Types of synapse. Endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas and adrenal; hormones secreted by them and their functions.

Classification of hormones; Mechanism of Hormone action.

**Chapter 8: Muscular System in humans.**

Histology of different types of Muscles; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.

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**DSCP-2: BIOCHEMISTRY & PHYSIOLOGY (PRACTICALS): 2 Credits**

**56 Hrs.**

**LIST OF EXPERIMENTS**

1. Preparation of models of nitrogenous bases- nucleosides and nucleotides.
2. Preparation of models of amino acids and dipeptides.
3. Preparation of models of DNA and RNA.
4. Qualitative analysis of Carbohydrates (glucose & starch), Proteins and Lipids.
5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.
6. Separation of amino acids or proteins by paper chromatography.
7. Determination of the activity of enzyme (Urease)-Effect of [S] and determination of  $K_m$  and  $V_{max}$ .
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.
9. Action of salivary amylase under optimum conditions.
10. Quantitative estimation of Oxygen consumption by fresh water Crab.
11. Quantitative estimation of salt gain and salt loss by fresh water.
12. Estimation of Hemoglobin in human blood using Sahli's Haemoglobinometer.
13. Counting of RBC in blood using Hemocytometer.
14. Counting of WBC in blood using Hemocytometer.
15. 15. Differential staining of human blood corpuscles using Leishman stain/ Hematoxylin & eosin.
16. Recording of blood glucose level by using Glucometer.

**REFERENCE BOOKS:**

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2. Zubay et al: Principles of Biochemistry: WCB (1995).

3. Voet&Voet: Biochemistry Vols I & 2: Wiley (2004).
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003) Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press.
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### Open Elective Course (OE):

**OE-2: PARASITOLOGY (THEORY):**

**2 Credits**

**42 Hrs.**

#### Course outcome:

**Parasitology:** Parasitology is the scientific discipline concerned with the study of the biology of parasites and parasitic diseases, including the distribution, biochemistry, physiology, molecular biology, ecology, evolution and clinical aspects of parasites, and the host response to these agents. This course will be able to know the students to;

- Identify, describe and contrast unicellular parasites and parasitic worms.
- Helps to understand the specific human and non-human parasitic diseases.
- Be able to prepare and observe live parasitic specimens and test students' own seropositivity for a particular parasitic infection.

- It is estimated that at least half of all known species are parasitic, so understanding the life cycle and interaction of these organisms with their hosts is often key to understanding the dynamics of ecosystems generally.
- By analyzing microorganisms up close, microbiologists play a crucial role in combating disease, creating chemical products for agriculture, and even helping to keep our planet earth healthy.

**Unit - 1:****14 Hrs.****Chapter 1: General Concepts.**

Introduction, Parasites, parasitoids, host, Zoonosis. Origin and evolution of parasites. Basic concept of Parasitism, Symbiosis, Phoresis, Commensalisms and Mutualism. Host-parasite interactions and adaptations. Life cycle of human parasites. Occurrence, Mode of infection and Prophylaxis.

**Chapter 2: Parasitic Platyhelminthes.**

Study of morphology, Life cycle, Pathogenicity, Prophylaxis and control measures of *Fasciolopsis buski*, *Schistosoma haematobium*, *Taenia solium*, *Hymenolepis nana*.

**Chapter 3: Parasitic Protists.**

Study of morphology, Life cycle, Pathogenicity, Prophylaxis and Control measures of *Entamoeba histolytica*, *Giardia intestinalis*, *Trypanosoma gambiensi*, *Plasmodium vivax*.

**Unit - 2:****14 Hrs.****Chapter 4: Parasitic Nematodes.**

Study of morphology, Life cycle, Pathogenicity, Prophylaxis and Control measures of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Wuchereria bancrofti*, *Trichinella spiralis*. Nematode plant interaction; Gall formation.

**Chapter 5: Parasitic Arthropods.**

Biology, Importance and Control of Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*), Mites (*Sarcoptes*), Lice (*Pediculus*), Flea (*Xenopsylla*), Bug (*Cimex*). Parasitoid (Beetles).

**Chapter 6: Parasitic Vertebrates.**

Cookcuter Shark, Hood Mocking bird and Vampire bat and their parasitic behavior and effect on host.

**Unit - 3:****14 Hrs.****Chapter 7: Molecular diagnosis & Clinical Parasitology.**

General concept of Molecular diagnosis for parasitic infection. Advantages and disadvantages of molecular diagnosis. Fundamental techniques used in molecular diagnosis of Endoparasites.

Immunoassay or Serological techniques for laboratory diagnosis of Endoparasites on the basis of marker molecules like *G. intestinalis*, *B. coli*, *E. histolytica*, *L. donovani*, Malarial parasite using ELISA, RIA, Counter Current Immunelectrophoresis (CCI), Complement Fixation Test (CFT) PCR, DNA, RNA probe.

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1. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications and Distributors.
2. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition, Lea & Febiger.
3. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor and Francis Group.
4. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition, All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi.
5. Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. Brown Publishers.
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17. John Hyde (1996) Molecular Parasitology Open University Press.
18. J Joseph Marr and Miklos Muller (1995) Biochemistry and Molecular Biology of Parasites 2 nd Edn Academic Press.

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**SCHEME OF EXAMINATION (THEORY)**  
(Applicable to DSC-1 and DSC-2 Papers)

**Time: 02 Hours****Max. Marks: 60****PART-A**

Answer ALL of the following questions

**5 X 1 = 05**

- Q1** a)  
b)  
c)  
d)  
e)

**PART-B**

Answer any FIVE of the following questions (Short notes)

**5 X 2 = 10**

- Q2** a)  
b)  
c)  
d)  
e)  
f)  
g)

**PART-C**

Answer any FIVE of the following questions (Explanatory)

**4 X 5 = 20****Q3 -Q8****PART-D**

Answer any TWO of the following questions (Essay type)

**2 X 10 = 20****Q9 - Q11**

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**SCHEME OF EXAMINATION (PRACTICALS)****Time: 03 Hours****Max. Marks: 25****DSCP-1: CYTOLOGY, GENETICS & INFECTIOUS DISEASES (PRACTICAL): 2 Credits**

1. Make a temporary squash preparation of the given material and demonstrate a stage of cell division. Write the procedure and comment on the stage with a diagram (Onion root tip). 08 Marks.
2. Prepare a whole mount of the given material (Temporary/Permanent). 04 Marks.
3. Identify the spots A, B and C, giving suitable reasons with diagram (Meiosis stages/ Protozoa/ Helminthes / Mutant / Polytene chromosome/Abnormal Karyotype. 3 x 3) = 09 Marks
4. Preparation of Karyotype of Human / Pedigree analysis. 04 Marks.

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**DSCP-2: BIOCHEMISTRY & PHYSIOLOGY (PRACTICAL): 2 Credits**

1. Biochemistry experiments by lots (Carbohydrates, Proteins & Lipids). 06 Marks.
2. Physiology experiments by lots (Nitrogenous wastes/ salivary amylase/ activity of urease enzyme). 06 Marks.
3. Differential staining of human blood corpuscles/ Estimation of blood glucose level. 05 Marks
4. Identify the spots A (Haemoglobinometer/Haemocytometer/Paper chromatography). 04 Marks.
5. Model submission. 03 Marks.

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record in the examination).

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**Bachelor of Science (Basic/Hons.)/ Integrated M.Sc. (Five Years)  
Degree in Molecular Biology  
Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies meeting of the Five-Year Integrated M.Sc. Programme in Molecular Biology held in the Department of Molecular Biology Yuvaraja College, Mysuru at 11.00 am on 30<sup>th</sup> November, 2021

| Sl. No. | Members              | Position | Signature/<br>Remarks |
|---------|----------------------|----------|-----------------------|
| 1.      | Dr. Devaki N.S.      | Chairman | Sd/                   |
| 2.      | Dr. Ashadevi J       | Member   | Sd/                   |
| 3.      | Dr. Sudha B.S        | Member   | Sd/                   |
| 4.      | Dr. Vidya R          | Member   | Sd/                   |
| 5.      | Dr. Bhaskaran V      | Member   | Sd/                   |
| 6.      | Dr. Anila Kumar K.R. | Member   | Sd/                   |
| 7.      | Dr. Bibha Choudhari  | Member   | Absent                |
| 8.      | Dr. Vinay Vishwanath | Member   | Absent                |

The Chairperson welcomed the members of Board of Studies to the meeting and placed before them the agenda of the meeting.

- Preparation of text books/reference books for the batch of students admitted during 2021-22. Added in Annexure III.
- Approval of Panel of Examiners for the Examinations during the year 2021-22. The panel of examiners was approved and sent separately to the Controller of Examinations, Yuvaraja College, Mysuru.
- Changes of syllabus/upgradation: National Education Policy is adopted to 5-year Integrated M.Sc. Programme in Molecular Biology. The course structure and regulations, also the syllabi for the I and II semesters was approved (Annexure III).
- Any other subjects referred to the Board of Studies by the Autonomous College for its consideration and opinion – Improvement of the Department in any matter other than syllabus. This year Board also recommends the urgent need of permanent faculty, teaching rooms both theory and practicals (minimum increase of three theory rooms and two practical labs) and instrument infrastructure.

30-11-2021  
Mysuru

Chairman,  
BOS in Molecular Biology



### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)                     | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|----------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | MBDSC-1: General Botany<br>(4+0+0)                       | 4                          | 4       | 40                                        | 60                                        |
|           | MBDSCP-1: General Botany<br>(0+0+2)                      | 4                          | 2       | 25                                        | 25                                        |
|           | MBDSC-2: General Zoology<br>(4+0+0)                      | 4                          | 4       | 40                                        | 60                                        |
|           | MBDSCP-2: General Zoology<br>(0+0+2)                     | 4                          | 2       | 25                                        | 25                                        |
| <b>II</b> | MBDSC-3: Cell Biology and<br>Plant Physiology-I (4+0+0)  | 4                          | 4       | 40                                        | 60                                        |
|           | MBDSCP-3: Cell Biology and<br>Plant Physiology-I (0+0+2) | 4                          | 2       | 25                                        | 25                                        |
|           | MBDSC-4: Inorganic &<br>Physical Chemistry (4+0+0)       | 4                          | 4       | 40                                        | 60                                        |
|           | MBDSCP-4: Inorganic &<br>Physical Chemistry (0+0+2)      | 4                          | 2       | 25                                        | 25                                        |

#### Programme opportunities:

- Students with B.Sc. Molecular Biology shall be eligible for 2 years M.Sc. in Molecular biology and Biochemistry, Biotechnology, Environmental Science.
- Students with B.Sc. Honors in Molecular Biology shall be eligible for One year M.Sc. in Molecular Biology
- Students with B.Sc. Molecular Biology shall be eligible for B.Ed.
- Students with B.Sc. Honors/ Integrated M.Sc. (Five years) Molecular biology shall be eligible for B.Ed. and also shall be eligible for PUC teaching and courses involved with interdisciplinary subjects in Biology at graduate and Masters level after meeting the minimum standards through KSET/NET/Ph. D. degree as per the rules and regulations laid by UGC from time to time.
- Students with B.Sc. degree/ B.Sc. Honors/ Integrated M.Sc. (Five Years) Molecular biology in Molecular Biology shall be eligible to take up all competitive examinations at state/national level.

#### Program Articulation Matrix for I and II semesters:

This matrix lists only the core courses. Core courses are essential to earn the degree in that discipline/subject. They include courses such as theory, laboratory, project, internships etc.

| Sem.      | Course                                          | PO addressed            | Pedagogy                                                                                                                                                                                                                                                                                  | Assessment pattern                                                                         |
|-----------|-------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>I</b>  | General Botany (Theory)                         | PO-1, PO-3, PO-4        | <ul style="list-style-type: none"> <li>The course is taught using traditional chalk and talk method using through examples and exercises.</li> <li>Power point presentations audio-visual method.</li> <li>Students are encouraged to use resources available on open sources.</li> </ul> | The continuous assessment through written test seminars, and peer discussions and /viva    |
|           | General Botany (Practical)                      | PO-1, PO-3, PO-4, PO-5  | The course is taught using related specimens, field visits and use of Microscopes and slides, Chalk and talk, digital presentations.                                                                                                                                                      | Assessment Through practical experiments and lab records and /viva.                        |
|           | General Zoology (Theory)                        | PO-1, PO- 3, PO-4       | <ul style="list-style-type: none"> <li>The course is taught using traditional chalk and talk method using through examples and exercises.</li> <li>Power point presentations audio-visual method.</li> <li>Students are encouraged to use resources available on open sources.</li> </ul> | The continuous assessment through written test, viva-voce, seminars, and peer discussions. |
|           | General Zoology (Practical)                     | PO-1, PO- 3, PO-4, PO-5 | The course is taught using related specimens, field visits and use of Microscopes and slides, Chalk and talk, digital presentations.                                                                                                                                                      | Assessment through Experiments.                                                            |
| <b>II</b> | Cell biology and Plant Physiology I (Theory)    | PO-1, PO- 3, PO-4       | <ul style="list-style-type: none"> <li>The course is taught using traditional chalk and talk method using through examples and exercises.</li> <li>Power point presentations audio-visual method.</li> <li>Students are encouraged to use resources available on open sources.</li> </ul> | The continuous assessment through written test, viva-voce, seminars, and peer discussions. |
|           | Cell biology and Plant Physiology I (Practical) | PO-1, PO- 3, PO-4, PO-5 | The course is taught using related specimens, and use of Microscopes, centrifuges, Haemocytometer, microtome machine and slides, Chalk and talk, digital presentations.                                                                                                                   | Assessment Through practical experiments and lab records and /viva.                        |
|           | Inorganic and Physical Chemistry (Theory)       | PO-1, PO- 3, PO-4       | <ul style="list-style-type: none"> <li>The course is taught using traditional chalk and talk method using through examples and exercises.</li> <li>Power point presentations audio-visual method.</li> </ul>                                                                              | The continuous assessment through written test, viva-voce, seminars, and peer discussions. |

|  |                                              |                         |                                                                                                                                                                                  |                                                                     |
|--|----------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
|  |                                              |                         | <ul style="list-style-type: none"> <li>Students are encouraged to use resources available on open sources.</li> </ul>                                                            |                                                                     |
|  | Inorganic and Physical Chemistry (Practical) | PO-1, PO- 3, PO-4, PO-5 | The course is taught using related and use of colorimeter, potentiometer, pH meter, specific gravity bottles, burettes, centrifuges, etc. Chalk and talk, digital presentations. | Assessment Through practical experiments and lab records and /viva. |

## I SEMESTER

### MBDSC-1: GENERAL BOTANY (THEORY): 4 Credits 56 Hrs.

#### Course outcome:

- Students understand the basis for classifying fungi and plants.
- They gain knowledge on the types and importance of classification.
- Students know external morphology of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.
- They acquire the knowledge of cellular diversity of fungi and plants starting from unicellular to highly complex angiosperm plants.
- They gain insight into the varied types of reproductive cycles of fungi and plants.
- Knowledge gained on the economic importance of different fungi and plants help them in future for research and other applications in agriculture, medicine and industry.
- Students understand the course of evolution in plants.

#### Unit-1:

14 Hrs.

**Classification:** Whittaker's five kingdom concept, Cavalier-Smith eight kingdom classification, Carl Woese three domain system of classification. Principles of nomenclature for plants, Nomenclature code for plants- Melbourne Code-International Code of Nomenclature for algae, fungi and plants (ICN), Typification, International Botanical Congress (IBC)

**Algae:** Classification (Fritsch, 1935), Thallus structure, Reproduction, Alternation of generations, Economic importance. Type study: *Microcystis*, *Chlamydomonas*, *Chlorella*, *Spirogyra*, Diatoms (Pinnate and Centric: only morphology), *Sargassum*, *Polysiphonia*.

#### Unit-2:

14 Hrs.

**Fungi:** Classification (Ainsworth, 1973). General characters and Economic importance; Type study: *Phytophthora*, *Rhizopus*, *Saccharomyces* (only cell structure), *Penicillium*, *Agaricus*, *Fusarium*, *Mycorrhiza* (VAM).

**Bryophytes:** Classification (Rothmaler, 1951). General characters and Economic importance. Type study: *Marchantia*, *Anthoceros*, *Sphagnum*.

**Unit-3:****14 Hrs.**

**Pteridophytes:** Classification-Wardlaw (1955): General characters and Economic importance. Type study: Psilotum, Selaginella, Equisetum (Morphology and anatomy), Pteris (Morphology), Azolla (Morphology & Internal structure), Geological time scale (in brief), Fossil pteridophytes (overview).

**Gymnosperms:** Classification-Sporne (1965): General characters and Economic importance. Type study: Pinus.

**Unit-4:****14 Hrs.**

**Angiosperm Taxonomy:** Classification (Bentham and Hooker) in brief, Angiosperm Phylogenetic Group IV system - Basal and meso angiosperms- eudicots in brief, Plant and plant parts in brief, Study the following families: Malvaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Asteraceae, Arecaceae, Poaceae.

**Anatomy:** Meristems, Simple permanent tissue-parenchyma, collenchymas, sclerenchyma, Complex permanent tissue-xylem and phloem. Tissue systems: Epidermal (epidermal cells, stomata, hairs) ground and vascular, Internal anatomy of dicot and monocot young stem, leaf and root. Secondary growth in root and stem in dicots and anomalous growth (Ex: Dracaena).

**Botanical Research Institutes and herbarium centre:** Botanical Survey of India, Birbal Sahni Institute of Paleosciences, Central National Herbarium, Calcutta.

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**MBDSCP-1: GENERAL BOTANY (PRACTICALS): 2 Credits 56 Hrs.****Course outcome:**

- Students understand the use of binocular microscope for understanding biology.
- They get practical knowledge of the aspects studied in theory.
- Students see and appreciate the beauty of phytoplanktons and other algae.
- They will see and understand better the microscopic and macroscopic stages of some of the fungi of kingdom mycota and oomycota.
- They gain insight into the views of internal structure and external morphology of different groups of plants such as bryophytes, pteridophytes and gymnosperms.
- Students get the skill of herbarium preparation.

**LIST OF EXPERIMENTS:**

| No.     | Experiments                                                                                                                                                                                   |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1, 2, 3 | Staining using safranin and mounting of algae: Type study: Spirulina, Chlamydomonas, Chlorella, Spirogyra, Diatoms (Centric and Pinnate) Sargassum, Batrachospermum/Polysiphonia.             |
| 4, 5    | Staining using cotton blue in lactophenol and mounting of fungi. Type study: Rhizopus, Phytophthora, Penicillium, Saccharomyces, Agaricus, Fusarium, Mycorrhiza (VAM) (eg. In sorghum roots). |
| 6, 7    | Bryophytes: Morphological and anatomical, features of Marchantia, Anthoceros, Sphagnum.                                                                                                       |

- 8, 9** Pteridophytes: Morphological, anatomical, reproductive features of Psilotum, Selaginella, Equisetum, Pteris (External morphology), Azolla (Morphology & Internal structure).
- 10** Gymnosperms: Morphological, anatomical, reproductive features of Pinus.
- 11, 12** Angiosperms: Study of one plant each belonging to eg. Malvaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Arecaceae, Poaceae.
- 13** Anatomy: T.S of dicot stem (eg. Tridax), leaf (Zinnia, grass), root (Cicer, Musa). T.S. of monocot stem, leaf and root.
- 14** Preparation of herbarium (demonstration), students have to prepare and submit one herbarium each to the department as a part of internal evaluation.

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**MBDSC-2: GENERAL ZOOLOGY (THEORY): 4 Credits 56 Hrs**

**Course outcome:**

- Students will understand the basis for classifying animals.
- They will gain knowledge on the types and importance of classification.
- Students will know external morphology of different phyla of animals starting from Protozoa to Chordata.
- They will acquire the knowledge of different types of tissues animals with special emphasis to humans. This gives a clear dimension to the students regarding their role in different organs.
- They will gain insight into the varied types of reproductive behavior of different groups of animals. This knowledge forms a basis for further research.
- Overview of human system also gives a foundation to understand a course on Animal Physiology in the fourth semester.
- Knowledge gained on the economic importance of different animals help them in future for research and other applications in agriculture, medicine and industry.

**Unit-1: 14 Hrs.**

**Biodiversity:** Definition, Numerical strength, Binomial and trinomial nomenclature. Molecular taxonomy. Definition of species. The system of hierarchy.

**Animal diversity:** Principles of animal classification. General characters and classification up to classes with examples of the following:

- a) Protista- Protozoa-(Honiberget al., (1964) Classification (upto classes).
- b) Metazoa: Branch 1. Parazoa – Porifera; Branch 2. Eumetazoa.
- c) Radiata – Cnidaria, Acnidaria
- d) Bilateria – Aschelminthes, Platyhelminthes, Annelida, Onychophora, Arthropoda, Mollusca, Echinodermata and Hemichordata.

**Unit-2: 14 Hrs.**

**Phylum:** Chordata: Sub-phyla-1. Urochordata 2. Cephalochordata. 3. Vertebrata

**Sub-phylum:** Vertebrata (Craniata):

- i) Agnatha- Cyclostomata
- ii) Gnathostomata- Class: Pisces, Amphibia, Reptilia, Aves and Mammalia.

**Unit-3: 14 Hrs.**

**Type Study**

- i) **Cockroach:** Externals, Mouthparts, Digestive system, Respiratory system, excretory system and Reproductive system.
- ii) **Man:** Skeletal system, Nervous system, Circulatory system, and Reproductive system.

**Unit-4:****14 Hrs.**

**Tissues** – Different types of Animal tissues, Functional morphology of mammalian stomach, intestine (ileum), liver, pancreas, spleen, and lung. Histopathology of liver cirrhosis and pancreas in diabetes.

**Note-** Salient features should be elaborated while giving general characters of each phylum/ group. Local examples with common and scientific names are to be mentioned.

**MBDSC-2; GENERAL ZOOLOGY (PRACTICALS):****2 Credits****54 Hrs.****Course outcome:**

- Students get practical knowledge of the aspects studied in theory.
- Students see and appreciate the beauty of zooplanktons and other aquatic animals.
- They will see and understand better animal diversity.
- They gain better insight of osteology.
- Students get the skill of plastination.

**LIST OF EXPERIMENTS:****1, 2: Slides and specimens:**

- ❖ Protozoa: Euglena, Trypanosoma, Entamoeba coli, Plasmodium vivax.
- ❖ Porifera: Sycon, Monaxon spicules and a Gemmule.
- ❖ Cnidaria: Obelia, Medusa, Fungia.
- ❖ Acnidaria – Pleurobrachia.
- ❖ Platyhelminthes: Fasciola, Section of liver fluke, Tapeworm (externals).
- ❖ Aschelminthes: Ascaris male and female, Section of Ascaris male and section of Ascaris female.
- ❖ Annelida: Nereis, T.S. of Neries.
- ❖ Onychophora: Peripatus.

**3,4: Slides and specimens:**

- ❖ Arthropoda: Penaeus – externals, Trophi of a mosquito, Honeybee and cockroach.
- ❖ Molluca: Fresh water mussel, Sepia, Octopus, Shells of Dentalium, Xancus and Cuttle bone.
- ❖ Echinodermata: Star fish, Sea urchin, Pedicellaria, Bipinnaria larva.
- ❖ Hemichordata: Balanoglossus externals, T.S. through proboscis/ Branchio-genital region.
- ❖ Chordata: Amphioxus- Externals, Section through intestine.
- ❖ Cyclostomata: Petromyzon.
- ❖ Fishes: Shark, Ophiocephalous, Anguilla.

**5; Slides and specimens:**

- ❖ Amphibia: Rana, Ichthyophis.
- ❖ Reptilia: Draco, Cobra, Viper, Krait.
- ❖ Aves: Parakeet, Woodpecker.
- ❖ Mammals: Rat and Guinea pig.



**6 & 7: Mountings:**

- ❖ Mounting of scales (placoid, ctenoid or cycloid); insect larvae (mosquito, *Drosophila*)
- ❖ Identification of any 5 fresh water planktons from the given water sample.

**8 & 9: Study by charts & photographs**

- ❖ Human: Nervous system, Arterial and Venous system.
- ❖ Collection and Study of any 6 harmful and beneficial insects.

**10 & 11:**

- ❖ Osteology: Skull of Rabbit.
- ❖ Vertebrae: Atlas, Axis, Procoelous, Amphicoelous, Acoelous vertebrae; Girdles and limbs skeleton of Rabbit.

**12 & 13:**

- ❖ **Tissues:** Types of animal tissues-epithelial tissues (squamous, cuboidal, columnar, ciliated and stratified), striated, smooth and cardiac muscles, bone, cartilage and nervous tissue
- ❖ **Organ Histology:** Section of mammalian ovary, testes, intestine (ileum), pancreas (normal and diabetic) and thyroid, Liver (normal and diabetic).

**14: Plastination of specimens:** Demonstration.**REFERENCES:**

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2. Ekambernath Ayyar. M., A. C., & Anantha Krishnan, T.N. (1990). *Manual of Zoology-Vol-I, Invertebrate (Part I & II)*. S. Vishwanathan. Pvt. Ltd.
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**II SEMESTER****MBDSC -3: CELL BIOLOGY AND PLANT PHYSIOLOGY (THEORY): 4 Credits 56 Hrs.****Course outcome:**

- Students will understand the structure and functions of cell organelles.
- They will acquire knowledge of mechanisms of cell membrane transport.
- They will get the knowledge on the role of ligands and receptors for cell signaling.
- This will enable them to understand the internal features of the cell and cell mobility.
- They will understand the stages of cell division, cell cycle.

- They will gain knowledge on principle and applications of microscopy.
- Students will understand the plant water relation, solute transport, different biophysico-chemical phenomenon.
- Students will understand the mechanism of crop stress tolerance to various abiotic stresses.
- Students will be able to integrate and apply their knowledge of plant physiology for analytical thinking and solving practical problems experienced in agricultural systems.

**Unit-1:****14 Hrs.****Cell Biology:** An overview of cells and cell research.**The origin and evolution of cells:** From molecules to cell, from prokaryotes to Eukaryotes,**Tools of cell biology:** Microscopy - compound and light microscope, electronmicroscope (SEM, TEM), confocal microscopy, fluorescence microscopy, phasecontrast microscopy, use of flow cytometry for sorting cells,**Compartmentalization in cells:** Overview and role of cell organelles-cytosol, endoplasmic reticulum, the golgi apparatus, lysosomes and Peroxisomes, ribosomes, vesicles, vacuoles, mitochondria, chloroplast, nucleus, nucleolus, nuclear membrane, centrioles and cell wall.**Cell communication:** Plasmodesmata, Gap junction, septate junction.**Unit-2:****14 Hrs.****Composition and architecture of plasma membrane:** Membrane asymmetry-lipids proteins and carbohydrates. Membrane models- Gorter and Grendel model, Davson and Danielli model (sandwich), Robertson model (unit membrane), Singer and Nicholson's model (fluid mosaic).**Membrane transport:** Simple diffusion (small molecules), facilitated diffusion, active transport (primary and secondary), passive transport, symport, uniport and antiport. Exocytosis, endocytosis and pinocytosis.**Unit-3:****14 Hrs.****Cell cycle:** cell division types, phases of cell cycle, mitosis and meiosis, comparison of cell division in prokaryotes and eukaryotes.**Chromatin organization:** Chromatin fiber structure, nucleosome, models of nucleosome, chromosome structure. Anatomy of eukaryotic chromosome – Centromere, Telomere, Nucleosome, Nucleomere, Kinetochore.**Extracellular matrix and cell adhesion molecules:** Proteoglycans, nonproteoglycans (hyaluronic acid), fibres (collagen, elastin), fibronectin. Integrins, selectins, cadherins, classification and role in maintaining cell integrity.

**Unit-4:****14 Hrs.****Plant Physiology;**

**Water and plant cell:** Transport process, Absorption by roots, Transport of water through xylem – role of cavitation and embolism. Transpiration, Mechanism of opening and closing of stomata & SPAC (Soil–plant-Atmosphere-Continuum).

**Solute transport and Plant Nutrition:** Pinocytosis, exocytosis, endocytosis CURL (Compartment of Uncoupling of Receptors – Ligand) concept. Aquaporins and phytosiderophore. Brief account of Plant nutrition and deficiency symptoms.

**Transport in phloem:** Pathways of translocation, source and sink relationship, Phloem sap and pressure flow model for phloem transport. Vein loading and unloading. Transport signaling molecules.

**Brief account of lipids, waxes & phytosterols** in plants.

**Stress physiology:** Water deficit and drought resistance, heat stress and heat shock, Chilling and freezing injury. Salinity and anaerobic stress.

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**MBDSCP-3: CELL BIOLOGY AND PLANT PHYSIOLOGY (PRACTICALS):****2 Credit****56 Hrs;****Course outcome:**

- Students will practical knowledge of the theoretical aspects studied.
- They will acquire cell biology practical skills such as haematology, cell viability, microtomy and DNA isolation.
- Skills on estimation of amino acid related to stress in plants is also imparted.

**LIST OF EXPERIMENTS:**

- 1,2:** Blood cell counting: RBC, WBC: Total and differential count.
- 3:** Temporary preparation of stained samples for Mitosis in onion root tips.
- 4:** Temporary preparation/observation of stained slides for Meiosis in flower buds (eg, Onion/Chlorophytum).
- 5:** Separation of cell organelles by differential centrifugation/direct observation of cell organelles. (Cell wall, Plasma membrane, Chloroplast and Nucleus).
- 6:** Cell viability assay by Trypan blue dye exclusion method.
- 7:** Isolation of DNA from coconut endosperm.
- 8,9:** Preparation of permanent slides Staining –Plant tissues in stem/leaf/root/callus.
- 10:** Determination of water potential of tissue by plasmolytic / gravimetric method.
- 11:** Determination of stomatal index, stomatal frequency and area of stomatal aperture.
- 12:** Cobalt Chloride experiment to show the differential rate of transpiration.
- 13:** Estimation of proline in stressed and unstressed plant.
- 14:** Photographs, charts, instruments related theory.

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1. Lodish, H. F., Berk, A., Darnell, J. E., Zipursky, S. L., Matsudaira, P., Kaiser, C. A., Krieger, M., & Scott, M. P. (2000). *Molecular Cell Biology*. W. H. Freeman and Co.
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3. Alberts, B., Johnson, A., Lewis, J., Roberts, K., Raff, M., & Walter, P. (2008). *Molecular Biology of the Cell*. Garland Science.
4. Cooper, G. M., & Hausman, R. E. (2004). *The Cell: A Molecular Approach*. Sinauer Associates.

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**MBDSC-4: INORGANIC AND PHYSICAL CHEMISTRY (THEORY) 04 Credits 56 Hrs.****Course outcome:**

- Students will understand the behavior of gases and their laws, atomic structure and chemical bonding.
- Important techniques like chromatography and X-ray crystallography are discussed which helps students in academia and research.
- They will understand bioinorganic chemistry, chemistry of biologically important elements which bridges the gap between chemistry and biology for better relationship between both.
- Students will understand the phenomenon of photochemistry.
- Students will learn about the electrochemical cell and its conductance in detail.
- Basic understanding of chemical kinetics and catalysis of reactions help students to better understand in higher semester paper enzymology

**Unit-1:****14 Hrs.**

**Behavior of Gases**-Gas Laws: Kinetic theory of gases- assumptions. Gas laws statement and equation- Boyle's law, Charle's law, Gay-Lussac's law, The combined gas law, Dalton's law of partial pressures, Avogadro's law and molar gas volume, The ideal gas law, Graham's law of diffusion. Kinetic molecular theory and kinetic gas equation (noderivation), deviation of real gases from the ideal gas law and Vander Vaal's equation- a qualitative treatment, Simple Problems.

**Atomic structure:** Quantum numbers and their significance. Shapes of s, p and d-orbitals. Modern Periodic law, Aufbau principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle and (n+l) rule. Periodic table based on electronic configuration(Z=30). Ionization enthalpy, successive ionization enthalpy and factors influencing ionization enthalpy, electron affinity, electronegativity, (explanation for variation in periodic table).

**Chemical bonding:** Definitions, formation of ionic bond with examples, covalent bond (sigma and pi bonds), co-ordinate bond with examples. Covalent radii, Van-der-Waal's radii. Hydrogen bond-definition and its significance in biological systems. Hybridization- Hybrid orbitals, sp, sp<sup>2</sup> and sp<sup>3</sup> hybridization taking acetylene(C<sub>2</sub>H<sub>2</sub>), berilium chloride

(BeCl<sub>2</sub>), ethylene (C<sub>2</sub>H<sub>4</sub>), boron trifluoride (BF<sub>3</sub>), and methane (CH<sub>4</sub>), silicon tetrachloride (SiCl<sub>4</sub>) as examples.

## Unit-2:

14 Hrs.

**Coordination Compounds; Molecular Compounds-** double salts and complex salts- definition, differences with examples. Werner's theory Ligands (uni, bi and polydentate), coordination number, coordination sphere, central metal ion/atom and complex ion definitions with example, stability of complex ion. Chelation. Stereochemistry of different coordination numbers (2-6). **Isomerism**-geometrical isomerism and optical isomerism in coordination compounds (coordination number 4 and 6).

**Bonding in coordination compounds:** Valence bond theory, crystal field theory, color in transition metal complexes,

**Concentration units:** methods of expressing concentration of solutions Definition and equation-Mole, Mole fraction, Molarity, Molality, Avagadro's number, Equivalent weight, Normality, Percentage composition, Theoretical yield, Percentage yield. Problems based on preparation and inter-conversion of these solutions.

**Acids-bases and buffers:** Statement & Examples: Lowry-Bronsted concept, Lewis concept of acids and bases, General theory of solvent system, ionic product of water, pH scale, buffers, Henderson-Hasselbach equation, buffer capacity, preparation of buffers. Theory of acid base indicators, choice of indicators, pH titration curves, calculation of isoelectric points, strengths of acids and bases. Ionization constant, formation constants, stepwise ionization constants for polyprotic acid.

## Unit-3:

14 Hrs.

**Colligative properties:** Lowering of vapor pressure, Raoult's law, definition and equations - elevation of boiling point, Ebullioscopy constant, depression of freezing point, cryoscopic constant, their application in determination of molecular weight of non-volatile solute-relationship between the constants and molecular mass, experimental methods of determining molecular mass by Walker-Lumsden's method and Rast's method Osmotic pressure and its measurement by Berkley and Hartley's method, relationship between osmotic pressure and molar mass. Hypo, hyper and isotonic solutions. Donnan membrane equilibrium. Abnormal molecular weights. Vant Hoff factor, degree of association and dissociation. Problems based on above concepts.

**Photochemistry:** Definition, electromagnetic radiations – different regions of EMR and properties of the radiations, Lambert – Beer's law Photochemical reactions- definition and examples, laws of photochemistry– Grotthus Draper law, Einstein's law of photochemical equivalence, quantum efficiency – high quantum yield and low quantum yield with one example each. Chemiluminescence and bioluminescence with examples, Phosphorescence, Fluorescence, Photosensitizers – Examples in natural systems.

**Distribution law:** Statement - Nernst's Distribution law, Equation – example – Iodine in water and carbon disulphide, Partition co-efficient, simple problems – limitations of Nernst's law, applications of distribution law with emphasis on solvent extraction.

**Unit-4:****14 Hrs.**

**Electrochemistry:** Definition and equations - Specific, equivalent and molar conductance, SI units for each, Determination of equivalent conductance of a strong electrolyte – theory and experimental method, Transport numbers. Applications of conductance measurements – a) Ionic product of water, b) Ionisation constant and degree of ionisation, c) conductometric titrations: i) strong acid v/s. strong base ii) weak acid (amino acid) v/s. strong base. Electrochemical cell - definition and representation of a cell. Single Electrode potential, standard electrode potential, EMF, Nernst's equation for single electrode potential. Electrochemical series, concentration cells

**Reference electrodes:** (primary-hydrogen electrode and secondary-calomel electrode), Secondary electrodes – quinhydrone and glass electrode -construction and working, redox potential and redox electrode ( $\text{Fe}^{2+}/\text{Fe}^{3+}$  as examples). Concentration cell- Liquid junction potential. Application of EMF measurements. i) Determination of pKa values of weak acids ii) Determination of pH of a buffer by potentiometric method using quinhydrone electrode & glass electrode iii) Potentiometric titration (Redox titration)

**Chemical kinetics:** Rate of reaction, order of reaction, molecularity, first order and second order reactions-definition and rate equation, half-life period characteristics of 1st and 2nd order reaction constants. Methods of determining order of a reaction - differential rate method, half-life period method, types of reactions - Elementary reactions, reaction mechanism, rate determining steps - qualitative treatments, complex reactions - consecutive, parallel, reversible, chain reactions; surface reactions - definition & examples. Theories of elementary reaction process - collision theory and transition state theory. Temperature dependence of reaction rates. Arrhenius equation- energy of activation. Problems in all units have to be solved.

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**MBDSC-4: INORGANIC AND PHYSICAL CHEMISTRY (PRACTICALS): 02 Credits 56 Hrs****LIST OF EXPERIMENTS:****PART-A (Inorganic):**

1. Calibration of Pipettes and Burette, Preparation of Normal and Molar solutions.
2. Preparation of standard sodium carbonate solution, standardization of HCl (methyl orange Indicator) and estimation of NaOH (Phenolphthalein Indicator).
3. Preparation of standard Oxalic acid solution, standardization of potassium permanganate solution and estimation of  $\text{H}_2\text{O}_2$  in solution.
4. Preparation of standard  $\text{K}_2\text{Cr}_2\text{O}_7$  and standardization of  $\text{Na}_2\text{S}_2\text{O}_3$ . Estimation of  $\text{Fe}^{2+}$  (ferrous) and  $\text{Fe}^{3+}$  (Ferric) ions in a mixture using diphenylamine indicator.
5. Preparation of standard potassium phthalate solution. Standardization of NaOH and estimation of oxalic acid in given solution (phenolphthalein).
6. Preparation of standard  $\text{ZnSO}_4$  solution, Standardization of EDTA and estimation of total hardness of water.
7. Determination of alkali content in antacid tablets.



8. Estimation of iron content in commercially available drug.

### PART-B (Physical)

1. Conductometric titration of strong acid and strong base; Conductometric titration of weak acid and strong base.
2. Verification of Beer-Lamberts Law and calculation of extinction co-efficient ( $\text{CuSO}_4$  solution +  $\text{NH}_4\text{OH}$ ).
3. Determination of molar conductance of the given strong electrolyte and weak electrolyte. Determination of  $\text{pK}_a$  of weak acid by potentiometric method. Determination of viscosity of a liquid (general/gum solution/ sugar syrup/ salt solution) by viscometric method- two liquids in a class).
4. pH titration of strong acid by strong base using pH meter; Potentiometric titration of ferrous ammonium sulphate v/s.  $\text{K}_2\text{Cr}_2\text{O}_7$  solution. Kinetics of acid hydrolysis of ethyl-methyl acetate and determination of order of reactions.

### REFERENCES:

1. Daniels, F. (1956). *Mathematical preparation for physical chemistry*. Mc. Graw Hill.
2. Rao, C. N. (1973). *University general chemistry: An introduction to chemical science*. Mc. Millan Publication.
3. Pruton, C. F., & Maron, S. H. (1958). *Principles of physical chemistry* (3rd ed.). Oxford and IBH publication.
4. Barrow. (2008). *Physical chemistry (Sie) 5E*. Tata McGraw-Hill Education.
5. Bahl, B. S., Bahl, A., & Tuli, G. D. (2000). *Essentials of physical chemistry*. S. Chand.
6. Emeleus, & Anderson. (1992). *A Text Book of Inorganic Chemistry*. New Age Publishers.
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8. Jain, M. K. (2000). *A Text Book of Organic Chemistry* (16th ed.). S. Chand and Co.
9. Soni, P. L. (2000). *A Text Book of Organic Chemistry* (15th ed.). S. Chand and Co. New Delhi.
10. Bahl, A., & Bahl, B. S. (2000). *A textbook of organic chemistry* (16th ed.). S. Chand.
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12. Bansal, R. K. (1999). *Laboratory manual of Organic chemistry* (3rd ed.). New Age Int.
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14. Kundan, M., & Jain, S. K. (1986). *Physical Chemistry* (3rd ed.). Chand & Co.
15. Sharma, K. K., & Sharma, C. K. (1998). *Textbook of physical chemistry* (8th ed.). Vani Educational Books.

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**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to MBDSC-1, MBDSC-2, MBDSC-3 and MBDSC-4 Papers)**  
**5-Year Integrated M.Sc. Course in Molecular Biology**

**Time: 02 Hours****Max. Marks: 60****Instructions:** Draw neat and labelled diagrams wherever necessary.**PART-A**

- 1. Define/Explain any five of the following:** **2x5=10**  
 (2 questions from each unit)

- a).
- b).
- c).
- d).
- e).
- f).
- g).
- h).

**PART-B**

- Answer any four of the following (Internal Choice)** **5x4=20**  
 (Internal choice should be from the same unit)

Q2 – Q5

**PART-C**

- Answer any three of the following:** **10X3=30**  
 (One question from each unit)

Q6 -Q9

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**SCHEME OF PRACTICAL EXAMINATION****I SEMESTER:****MBDSCP-1: General Botany Practical****Time: 03 Hours****Max. Marks: 25**

- 1. Identify the materials A, B and C with reasons.** **3x2=06 Marks**  
 (Identification: 1 Mark; Reasons with labelled diagram: 1 Mark; one each from algae/fungi/bryophytes/pteridophytes/gymnosperms: without repeating any group).
- 2. Prepare a stained slide of the material D, sketch, label and identify with reasons.** **04 Marks**  
 (Staining and mounting: 2 Marks; sketch and label: 1 Mark; identification with reasons: 1 Mark; Material to be given is from anatomy angiosperms).
- 3. Identify the family of the given plant E Describe it in technical terms.** **05 Marks**  
 (Identification of the family: 1 Mark; technical description: 4 Marks).
- 4. Write critical notes on F and G.** **2x2=4 Marks**

(from algae/ fungi/ bryophytes/pteridophytes /gymnosperms; Note: not more than one from each group) (Identification with reasons: 2 Marks).

5. **Identify the microslides H and I, with reasons.** 2x3=6 Marks

(One each from algae/fungi/ bryophytes/pteridophytes/ gymnosperms/anatomy of angiosperms; Note: not more than one from each group). (Identification with reasons: 2 Mark, Labelled diagram: 1 Mark).

**Note:** Duly certified practical record shall be submitted at the practical examination.

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### MBDSCP-2: GENERAL ZOOLOGY PRACTICAL

**Time: 03 Hours**

**Max. Marks: 25**

1. **Identify and comment on the charts/photograph of dissected specimen A**

03 Marks

[Circulatory/Nervous system of Human] (Identification: 1Mark; comment: 2 Marks).

2. **Prepare the whole mount of fish scale (B).**

05 Marks

(Procedure- 2 Marks, identification – 1 Mark, preparation – 2 Marks).

3. **Identify the specimen/slide and give the suitable reasons with diagram [C-F].**

4X3=12 Marks

(specimen or slides: 1 from Non-chordata; 1 from protochordata; 1 from Chordata; 1 from osteology/histology) (Identification- 1 Mark; Reasons and Diagram -2 marks).

4. **Identification and comment on the insects – harmful/useful 'G'**

02 Marks

(Identification- 1 Mark; comment: 1 Mark).

5. **Identification of any one 'Mouth Part' 'H'.**

03 Marks

(For each Identification: 1 Mark; diagram: 1 Mark; reasons: 1 Mark).

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record).

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## II SEMESTER:

### MBDSCP-3: CELL BIOLOGY AND PLANT PHYSIOLOGY PRACTICAL

**Time: 03 Hours**

**Max. Marks: 25**

1. Prepare a temporary squash and stain the given material **A** Identify any two stages of cell division during mitosis, draw diagrams and comment on the stages/Count and calculate RBC/WBC using the given blood sample and write the procedure and record the percent of occurrence. 8 Marks

(For mitosis squash preparation: Preparation: 3 Marks; Identification of any one stage: 2 Marks; Drawing and labeling and commenting: 03 Marks) (For blood Preparation: 02 marks; Brief procedure: 03 Marks; Calculations: 02 Marks; Report: 01 Mark).

2. Determine the of water potential by gravimetric method/plasmolytic method/  
Determination of stomatal index, stomatal frequency of the given leaf material Write  
the principle, procedure and result. 8 Marks  
(Experiment conduction: 3 Marks; Procedure: 3 Marks; Results: 2 Marks)
3. Write the Principle and Procedure of the experiment given below. 5 Marks
  - a. Cell viability assay by Trypan blue dye exclusion method.
  - b. Separation of cell organelles by differential centrifugation.
  - c. Preparation of permanent slides Staining (fixing and infiltration/embdding  
and sectioning/ staining the sectioning and mounting: any one among them be given).
  - d. Isolation of DNA from coconut endosperm
  - e. Estimation of proline in stressed and unstressed plants
4. Identify the two spotters (two to be given one from plant physiology and one from cell  
biology) (from the photographs/charts/experiment related one which is not given as  
experiment for conduction in the examination). 2x2=4 Marks

**Note:** Duly certified practical record shall be submitted at the practical examination.

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#### **MBDSCP-4: INORGANIC AND PHYSICAL CHEMISTRY PRACTICAL**

**Time: 03 Hours**

**Max. Marks: 25**

**Part-A: Inorganic Chemistry: 12 Marks**

Volumetric estimation (experiments 2/3/4/5/6)

**Part -B: Physical Chemistry: 13 Marks**

Physical chemistry instrumental (experiments 1/2/3/4)

**THE DETAILS OF SPLITTING OF THE MARKS EACH OF THE EXPERIMENTS WILL BE  
ACCORDING TO THE SCHEME APPROVED BY THE BOARD OF STUDIES IN  
CHEMISTRY FOR THE RESPECTIVE EXPERIMENTS.**

**Note:** Duly certified practical record shall be submitted at the practical examination.

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## **Bachelor of Computer Applications (BCA) (Basic/Hons.) Degree Programme**

### **Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020**

**(2021-22 Batch Onwards)**

#### **BOARD OF STUDIES: PROCEEDINGS**

The meeting of the Board of Studies in Computer Science (UG) of Yuvaraja College Mysore, was held at 11:00 a.m. on 27-11-2021, at the Department of Computer Science, Yuvaraja College (Autonomous), University of Mysore, Mysuru.

#### **Annexures:**

1. The Syllabus of NEP and scheme of Examination for Theory and Practical-I and II semester schemes
2. The panel of Examiners for the year 2021-22.

| Sl. No. | Members                                                                                                                           | Position | Signature/<br>Remarks |
|---------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Annapurna. H, Dept. of Computer Science, Yuvaraja College, Mysore                                                                 | Chairman | Sd/                   |
| 2.      | Chandraiah. T, Dept. of Computer Science, Yuvaraja College, Mysore                                                                | Member   | Sd/                   |
| 3.      | Dr. Manjunatha. K. S, Associate Professor and Head, Dept. of Computer Science, Maharani's Science College for Women, Mysore       | Member   | Sd/                   |
| 4.      | Gloriya Priyadarshini, Head of the Department, Dept. of Computer Science, St. Philomena's College, Mysore                         | Member   | Sd/                   |
| 5.      | Vidya Shankar, Head of the department, Dept. of Computer Science, J S S College for Arts, Science and Commerce, Ooty road, Mysore | Member   | Sd/                   |
| 6.      | Nagesh, Project Leader, Excelsoft, Mysore                                                                                         | Member   | Sd/                   |
| 7.      | Dr. Basavanna. M, Associate Professor, and Chairman, DOS in Computer Science, Davanagere University, Davangere, India.            | Member   | Absent                |

#### **Resolutions Passed:**

1. The Board resolved to adopt the CBCS scheme under NEP-2020 with 60+40 pattern in the framing of the syllabus for first year B.Sc. and BCA Programme.
2. The Board after discussions and deliberations framed and passed the syllabus for Computer Science Course for the I and II semesters of the B.Sc. and BCA Programme under CBCS scheme (NEP-2020) proposed to commence from the academic year 2021-22.

Finally, the Chairman thanked the members for their active participation, invaluable suggestions and co-operation.

27-11-2021  
Mysuru

Chairman,  
BOS in Computer Science

### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Paper<br>(L+T+P)                | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|-----------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | CA C-1: Fundamentals of Computers (3+0+0)           | 3                          | 3       | 40                                        | 60                                        |
|           | CA CP-1: Information Technology (0+0+2)             | 4                          | 2       | 25                                        | 25                                        |
|           | CA C-2: Programming in C (3+0+0)                    | 3                          | 3       | 40                                        | 60                                        |
|           | CA CP-2: C Programming (0+0+2)                      | 4                          | 2       | 25                                        | 25                                        |
|           | CA C-3: Accountancy (3+0+0)                         | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | CA C-4: Data Structures using C (3+0+0)             | 3                          | 3       | 40                                        | 60                                        |
|           | CA CP-3: Data Structure (0+0+2)                     | 4                          | 2       | 25                                        | 25                                        |
|           | CA C-5: Object Oriented Concepts using JAVA (3+0+0) | 3                          | 3       | 40                                        | 60                                        |
|           | CA CP-4: JAVA (0+0+2)                               | 4                          | 2       | 25                                        | 25                                        |
|           | CA C-6: Discrete Mathematical Structures (3+0+0)    | 3                          | 3       | 40                                        | 60                                        |

#### Objectives:

- The primary objective of this program is to provide a foundation of computing principles and business practices for effectively using/managing information systems and enterprise software.
- It helps students analyze the requirements for system development and exposes students to business software and information systems.
- This course provides students with options to specialize in legacy application software, system software or mobile applications.
- To produce outstanding IT professionals who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves.
- To provide opportunity for the study of modern methods of information processing and its applications.

- To develop among students, the programming techniques and the problem-solving skills through programming.
- To prepare students who wish to go on to further studies in computer science and related subjects.
- To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

**Programme outcome:**

The Bachelor of Computer Application (BCA (Hons)) program enables students to attain following additional attributes besides the afore-mentioned attributes, by the time of graduation: At the end of the course the student should be able to:

- **Discipline knowledge:** Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
- **Problem Solving:** Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
- **Design and Development of Solutions:** Ability to design and development of algorithmic solutions to real world problems and acquiring a minimum knowledge on statistics and optimization problems. Establishing excellent skills in applying various design strategies for solving complex problems.
- **Programming a computer:** Exhibiting strong skills required to program a computer for various issues and problems of day-to-day applications with thorough knowledge on programming languages of various levels.
- **Application Systems Knowledge:** Possessing a sound knowledge on computer application software and ability to design and develop app for applicative problems.
- **Modern Tool Usage:** Identify, select and use a modern scientific and IT tool or technique for modeling, prediction, data analysis and solving problems in the area of Computer Science and making them mobile based application software.
- **Communication:** Must have a reasonably good communication knowledge both in oral and writing.
- **Project Management:** Practicing of existing projects and becoming independent to launch own project by identifying a gap in solutions.
- **Ethics on Profession, Environment and Society:** Exhibiting professional ethics to maintain the integrity in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
- **Lifelong Learning:** Should become an independent learner. So, learn to learn ability.
- **Motivation to take up Higher Studies:** Inspiration to continue educations towards advanced studies on Computer Science.
- Apply standard Software Engineering practices and strategies in real -time software project development.

- Design and develop computer programs/computer -based systems in the areas related to AI, algorithms, networking, web design, cloud computing, IoT and data analytics.
- Acquaint with the contemporary trends in industrial/research settings and thereby innovate novel solutions to existing problems.
- The ability to apply the knowledge and understanding noted above to the analysis of a given information handling problem.
- The ability to work independently on a substantial software project and as an effective team member.

## I SEMESTER

### Course Outcomes:

- Introduction to computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.
- Operating systems, functions of operating systems, classification of operating systems, kernel, shell, basics of Unix, shell programming, booting.
- Databases, why databases are used, users, SQL, data types in SQL, introduction of queries - select, alter, update, delete, truncate, using where, and or in not in.
- Internet basics, features, applications, services, internet service providers, domain name system, browsing, email, searching.
- Web Programming basics, introduction of HTML and CSS programming.
- Introduction of computers, classification of computers, anatomy of computer, constituents and architecture, microcontrollers.
- Confidently operate Desktop Computers to carry out computational tasks.
- Understand working of Hardware and Software and the importance of operating systems.
- Understand programming languages, number systems, peripheral devices, networking, multimedia and internet concepts.
- Read, understand and trace the execution of programs written in C language.
- Write the C code for a given problem.
- Perform input and output operations using programs in C.
- Write programs that perform operations on arrays.
- Study and understand Accounting, systems of Book, Branches of accounting advantage and limitations.
- Know the concept of accounting, financial accounting process and Journalization.
- Maintenance different account book and reconciliations.
- Preparations of different bills, and trial balance.
- Understand the basic concepts of Mathematical reasoning, set and functions.



**CA C-1: FUNDAMENTALS OF COMPUTERS (THEORY): 3 Credits 42 Hrs.**

**Unit-1: Fundamentals of Computers:** Introduction to Computers - Computer Definition, Characteristics of Computers, Evolution and History of Computers, Types of Computers, Basic Organisation of a Digital Computer; Number Systems – different types, conversion from one number system to another; Computer Codes – BCD, Gray Code, ASCII and Unicode; Boolean Algebra – Boolean Operators with Truth Tables; Types of Software – System Software and Utility Software; Computer Languages - Machine Level, Assembly Level & High Level Languages, Translator Programs – Assembler, Interpreter and Compiler; Planning a Computer Program - Algorithm, Flowchart and Pseudo code with Examples.

**Introduction to computers:** Characteristics of computers, Classification of Digital Computer Systems: Microcomputers, Minicomputers, Mainframes, Super computers. **14 Hrs.**

**Unit-2:** Anatomy of Computer: Introduction, Functions & Components of a Computer, Central Processing Unit, Microprocessor, Storage units, Input and output Devices. How CPU and memory works. Program execution with illustrative examples. Introduction to microcontrollers.

**Operating System Fundamentals:** Operating Systems: Introduction, Functions of an operating System, Classification of Operating Systems, System programs, Application programs, Utilities, The Unix Operating System, Basic Unix commands, Microkernel Based Operating System, Booting. **14 Hrs.**

**Unit-3: Introduction to Database Management Systems:** Database, DBMS, Why Database -File system vs DBMS, Database applications, Database users, Introduction to SQL, Data types, Classification of SQL-DDL with constraints, DML, DCL, TCL

**Internet Basics:** Introduction, Features of Internet, Internet application, Services of Internet, Logical and physical addresses, Internet Service Providers, Domain Name System.

**Web Basics:** Introduction to web, web browsers, http/https, URL, HTML5, CSS. **14 Hrs.**

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**CA CP-1: INFORMATION TECHNOLOGY (PRACTICAL): 2 Credits 56 Hrs.****LIST OF EXPERIMENTS****Part-A: Hardware**

1. Identification of the peripherals of a computer, components in a CPU and their functions.
2. Assembling and disassembling the system hardware components of personal computer.
3. Basic Computer Hardware Trouble shooting.
4. LAN and WiFi Basics.
5. Operating System Installation – Windows OS, UNIX/LINUX, Dual Booting.

6. Installation and Uninstallation of Software – Office Tools, Utility Software (like Anti-Virus, System Maintenance tools); Application Software - Like Photo/Image Editors, Audio Recorders/Editors, Video Editors ...); Freeware, Shareware, Payware and Trialware; Internet Browsers, Programming IDEs.
7. System Configuration – BIOS Settings, Registry Editor, MS Config, Task Manager, System Maintenance, Third-party System Maintenance Tools (Similar to CCleaner and Jv16 PowerTools ...).

#### **Part-B: Software**

1. Activities using Word Processor Software.
2. Activities using Spreadsheets Software.
3. Activities using Presentation Software.
4. Activities involving Multimedia Editing (Images, Video, Audio ...).
5. Tasks involving Internet Browsing.
6. Flow charts: Installation and using of flowgarithms software for different arithmetic tasks like sum, average, product, difference, quotient and remainder of given numbers, calculate area of Shapes (Square, Rectangle, Circle and Triangle), arrays and recursion.

NOTE: In addition to the ones listed above, universities can include other activities so as for the student to become proficient in using personal computers for multiple purposes for which modern computers can be put to use.

#### **REFERENCE BOOKS:**

1. Pradeep K. Sinha and Priti Sinha: Computer Fundamentals (Sixth Edition), BPB Publication.
2. David Riley and Kenny Hunt, Computational thinking for modern solver, Chapman & Hall/CRC.
3. J. Glenn Brook shear," Computer Science: An Overview", Addison-Wesley, 12<sup>th</sup> Ed.
4. R.G. Dromey, "How to solve it by Computer", PHI.
5. Computational Thinking for the Modern Problem Solver, By Riley DD, Hunt K.A CRC press, 2014.
6. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer.

**Web References:** <http://www.flowgorithm.org/documentation/>

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#### **CA C-2: PROGRAMMING IN C (THEORY):      3 Credits    42 Hrs.**

**Unit-1: Introduction to C Programming:** Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C.

**C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.

**Input and output with C:** Formatted I/O functions - *printf* and *scanf*, control strings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar*, *putchar*, *gets* and *puts* functions.

**C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associativity; Evaluation of arithmetic expressions; Type conversion. **14 Hrs.**

**Unit-2: Control Structures:** Decision making Statements - *Simple if, if\_else, nested if\_else, else\_if ladder, Switch Case, goto, break & continue* statements; Looping Statements - Entry controlled and exit controlled statements, *while, do-while, for* loops, Nested loops. **Derived data types in C:** Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation.

**Strings:** Declaring & Initializing string variables; String handling functions - *strlen, strcmp, strcpy and strcat*; Character handling functions - *tolower, toupper, isalpha, isnumeric* etc. **14 Hrs.**

**Unit-3: Pointers in C:** Understanding pointers - Declaring and initializing pointers, accessing address and value of variables using pointers; Pointers and Arrays; Pointer Arithmetic; Advantages and disadvantages of using pointers;

**User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.

**User defined data types:** Structures - Structure Definition, Advantages of Structure, declaring structure variables, accessing structure members, Structure members initialization, comparing structure variables, Array of Structures; Unions - Union definition; difference between Structures and Unions. **14 Hrs.**

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**CA CP-2: C PROGRAMMING (PRACTICAL): 2 Credits 56 Hrs.**

### LIST OF EXPERIMENTS

#### Part-A:

1. Program to read radius of a circle and to find area and circumference.
2. Program to read three numbers and find the biggest of three.
3. Program to demonstrate library functions in math.h.
4. Program to check for prime.
5. Program to generate n primes.
6. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome.

7. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers.
8. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder).
9. Program to find the roots of quadratic equation (demonstration of switch Case statement).
10. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array).
11. Program to remove Duplicate Element in a single dimensional Array.
12. Program to perform addition and subtraction of Matrices.

#### **Part B:**

1. Program to find the length of a string without using built in function.
2. Program to demonstrate string functions.
3. Program to demonstrate pointers in C.
4. Program to check a number for prime by defining isprime( ) function.
5. Program to read, display and to find the trace of a square matrix.
6. Program to read, display and add two m x n matrices using functions.
7. Program to read, display and multiply two m x n matrices using functions.
8. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
9. Program to Reverse a String using Pointer.
10. Program to Swap Two Numbers using Pointers.
11. Program to demonstrate student structure to read & display records of n students.
12. Program to demonstrate the difference between structure & union.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course.

#### **REFERENCE BOOKS:**

1. C: The Complete Reference, By Herbert Schildt.
2. C Programming Language, By Brain W. Kernighan.
3. Kernighan & Ritchie: The C Programming Language (PHI).
4. P. K. Sinha & Priti Sinha: Computer Fundamentals (BPB).
5. E. Balaguruswamy: Programming in ANSI C (TMH).
6. Kamthane: Programming with ANSI and TURBO C (Pearson Education).
7. V. Rajaraman: Programming in C (PHI – EEE).
8. S. Byron Gottfried: Programming with C (TMH).
9. Yashwant Kanitkar: Let us C .
10. P.B. Kottur: Programming in C (Sapna Book House).

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**CA C-3: ACCOUNTANCY (THEORY): 3 Credits 42 Hrs.**

**Unit-1: Introduction:** History and Development of Accounting, Meaning, Objectives and functions of Accounting, Book keeping V/s Accounting, Users of accounting data, systems of book keeping and accounting, branches of accounting, advantages and limitations of accounting.

**Accounting Concepts and Convention:** Meaning, need and classification, accounting standards meaning, need and classification of Indian accounting standards. Accounting principles V/s accounting standard. **14 Hrs.**

**Unit-2: Financial Accounting Process:** Classification of accounting transactions and accounts, rules of debit and credit as per Double Entry System. Journalization and Ledger posting.

**Preparation of Different Subsidiary Books:** Purchase Day book Sales Day Book, Purchase Returns Day Book, Sales Returns Day Book, Cash Book.  
Bank Reconciliation Statement: Meaning, Causes of Difference, Advantages, Preparation of Bank Reconciliation Statements. **14 Hrs.**

**Unit-3: Account Procedure:** Honor of the Bill, Dishonor of the Bill, Endorsement, Discounting, Renewal, Bill for collection, Retirement of the Bill, Accommodation Bills, Bill Receivable Book and Payable Book.

Preparation of Trial Balance: Rectification of errors and Journal Proper.

**Preparation of Final Accounts:** Meaning, need and classification, Preparation of Manufacturing, Trading, Profit and loss account and Balance-Sheet of sale-traders and partnership firms. **14 Hrs.**

**REFERENCE BOOKS:**

1. S. Ramesh, B.S. Chandrashekar, A Text Book of Accountancy.
2. V.A. Patil and J.S. Korihalli, Book – keeping and accounting, (R. Chand and Co. Delhi).
3. R. S. Singhal, Principles of Accountancy, (Nageen Prakash pvt. Lit. Meerut).
4. M. B. Kadkol, Book – Keeping and Accountancy, (Renuka Prakashan, Hubli).
5. Vithal, Sharma: Accounting for Management, Macmillan Publishers, Mumbai.
6. B.S. Raman, Accountancy, (United Publishers, Mangalore).
7. Tulsian, Accounting and Financial Management – I: Financial Accounting – Person Education.

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**II SEMESTER**

**Course Outcomes:** After completing this course satisfactorily, a student will be able to:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms.
- Describe common applications for arrays, records, linked structures, stacks, queues, trees, and graphs.

- Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs.
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance
- Describe the concept of recursion, give examples of its use.
- Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.
- Understand the features of Java and the architecture of JVM.
- Write, compile, and execute Java programs that may include basic data types and control flow constructs and how type casting is done.
- Identify classes, objects, members of a class and relationships among them needed for a specific problem and demonstrate the concepts of polymorphism and inheritance.
- The students will be able to demonstrate programs based on interfaces and threads and explain the benefits of JAVA's Exceptional handling mechanism compared to other Programming Language.
- Write, compile, execute Java programs that include GUIs and event driven programming and also programs based on files.
- Implement Object Oriented programming concept using basic syntaxes of control Structures.
- Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
- Demonstrates how to achieve reusability using inheritance.
- Demonstrate understanding and use of interfaces, packages, different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.
- Identify and describe common user interface components to design GUI in Java using Applet & AWT along with response to events.

#### **CA C-4: DATA STRUCTURES USING C (THEORY):      3 Credits    42 Hrs.**

**Unit-1: Introduction to data structures:** Definition; Types of data structures - Primitive & Non-primitive, Linear and Non-linear; Operations on data structures.

Dynamic memory allocation: Static & Dynamic memory allocation; Memory allocation and de-allocation functions - *malloc*, *calloc*, *realloc* and *free*.

Algorithm Specification, Performance Analysis, Performance Measurement.

Recursion: Definition; Types of recursions; Recursion Technique Examples - GCD, Binomial coefficient  $nCr$ , Towers of Hanoi; Comparison between iterative and recursive functions.

**Arrays:** Basic Concepts–Definition, Declaration, Initialisation, Operations on arrays; Types of arrays; Arrays as abstract data types (ADT); Representation of Linear Arrays in memory.

**14 Hrs.**

**Unit-2: Traversing linear arrays;** Inserting and deleting elements; Sorting – Selection sort, Bubble sort, Quick sort, Selection sort, Insertion sort; Searching - Sequential Search, Binary search; Iterative and Recursive searching; Multidimensional arrays; Representation of multidimensional arrays; Sparse matrices.

**Linked list:** Basic Concepts – Definition and Representation of linked list, Types of linked lists - Singly linked list, Doubly linked list, Header linked list, Circular linked list; Representation of Linked list in Memory; Operations on Singly linked lists – Traversing, Searching, Insertion, Deletion; Memory allocation; Garbage collection. **14 Hrs.**

**Unit-3: Stacks:** Basic Concepts – Definition and Representation of stacks; Operations on stacks; Applications of stacks; Infix, postfix and prefix notations; Conversion from infix to postfix using stack; Evaluation of postfix expression using stack; Application of stack in function calls.

**Queues:** Basic Concepts – Definition and Representation of queues; Types of queues - Simple queues, Circular queues, Double ended queues, Priority queues; Operations on Simple queues;

**Trees:** Definition; Tree terminologies –node, root node, parent node, ancestors of a node, siblings, terminal & non-terminal nodes, degree of a node, level, edge, path, depth;

**Binary tree:** Type of binary trees - strict binary tree, complete binary tree, binary search tree and heap tree; Array representation of binary tree. Traversal of binary tree; preorder, inorder and postorder traversal. **14 Hrs.**

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**CA CP-3: DATA STRUCTURES (PRACTICAL): 2 Credits 56 Hrs.**

### LIST OF EXPERIMENTS

#### Part-A:

1. Program to find GCD using recursive function.
2. Program to display Pascal Triangle using binomial function.
3. Program to generate n Fibonacci numbers using recursive function.
4. Program to implement Towers of Hanoi.
5. Program to implement dynamic array, find smallest and largest element of the array.
6. Program to create two files to store even and odd numbers.
7. Program to create a file to store student records.
8. Program to read the names of cities and arrange them alphabetically.
9. Program to sort the given list using selection sort technique.
10. Program to sort the given list using bubble sort technique.

#### Part B:

1. Program to sort the given list using insertion sort technique.
2. Program to sort the given list using quick sort technique.
3. Program to sort the given list using merge sort technique.



4. Program to search an element using linear search technique.
5. Program to search an element using recursive binary search technique.
6. Program to implement Stack.
7. Program to convert an infix expression to postfix.
8. Program to implement simple queue.
9. Program to implement linear linked list.
10. Program to display traversal of a tree.

#### REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni: Fundamentals of Data Structures.
2. Tanenbaum: Data structures using C (Pearson Education).
3. Kamathane: Introduction to Data structures (Pearson Education).
4. Y. Kanitkar: Data Structures Using C (BPB).
5. Kottur: Data Structure Using C.
6. Padma Reddy: Data Structure Using C.
7. Sudipa Mukherjee: Data Structures using C-1000 Problems and Solutions (McGraw Hill Education, 2007)).

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#### CA C-5: OBJECT ORIENTED PROGRAMMING WITH JAVA (THEORY):

3 Credits

42 Hrs.

**Unit-1: Introduction to Java:** Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

**Objects and Classes:** Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference. **14 Hrs.**

**Unit-2: Inheritance and Polymorphism:** Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

**Event and GUI programming:** Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism. **14 Hrs.**

**Unit-3: I/O programming:** Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

**Multithreading in Java:** Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try catch-finally, Collections in java, Introduction to JavaBeans and Network Programming. **14 Hrs.**

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**CA CP-4: JAVA (PRACTICAL):      2 Credits    56 Hrs.**  
**LIST OF EXPERIMENTS**

**Practice Lab**

1. Program to print the following triangle of numbers  
1  
1 2  
1 2 3  
1 2 3 4  
1 2 3 4 5
2. Program to simple java application, to print the message, "Welcome to java"
3. Program to display the month of a year. Months of the year should be held in an array.
4. Program to find the area of rectangle.
5. program to demonstrate a division by zero exception
6. Program to create a user defined exception say Pay Out of Bounds.

**PART A: Java Fundamentals OOPs in Java**

1. Program to assign two integer values to X and Y. Using the 'if' statement the output of the program should display a message whether X is greater than Y.
2. Program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint Fact of 4 = 4\*3\*2\*1).
3. Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
4. Program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MulDiv that extends from AddSub class to use the member data of the super class. MulDiv should have methods to multiply and divide A main function should access the methods and perform the mathematical operations.
5. Program with class variable that is available for all instances of a class. Use static variable declaration. Observe the changes that occur in the object's member variable values.
6. Program
  - a. To find the area and circumference of the circle by accepting the radius from the user.
  - b. To accept a number and find whether the number is Prime or not.
7. Program to create a student class with following attributes;
8. Enrollment No: Name, Mark of sub1, Mark of sub2, mark of sub3, Total Marks. Total of the three marks must be calculated only when the student passes in all three subjects. The pass mark for each subject is 50. If a candidate fails in any one of the subjects his total mark must be declared as zero. Using this condition write a constructor for this class. Write separate functions for accepting and displaying

student details. In the main method create an array of three student objects and display the details.

9. In a college first year class are having the following attributes Name of the class (BCA, BCom, BSc), Name of the staff No of the students in the class, Array of students in the class.
10. Define a class called first year with above attributes and define a suitable constructor. Also write a method called best Student () which process a first-year object and return the student with the highest total mark. In the main method define a first-year object and find the best student of this class.
11. Program to define a class called employee with the name and date of appointment. Create ten employee objects as an array and sort them as per their date of appointment. ie, print them as per their seniority.
12. Create a package 'student. Fulltime. BCA 'in your current working directory
  - a. Create a default class student in the above package with the following attributes: Name, age, sex.
  - b. Have methods for storing as well as displaying.

### **PART B: Exception Handling & GUI Programming**

1. Program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.
2. Program to handle Null Pointer Exception and use the "finally" method to display a message to the user.
3. Program which create and displays a message on the window.
4. Program to draw several shapes in the created window.
5. Program to create an applet and draw grid lines.
6. Program which creates a frame with two buttons father and mother. When we click the father button the name of the father, his age and designation must appear. When we click mother similar details of mother also appear.
7. Create a frame which displays your personal details with respect to a button click.
8. Create a simple applet which reveals the personal information of yours.
9. Program to move different shapes according to the arrow key pressed.
10. Program to create a window when we press M or m the window displays Good Morning, A or the window displays Good After Noon E or e the window displays Good Evening, N or n the window displays Good Night.
11. Demonstrate the various mouse handling events using suitable example.
12. Program to create menu bar and pull-down menus.

Note: Student has to execute a minimum of 10 programs in each part to complete the Lab course.

### **REFERENCE BOOKS:**

1. Programming with Java, By E Balagurusamy – A Primer, Fourth Edition, Tata McGraw Hill Education Private Limited.
2. Core Java Volume I – Fundamentals, By Cay S. Horstmann, Prentice Hall.

3. Object Oriented Programming with Java: Somashekara, M.T., Guru, D.S., Manjunatha, K.S.
4. Java 2 - The Complete Reference – McGraw Hill publication.
5. Java - The Complete Reference, 7th Edition, By Herbert Schildt– McGraw Hill publication.

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### **CA C-6: DISCRETE MATHEMATICAL STRUCTURES (THEORY):**

**3 Credits**

**42 Hrs.**

**Course Outcomes:** After completing this course satisfactorily, a student will be able to:

- To understand the basic concepts of Mathematical reasoning, set and functions.
- To understand various counting techniques and principle of inclusion and exclusions.
- Understand the concepts of various types of relations, partial ordering and equivalence relations.
- Apply the concepts of generating functions to solve the recurrence relations.
- Familiarize the fundamental concepts of graph theory and shortest path algorithm.

**Unit-1: The Foundations:** Logic and proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

**Basic Structures:** Sets, Functions, Sequences, Sums, and Matrices: Sets, set operations, Functions, Sequences and Summations, matrices. **14 Hrs.**

**Unit-2: Counting:** Basics of counting, Pigeonhole principle, Permutation and combination, Binomial Coefficient and Combination, Generating Permutation and Combination.

**Advanced Counting Techniques:** Applications of Recurrence Relations, Solving Linear Recurrence, Relations, Divide and Conquer Algorithms and Recurrence Relations, Generating functions, Inclusion-Exclusion, Applications of Inclusion-exclusion.

**Induction and Recursion:** Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Corrections. **14 Hrs.**

**Unit-3: Relation:** Properties of relation, Composition of relation, Closer operation on relation, Equivalence relation and partition. Operation on relation, Representing relation.

**Graphs:** Graphs and Graph models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring. **14 Hrs.**

**REFERENCE BOOKS**

1. Discrete Mathematics and Its Applications, Kenneth H. Rosen: Seventh Edition, 2012.
2. Discrete Mathematical Structure, Bernard Kolman, Robert C, Busby, Sharon Ross, 2003.
3. Graph Theory with Applications to Engg and Comp. Sci: Narsingh Deo-PHI 1986.
4. Discrete and Combinatorial Mathematics Ralph P. Grimaldi, B. V. Ramatta, Pearson, Education, 5 Edition.
5. Discrete Mathematical Structures, Trembley and Manobar.

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**QUESTION PAPER (THEORY)****(Applicable to CA C-1, CA C-2, CA C-3, CA C-4, CA C-5, and CA C-6 Papers)****Time: 02 Hours****Max. Marks: 60****PART-A**

Answer any Five of the following questions (Two questions from each unit)

**5 X 2 = 10**

- 1** a)  
b)  
c)  
d)  
e)  
f)  
g)  
h)

**PART-B**

Answer any Five of the following questions (Two questions from each unit)

**5 X 4 = 20****Q2-Q9****PART-C**

Answer any Three of the following questions (Minimum one question from each unit)

**3 X 10 = 30****Q10 -Q14**

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**SCHEME OF EXAMINATION (PRACTICALS)****Time: 03 Hours****Max. Marks: 25****CA CP-1: INFORMATION TECHNOLOGY (PRACTICAL):****2 CREDITS**

| <b>Assessment Criteria</b>         |                                     | <b>Marks</b> |
|------------------------------------|-------------------------------------|--------------|
| Activity – 1 from Part A           | Write up on the activity/ task      | 05           |
|                                    | Demonstration of the activity/ task | 05           |
| Activity-2 from Part B             | Write up on the activity/ task      | 05           |
|                                    | Demonstration of the activity/ task | 05           |
| Viva Voice based on Lab Activities |                                     | 05           |
| <b>Total</b>                       |                                     | <b>25</b>    |

**CA CP-2: C PROGRAMMING (PRACTICAL): 2 CREDITS**

| <b>Assessment Criteria</b>         |                          | <b>Marks</b> |
|------------------------------------|--------------------------|--------------|
| Program – 1 from Part A            | Flowchart / Algorithm    | 02           |
|                                    | Writing the Program      | 05           |
|                                    | Execution and Formatting | 03           |
| Program -2 from Part B             | Flowchart/Algorithm      | 02           |
|                                    | Writing the Program      | 05           |
|                                    | Execution and Formatting | 03           |
| Viva Voice based on Lab Activities |                          | 05           |
| <b>Total</b>                       |                          | <b>25</b>    |

**CA CP-3: C PROGRAMMING (PRACTICAL): 2 CREDITS**

| <b>Assessment Criteria</b>        |                          | <b>Marks</b> |
|-----------------------------------|--------------------------|--------------|
| Program – 1 from Part A           | Flowchart / Algorithm    | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Program -2 from Part B            | Flowchart/Algorithm      | 02           |
|                                   | Writing the Program      | 05           |
|                                   | Execution and Formatting | 03           |
| Viva Voice based on C Programming |                          | 05           |
| <b>Total</b>                      |                          | <b>25</b>    |

**CA CP-4: JAVA (PRACTICAL): 2 CREDITS**

| <b>Assessment Criteria</b>                                |                          | <b>Marks</b> |
|-----------------------------------------------------------|--------------------------|--------------|
| Program – 1 from Part A                                   | Flowchart / Algorithm    | 02           |
|                                                           | Writing the Program      | 05           |
|                                                           | Execution and Formatting | 03           |
| Program -2 from Part B                                    | Flowchart/Algorithm      | 02           |
|                                                           | Writing the Program      | 05           |
|                                                           | Execution and Formatting | 03           |
| Viva Voice based on Object Oriented Programming with JAVA |                          | 05           |
| <b>Total</b>                                              |                          | <b>25</b>    |

**Note:** Duly certified practical record shall be submitted at the practical examination (No evaluation of record in the examination).

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## **Bachelor of Business Administration (BBA) (Basic/Hons.) Degree Programme**

### **Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020**

**(2021-22 Batch Onwards)**

#### **BOARD OF STUDIES: PROCEEDINGS**

The meeting of BOS BBA was held at the Department of Management Science, Yuvaraja's College, Mysore on 26-11-2021.

| Sl. No. | Members                                                                                                       | Position | Signature/<br>Remarks |
|---------|---------------------------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Prof. Anand. D.<br>Department of Studies in Business Administration,<br>BIMS University of Mysore, Mysuru     | Chairman | Sd/                   |
| 2.      | Prof. S.J Manjunath<br>Department of Studies in Business Administration,<br>BIMS University of Mysore, Mysuru | Member   | Sd/                   |
| 3.      | Mrs. Geetha. N<br>Vidhyavardhaka First Grade College, Mysuru                                                  | Member   | Sd/                   |
| 4.      | Dr. S. Manju, Department of Commerce<br>Maharani's Management and Commerce College, Mysuru                    | Member   | Sd/                   |
| 5.      | Dr. A.C. Pramila, Department of Commerce, Maharaja<br>College, Mysuru                                         | Member   | Sd/                   |
| 6.      | Dr. M. Veena, Department of Management ,<br>Maharani's Women's Commerce and Management<br>College, Mysuru     | Member   | Sd/                   |
| 7.      | Mr. Sudhindra, Managing Partner,<br>Career Point, Mysuru                                                      | Member   | Sd/                   |

Chairperson welcomed the members of Board of Studies to the meeting and placed before them the agenda of the discussion.

The board prepared and approved

- The syllabus for I and II semester of I BBA in accordance with NEP 2020 guidelines issued by the University of Mysore.
- It was decided to continue the same syllabus for the II and III BBA which was approved in the previous board 2020-21.
- Approved the panel of examiners for the academic year 2021-22.

The chairperson thanked the members and the meeting was concluded.

26-11-2021

Chairman,



### Details of Course of Study: I and II Semesters

| Sem.      | Discipline Core/<br>Open Elective Paper<br>(L+T+P)                          | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|-----------|-----------------------------------------------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| <b>I</b>  | BBA C-1: Management Principles & Practice (4+0+0)                           | 4                          | 4       | 40                                        | 60                                        |
|           | BBA C-2: Fundamentals of Business Accounting (4+0+0)                        | 4                          | 4       | 40                                        | 60                                        |
|           | BBA C-3: Marketing Management (4+0+0)                                       | 4                          | 4       | 40                                        | 60                                        |
|           | OE-1: Business Organization (3+0+0)                                         | 3                          | 3       | 40                                        | 60                                        |
|           | OE-2: Office Organization and Management (3+0+0)                            | 3                          | 3       | 40                                        | 60                                        |
| <b>II</b> | BBA C-4: Financial Accounting and Reporting (4+0+0)                         | 4                          | 4       | 40                                        | 60                                        |
|           | BBA C-5: Human Resource Management (4+0+0)                                  | 4                          | 4       | 40                                        | 60                                        |
|           | BBA C-6A: Business Environment OR<br>BBA C-6A: Business Mathematics (4+0+0) | 4                          | 4       | 40                                        | 60                                        |
|           | OE-3: People Management (3+0+0)                                             | 3                          | 3       | 40                                        | 60                                        |
|           | OE-4: Retail Management (3+0+0)                                             | 3                          | 3       | 40                                        | 60                                        |

#### Objectives:

- To develop the skills required for the application of business concepts and techniques learned in the classroom at the workplace.
- To provide competent and technical skills personnel to the industry in the area of Marketing, Finance, Human Resource, Data Analytics, Retailing and Logistics and Supply Chain Management. To enhance the employability skills of the management students.
- To enhance the capability of the students, improve their decision-making skills.
- To encourage entrepreneurship among students pursuing education in the field of Business Administration.
- To empower students for pursuing professional courses like MBA, Chartered Accountancy, Company Secretary, etc.,
- To ensure holistic development of Business administration students.

## I SEMESTER

### **BBA C-1: MANAGEMENT PRINCIPLES & PRACTICE (THEORY): 4 Credits 56 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate;

- The ability to understand concepts of business management, principles and function of management.
- The ability to explain the process of planning and decision making.
- The ability to create organization structures based on authority, task and responsibilities.
- The ability to explain the principles of direction, importance of communication, barrier of communication, motivation theories and leadership styles.
- The ability to understand the requirement of good control system and control techniques.

**Pedagogy:** Classrooms lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.

#### **Module 1: Introduction to Management:**

Introduction –Meaning, Evolution of management thought, Pre-Scientific Management Era, Classical Management Era, Neo-Classical Management Era, Modern Management Era; Nature and Characteristics of Management - Scope and Functional areas of Management; Management as a Science, Art or Profession; Management and Administration; Principles of Management.

#### **Module 2: Planning and Decision Making:**

Nature, Importance and Purpose of Planning - Planning Process; Objectives; Types of plans (Meaning only); Decision making- Importance and steps; MBO and MBE (Meaning only).

#### **Module 3: Organizing and Staffing:**

Nature and purpose of Organization; Principles of Organizing; Delegation of Authority; Types of Organization - Departmentation, Committees; Centralization vs Decentralization of Authority and Responsibility, Span of Control; Nature and importance of Staffing.

#### **Module 4: Directing and Communicating:**

Meaning and Nature of Direction, Principles of Direction; Communication - Meaning and Importance, Communication Process, Barriers to Communication, Steps to overcome Communication Barriers, Types of Communication; Motivation theories – Maslow's Need Hierarchy Theory, Herzberg's Two Factor Theory, Mc.Gregor's X and Y theory. Leadership – Meaning, Formal and Informal Leadership, Characteristics of Leadership; Leadership Styles – Autocratic Style, Democratic Style, Participative Style, Laissez Faire Leadership Styles, Transition Leadership, Charismatic Leadership Style.

**Module 5: Coordinating and Controlling:**

Coordination–Meaning, Importance and Principles. Controlling–Meaning and steps in controlling, Essentials of Effective Control system, Techniques of Control (in brief) Business Social Responsibility - Meaning, Arguments for and against Business Social Responsibility; Green management - Meaning, Green Management Actions; Managerial Ethics – Meaning - Importance of Ethics in Business, Factors that determine Ethical or Unethical behavior.

**Skill Developments Activities:**

- ❖ Two cases on the above syllabus should be analyzed by the teacher in the classroom and the same needs to be recorded by the student in the Skill Development Book.
- ❖ Draft different types of Organization structure.
- ❖ Draft Control charts.

**REFERENCE BOOKS:**

1. Stephen P. Robbins, Management, Pearson.
2. Koontz and O'Donnell, Management, McGraw Hill.
3. L M Prasad, Principles of management, Sultan Chand and Sons.
4. V.S.P. Rao/Bajaj, Management process and organization, Excel Books.GH25.
5. T. Ramaswamy: Principles of Management, HPH.

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**BBA C-2: FUNDAMENTALS OF BUSINESS ACCOUNTING (THEORY):****4 Credits****56 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate;

- Understand the framework of accounting as well accounting standards.
- The Ability to pass journal entries and prepare ledger accounts.
- The Ability to prepare subsidiaries books.
- The Ability to prepare trial balance and final accounts of proprietary concern.
- Construct final accounts through application of tally.

**Pedagogy:** Classroom's lecture, tutorials, and problem solving.

**Module 1: Introduction to Financial Accounting:**

Introduction – Meaning and Definition – Objectives of Accounting – Functions of Accounting – Users of Accounting Information – Limitations of Accounting – Accounting Cycle - Accounting Principles – Accounting Concepts and Accounting Conventions. Accounting Standards – objectives- significance of accounting standards. List of Indian Accounting Standards.

**Module 2: Accounting Process:**

Meaning of Double entry system – Process of Accounting – Kinds of Accounts – Rules - Transaction Analysis – Journal – Ledger – Balancing of Accounts – Trial Balance – Problems on Journal, Ledger Posting and Preparation of Trial Balance.

**Module 3: Subsidiary Books:**

Meaning – Significance – Types of Subsidiary Books –Preparation of Purchases Book, Sales Book, Purchase Returns Book, Sales Return Book, Bills Receivable Book, Bills Payable Book. Types of Cash Book- Simple Cash Book, Double Column Cash Book , Three Column Cash Book and Petty Cash Book(Problems only on Three Column Cash Book and Petty Cash Book), Bank Reconciliation Statement – Preparation of Bank Reconciliation Statement (Problems on BRS).

**Module 4: Final Accounts of Proprietary Concern:**

Preparation of Statement of Profit and Loss and Balance Sheet of a proprietary concern with special adjustments like depreciation, outstanding and prepaid expenses, outstanding and received in advance of incomes, provision for doubtful debts, drawings and interest on capital.

**Module 5: Accounting Software:**

Introduction-meaning of accounting software, types accounting software-accounting software Tally-Meaning of Tally software – Features – Advantages, Creating a New Company, Basic Currency information, other information, Company features and Inventory features. Configuring Tally - General Configuration, Numerical symbols, accounts/inventory info – master configuration -voucher entry configuration. Working in Tally: Groups, Ledgers, writing voucher, different types of voucher, voucher entry Problem on Voucher entry - Generating Basic Reports in Tally-Trial Balance, Accounts books, Cash Book, Bank Books, Ledger Accounts, Group Summary, Sales Register and Purchase Register, Journal Register, Statement of Accounts, and Balance Sheet.

**Skill Developments Activities:**

- ❖ List out the accounting concepts and conventions. Prepare a Bank Reconciliation Statement with imaginary figures.
- ❖ Collect the financial statement of a proprietary concern and record it.
- ❖ Prepare a financial statement of an imaginary company using tally software.

**REFERENCE BOOKS:**

1. Hanif and Mukherjee, Financial Accounting, Mc Graw Hill Publishers.
2. Arulanandam & Raman; Advanced Accountancy, Himalaya Publishing House.
3. S. Anil Kumar, V. Rajesh Kumar and B. Mariyappa–Fundamentals of Accounting, Himalaya Publishing House.
4. Dr. S.N. Maheswari, Financial Accounting, Vikas Publication.
5. S P Jain and K. L. Narang, Financial Accounting, Kalyani Publication.

6. Radhaswamy and R.L. Gupta, Advanced Accounting, Sultan Chand.
7. M.C. Shukla and Goyel, Advanced Accounting, S Chand.

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### **BBA C-3: MARKETING MANAGEMENT (THEORY): 4 Credits 56 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate;

- Understand the concepts and functions of marketing.
- Analyse marketing environment impacting the business.
- Segment the market and understand the consumer behavior.
- Describe the 4 p's of marketing and also strategize marketing mix.
- Describe 7 p's of service marketing mix.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.

#### **Module 1: Introduction to Marketing:**

Meaning and Definition, Concepts of Marketing, Approaches to Marketing, Functions of Marketing. **Recent trends in Marketing**-E- business, Tele-marketing, M-Business, Green Marketing, Relationship Marketing, Concept Marketing, Digital Marketing, social media marketing and E-tailing (Meaning only).

#### **Module 2: Marketing Environment:**

**Micro Environment** – The company, suppliers, marketing intermediary's competitors, public and customers; **Macro Environment**- Demographic, Economic, Natural, Technological, Political, Legal, Socio-Cultural Environment.

#### **Module 3: Market Segmentation and Consumer Behaviour:**

Meaning and Definition, Bases of Market Segmentation, Requisites of Sound Market Segmentation; Consumer Behavior-Factors influencing Consumer Behavior; Buying Decision Process.

#### **Module 4: Marketing Mix:**

Meaning, Elements of Marketing Mix (Four P's) – Product, Price, Place, Promotion. Product-Product Mix, Product Line, Product Lifecycle, New Product Development, Reasons for Failure of New Product, Branding, Packing and Packaging, Labeling, Pricing – Objectives, Factors influencing Pricing Policy, Methods of Pricing; Physical Distribution–Meaning, Factors affecting Channel Selection, Types of Marketing Channels. Promotion – Meaning and Significance of Promotion, Personal Selling and Advertising (Meaning Only).

#### **Module 5: Services Marketing:**

Meaning and definition of services, difference between goods and services, features of services, seven P's of services marketing (concepts only).

**Skill Developments Activities:**

- ❖ Two cases on the above syllabus should be analyzed and recorded in the skill development.
- ❖ Design a logo and tagline for a product of your choice.
- ❖ Develop an advertisement copy for a product.
- ❖ Prepare a chart for distribution network for different products

**REFERENCE BOOKS:**

1. Philip Kotler, Marketing Management, Prentice Hall.
2. Lovelock Christopher, Services Marketing: People, Technology, Strategy, PHI.
3. William J. Stanton, Michael J. Etzel, Bruce J Walker, Fundamentals of Marketing, McGraw Hill Education.
4. Bose Biplab, Marketing Management, Himalaya Publishers.
5. J.C. Gandhi, Marketing Management, Tata McGraw Hill.
6. Ramesh and Jayanti Prasad: Marketing Management, I.K. International.
7. Sontakki, Marketing Management, Kalyani Publishers.

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**Open Elective Course (OE):****OE-1: BUSINESS ORGANIZATION (THEORY): 3 Credits 45 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate:

- An understanding of the nature, objectives and social responsibilities of business.
- An ability to describe the different forms of organisations.
- An understanding of the basic concepts of management.
- An understanding of functions of management.
- An understanding of different types of business combinations.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.

**Module 1: Introduction to Business:**

**Business:** Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business. Concept of Business Organisation.

**Module 2: Forms of Business Organization:**

Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits.

**Module 3: Public Enterprises:**

Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits.

**Module 4: Business Combinations:**

Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations.

**Module 5: Management of Organizations:**

Management-Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

**Skill Developments Activities:**

- ❖ Preparation of partnership deed.
- ❖ Draw a business tree. Make a list of 10 PSUs.
- ❖ Prepare a list of different types of business combinations.

**REFERENCE BOOKS:**

1. C B. Gupta - Business Organisation and Management, Sultan Chand & Sons.
2. Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan.
3. M. C. Shukla - Business Organisation and Management. S Chand & Company Ltd.
4. S.A Sherlekar - Business Organization, Himalaya Publishing House.
5. Y.K. Bhushan. Fundamentals of Business Organisation and Management, S. Chand & Sons.
6. R.K. Sharma, Business Organisation & Management Kalyani Publishers.
7. Dr. I.M. Sahai, Dr. Padmakar Asthana, 'Business Organisation & Administration', Sahitya Bhawan Publications Agra.

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**OE-2: OFFICE ORGANIZATION AND MANAGEMENT (THEORY): 3 Credits 45 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate;

- An understanding of basic knowledge of office organisation and management.
- Demonstrate skills in effective office organization.
- Ability to maintain office records.
- Ability to maintain digital record.
- Understanding of different types of organisation structures and responsibilities as future office managers.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.



**Module 1: Fundamentals of Office Management: Introduction:** Meaning, importance and functions of modern office. **Modern Office Organisation:** Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types. **Nature of office services:** Types of services in a modern office, decentralisation and centralisation of office services, Departmentation of Office. **Office management:** Meaning, Elements and major processes of Office management. **Office Manager:** Functions and qualifications of Office manager.

**Module 2: Administrative Arrangement and Facilities:**

**Office Accommodation and its Importance:** Location of Office, Choice of Location: Urban vs Suburban, Factors to be Considered in Selecting the Site, Securing Office Space. **Office Lay-out:** Objectives of Office Lay-out, Principles of Office Lay-out, steps in Lay-out Planning, Advantages of a Good Lay-out. **Types of offices:** Open Office and Private Office- advantages and disadvantages.

**Module 3: Office Environment:**

**Meaning and Components of Office Environment: Interior Decoration:** Colour Conditioning, Floor Coverings, Furnishings. **Furniture and Fixtures:** Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture.

**Lighting** and Ventilation, **Noise:** Internal Noise, External Noise. Cleanliness, Sanitation and Health. Safety and Security.

**Module 4: Records Management:**

**Introduction to records:** Importance of Records, types of office records. **Records Management:** Meaning, Principles of Record Keeping, Functions of 'Records Management. **Filing:** Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files, Filing Procedure or Routine. **Filing Methods:** Horizontal Filing -meaning, types and advantages, Vertical Filing- meaning, equipment used, advantage and disadvantages. **Centralisation and Decentralisation of Filing-** Centralised filing and Decentralised Filing. **Office manual:** contents, Importance, types of office manuals. **Indexing:** Meaning, importance, advantages and essentials of good indexing, type of Index. **Retention and disposal of files:** Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

**Module 5: Office Mechanisation and Data Processing:**

**Meaning, Importance and Objectives of Office Mechanisation,** Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation. **Kinds of Office Machines:** Duplicating Machines and Photocopying Machines, Accounting, tabulating and computing machines, communication machines. **Introduction to Data and Information:** Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Lifecycle (chart). **Data Collection Methods-** Primary and secondary data collection methods. **Data**

**presentation** Methods of Presentation of Data. **Data processing using computers:** Components of Computers, Input and Output Devices, Software used in Computers (names and uses only), Computer Applications in Office' Management, Advantages and Limitations of Computerisation.

**Skill Developments Activities:**

- ❖ Visit an office and enlist the different types of machines used in the office.
- ❖ Identify the different types of stationery used in offices today.
- ❖ Draw a data life cycle chart.
- ❖ Draw charts indicating different types of office layouts.

**REFERENCE BOOKS:**

1. S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd.
2. M.E Thakuram Rao, Office organisation and Management, Atlantic.
3. Judith Read, Mary Lea Ginn, Record Management, 10<sup>th</sup> Edition, Cengage Learning.

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## **II SEMESTER**

**BBA C-4: FINANCIAL ACCOUNTING AND REPORTING (THEORY): 4 Credits 56 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will demonstrate;

- The ability to prepare final accounts of partnership firms.
- The ability to understand the process of public issue of shares and accounting for the same
- The ability to prepare final accounts of joint stock companies.
- The ability to prepare and evaluate vertical and horizontal analysis of financial statements.
- The ability to understand company's annual reports.

**Pedagogy:** Classroom's lecture, tutorials, and Problem Solving.

**Module 1: Final Accounts of Partnership Firm:**

Meaning of Partnership Firm, Partnership deed-clauses in partnership deed, Preparation of Final accounts of partnership Firm-Trading and Profit and Loss Account, Profit and Loss Appropriation Account, Partners capital account and Balance sheet. Goodwill-Nature, Factors influencing goodwill and methods of valuation of goodwill (Average and super profit methods).

**Module 2: Issue of Shares:**

Meaning of Share, Types of Shares – Preference shares and Equity shares – Issue of Shares at par, at Premium, at Discount: Pro-Rata Allotment; Journal Entries relating to issue of shares; Preparation of respective ledger accounts; Preparation of Balance Sheet in the Vertical form (Practical Problems).

**Module 3: Final Accounts of Joint Stock Companies:**

Statutory Provisions regarding preparation of Company Final Accounts – Treatment of Special Items, Managerial Remuneration, Tax deducted at source, Advance payment of Tax, Provision for Tax, Depreciation, Interest on debentures, Dividends, Rules regarding payment of dividends, Transfer to Reserves, Preparation of Profit and Loss Account and Balance Sheet (Vertical Form Schedule -III) (Practical Problems).

**Module 4: Financial Statements Analysis:**

Comparative Statements - Comparative Income Statement, Comparative Balance Sheet; Common size Statements – Common Size Income Statement, Common Size Balance Sheet – Trend Percentages. (Analysis and Interpretation).

**Module 5: Corporate Financial Reporting Practices:**

Corporate Financial Reporting - meaning, types, characteristics of Corporate financial report, users of corporate financial report; Components corporate financial report– general corporate information, financial highlights, letter to the shareholders from the CEO, management's discussion and analysis; Financial Statements–balance sheet, income statement, cash flow statement, and notes to the financial statements; Auditor's report; Significant Accounting Policies; Corporate Governance Report; Corporate Social Responsibility Report (Discuss only Role and Significance of above components of corporate financial report).

**Skill Developments Activities:**

- ❖ Collect financial statement of a company for five years and analyse the same using trend analysis.
- ❖ Refer annual reports of two companies and list out the components.
- ❖ Draft a partnership deed as per Partnership Act.
- ❖ List out the accounting policies in annual report of the company.

**REFERENCE BOOKS:**

1. B S Raman, Financial Accounting, HPH.
2. RL Gupta & Radhaswamy M, Advanced Accounting. S Chand and co., New Delhi.
3. C. Shukla and T S Grewal, Advanced accounting, S Chand and co., New Delhi.
4. S P Jain and Narong K L, Financial Accounting, Tenth Edition, Kalyani Publishers, New. Delhi.

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**BBA C-5: HUMAN RESOURCE MANAGEMENT (THEORY): 4 Credits 56 Hrs.**

**Course Outcomes:** On successful completion of the course, the students will be able to demonstrate;

- Ability to describe the role and responsibility of Human resources management functions on business.
- Ability to describe HRP, Recruitment and Selection process.
- Ability to describe to induction, training, and compensation aspects.

- Ability to explain performance appraisal and its process.
- Ability to demonstrate Employee Engagement and Psychological Contract.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies & field work etc.,

### **Module 1: Introduction to Human Resource Management.**

Meaning and Definition of HRM – Features Objectives, Differences between Human Resource Management and Personnel Management, Importance, Functions and Process of HRM, Role of HR Manager, Trends influencing HR practices.

### **Module 2: Human Resource Planning, Recruitment & Selection Human Resource Planning:**

Meaning and Importance of Human Resource Planning, Process of HRP. **HR Demand Forecasting-** Meaning and Techniques (Meanings Only) and HR supply forecasting. **Succession Planning** – Meaning and Features. **Job Analysis:** Meaning and Uses of Job Analysis, Process of Job Analysis – Job Description, Job Specification, Job Enlargement, Job Rotation, Job Enrichment (Meanings Only). **Recruitment** – Meaning, Methods of Recruitment, Factors affecting Recruitment, Sources of Recruitment. **Selection** – Meaning, steps in Selection Process, Psychometric tests for Selection, Barriers to effective Selection, Making Selection effective; Placement, Gamification – Meaning and Features.

**Module 3: Induction, Training and Compensation: In Induction:** Meaning, Objectives and Purpose of Induction, Problems faced during Induction, Induction Program Planning. **Training:** Need for training, Benefits of training, Assessment of Training Needs and Methods of Training and Development; Kirkpatrick Model; Career Development. **Compensation:** Direct and Indirect forms of Compensation (Meaning Only), Compensation Structure.

**Module 4: Performance Appraisal, Promotion & Transfers Performance appraisal:** Meaning and Definition, Objectives and Methods of Performance Appraisal – Uses and Limitations of Performance Appraisal, Process of Performance Appraisal. **Promotion:** Meaning and Definition of Promotion, Purpose of Promotion, Basis of promotion. **Transfer:** Meaning of Transfer, Reasons for Transfer, Types of Transfer, Right Sizing of Work Force, Need for Right Sizing.

**Module 5: Employee Engagement and Psychological Contract Employee Engagement (EE):** Meaning and Types of EE, Drivers of Engagement - Measurement of EE, Benefits of EE. **Psychological contract:** Meaning and features.

### **Skill Developments Activities:**

- Preparation of Job Descriptions and Job specifications for a Job profile.
- Choose any MNC and present your observations on training program.
- Develop a format for performance appraisal of an employee.
- Discussion of any two Employee Engagement models.

- Analysis of components of pay structure based on the CTC sent by the Corporate to the institute for the various jobs of different sectors.

#### REFERENCE BOOKS:

1. Aswathappa, Human Resource Management, McGraw Hill.
2. Edwin Flippo, Personnel Management, McGraw Hill.
3. C.B. Mamoria, Personnel Management, HPH.
4. Subba Rao, Personnel and Human Resources Management, HPH.
5. Madhurimalal, Human Resource Management, HPH.
6. Rajkumar: Human Resource Management I.K. Intl.
7. Michael Porter, HRM and Human Relations, Juta & Co. Ltd.
8. K. Venkataramana, Human Resource Management, SHBP. Chartered Accountants of India, New Delhi.

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#### **BBA C-6A: BUSINESS ENVIRONMENT (THEORY):      4 Credits      56 Hrs.**

**Course Outcomes:** On successful completion Student will demonstrate;

An Understanding of components of business environment. Ability to analyse the environmental factors influencing business organisation. Ability to demonstrate Competitive structure analysis for select industry. Ability to explain the impact of fiscal policy and monetary policy on business. Ability to analyse the impact of economic environmental factors on business.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

#### **Module 1: Introduction Business Environment:**

Meaning of business, scope and objectives Business, business environment, Micro and Macro-environment of business (social, cultural, economic, political, legal technological and natural) Impact of these factors on decision making in business, Environmental analysis, and Competitive structure analysis of Business.

#### **Module 2: Government and Legal Environment:**

**Government Functions** of the State, Economic role of government, State intervention in business- reasons for and types of state intervention in business. Impact of Monetary policy, Fiscal policy, Exim policy and industrial policy on business. **Legal environment** - Various laws affecting Indian businesses.

#### **Module 3: Economic Environment and Global Environment:**

An overview of economic environment, nature of the economy, structure of economy, factors affecting economic environment. **Globalisation of business;** meaning and dimensions, stages, essential conditions of globalisation, foreign market entry strategies, merits and demerits of globalisation of business, Impact of Globalisation on Indian businesses, Forms of globalisation of businesses - MNCs, TNCs etc.

**Module 4: Technological Environment:**

Meaning and features; types of innovation, Impact of Technological changes on business, Technology and Society, Technological Acquisition modes, IT revolution and business, Management of Technology.

**Module 5: Natural Environment:**

Meaning and nature of physical environment. Impact of Natural environment on business.

**Skill Developments Activities:**

- List out key features of recent Monetary policy published by RBI impacting businesses.
- Give your observation as to how technology has helped society.
- Draft Five Forces Model for Imaginary business. Identify the benefits of Digital transformation in India.

**REFERENCE BOOKS:**

1. Dr. K Ashwatappa: Essentials of Business Environment.
2. Sundaram & Black: The International Business Environment; Prentice Hall.
3. Chidambaram: Business Environment; Vikas Publishing.
4. Upadhyay, S: Business Environment, Asia Books.
5. Chopra, BK: Business Environment in India, Everest Publishing.
6. Suresh Bedi: Business Environment, Excel Books.
7. Economic Environment of Business by M. Ashikary.
8. Business Environment by Francis Cherrinulam.

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**BBA C-6B: BUSINESS MATHEMATICS (THEORY): 4 Credits 56 Hrs.**

**Course Outcomes:** On successful completion Student will demonstrate;

- The Understanding of the basic concepts of business maths and apply them to create solve and interpret application problems in business.
- Ability to solve problems on various types of equation.
- Ability to solve problems on Matrices and execute the laws of indices, law of logarithm and evaluate them.
- Ability to apply the concept of simple interest and compound interest bills discounted etc. and apply them in day-to-day life.
- Ability to solve problems on Arithmetic progression, Geometric progression and construct logical application of these concepts.

**Pedagogy:** Classroom's lecture, tutorials, Problem solving.

**Module 1: Number System:**

Introduction – Natural Numbers - Even Numbers – Odd Numbers – Integers – Prime Numbers – Rational and Irrational numbers, Real Numbers, HCF and LCM (Simple problems).

**Module 2: Theory of Equations:**

Introduction – Meaning – Types of Equations – Simple/ Linear Equations and Simultaneous Equations (only two variables), Elimination and Substitution Methods only. Quadratic Equation - Factorization and Formula Method ( $ax^2 + bx + c = 0$  form only). Simple problems.

**Module 3: Indices, Matrices and Logarithms:**

Meaning – types – operation on matrices – additions – subtractions and multiplication of two matrices – transpose – determinants – minor of an element – co-factor of an element – inverse – crammers rule in two variables – problems. Indices and Logarithms: Meaning- Basic Laws of Indices and their application for simplification. Laws of Logarithms – Common Logarithm, Application of Log Table for Simplification.

**Module 4: Commercial Arithmetic:**

Simple Interest, Compound Interest including yearly and half yearly calculations, Annuities, Percentages, Bills Discounting, Ratios and proportions, duplicate-triplicate and sub-duplicate of a ratio. Proportions: third, fourth and inverse proportion - problems.

**Module 5: Progressions:**

Arithmetic Progression - Finding the ' $n^{\text{th}}$ ' term of AP and Sum to  $n^{\text{th}}$  term of AP. Insertion of Arithmetic Mean Geometric Progression – Finding the ' $n^{\text{th}}$ ' term of GP and sum to ' $n^{\text{th}}$ ' term of GP and insertion of Geometric Mean.

**Skill Developments Activities:**

- Develop an Amortization Table for Loan Amount – EMI Calculation.
- Secondary overhead distribution summary using Simultaneous Equations Method.
- Application of Matrix In Business Problems.

**REFERENCE BOOKS:**

1. Saha: Mathematics for Cost Accountants, Central Publishers.
2. R.G. Saha and Others – Methods and Techniques for Business Decisions, VBH.
3. Dr. Sancheti and Kapoor: Business Mathematics and Statistics, Sultan Chand.
4. Zamarudeen: Business Mathematics, Vikas.
5. R.S Bhardwaj: Mathematics for Economics and Business.
6. Madappa, Mahadi Hassan, M. Iqbal Taiyab – Business Mathematics,
7. Subhash. G.R. Veena and Seema: Business Mathematics and Statistics I.K. Intl Publishers.

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## Open Elective Course (OE):

**OE-3: PEOPLE MANAGEMENT (THEORY):      3 Credits      45 Hrs.**

**Course outcome:** On successful completion of the course, student will demonstrate:

- Ability to examine the difference between People Management with Human Resource Management.
- Ability to explain the need for and importance of People Management.
- Ability to explain role of manager in different stages of performance management process.
- Ability to list modern methods of performance and task assessment.
- Ability to analyse the factors influencing the work life balance of a working individual.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.

### **Module 1: Introduction to People Management:**

Diversity in organisation: age, gender, ethnicity, race, and ability. People Management: Meaning, Features, Significance of people management, Difference between People Management and Human Resource Management, impact of individual and organizational factors on people management.

### **Module 2: Getting Work Done and Assessment and Evaluation:**

Getting work done: Challenges of getting work done, significance of prioritization and assigning work to team members. Performance Management: meaning, role of a manager in the different stages of the performance management process, Types of Performance assessment, Assessment and Evaluation Process of evaluation of tasks in the organisation. Modern tools of assessment and evaluation of tasks and performance.

**Module 3: Building Peer Networks and Essentials of Communication: Building Peer Networks:** Understanding the importance of peer networks in an organization; being able to influence those on whom you have no authority; challenges Peer networking and different types of people networking in the workplace. **Essentials of Communication:** Concept of the communication process with reflection on various barriers to effective communication and ways to overcome, Types of Communication and Channels of Communication.

### **Module 4: Motivation:**

Meaning, Importance and need for motivation, team motivation- meaning, importance team motivation, types of Motivators and Modern methods of motivation.

### **Module 5: Managing Self:**

Reflection on what does it mean to be a people manager; building a personal development plan for oneself, Self-Stress Management: Causes for stress, work life Balance, Importance of Work life balance, Factors influencing Work Life Balance.

**Skill Developments Activities:**

- Analyse two cases on any of the above content indicated above.
- List out the modern tools to performance assessment and evaluation.
- Conduct a survey of work life balance of working individuals.
- Draft a Career development of working individual in the middle level management.

**REFERENCE BOOKS:**

1. McShane, Steven L. and Mary Ann Von Glinow, Organizational Behavior: Emerging Knowledge and Practice for the Real World. McGraw-Hill, latest edition.
2. Bernardin, H. John and Joyce E. A. Russell. Human Resource Management: An Experiential Approach. McGraw-Hill, 6/e.
3. Argyris, C. (1974). Personality vs. Organization. Organizational Dynamics. Vol. 3. No. 2, Autumn. Blume.
4. B. Baldwin, T. and Ryan, K. (2013). Communication Apprehension. A barrier to student's leadership, adaptability and multicultural appreciation. Academy of Management Learning & Education, Jun, Vol. 12 Issue 2, p158-172.
5. Colquitt, J.A., LePine, J.A., & Wesson, M.J. (2009) Organizational Behavior: Improving Performance and Commitment in the Workplace (International edition). New York: McGraw-Hill.
6. Goleman, D. (1998). Working with Emotional Intelligence. Bantam Books.

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**OE-4: RETAIL MANAGEMENT (THEORY):                      3 Credits                      45 Hrs.****Course Outcomes:** On successful completion Student will demonstrate;

- An understanding of the types and forms of Retail business.
- Ability to examine Consumer Behaviour in various environment.
- Ability to analyse various Retail operations and evaluate them.
- Ability to analyse various marketing mix elements in retail operations.
- An understanding of Information Technology in retail business.

**Pedagogy:** Classroom's lecture, tutorials, Group discussion, Seminar, Case studies.**Module 1: Introduction to Retail Business:**

Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

**Module 2: Consumer Behaviour in Retail Business:**

Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

**Module 3: Retail Operations:**

Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual

merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

#### **Module 4: Retail Marketing Mix:**

Introduction -Product: Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing: Influencing factors – approaches to pricing – price sensitivity - Value pricing – Markdown pricing. Place: Supply channel – SCM principles – Retail logistics – computerized replenishment system – corporate replenishment policies. Promotion: Setting objectives – communication effects - promotional mix.

#### **Module 5: Information Technology in Retailing:**

Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

#### **Skill Developments Activities:**

- Draw a retail life cycle chart and list the stages.
- Draw a chart showing a store operation.
- List out the major functions of a store manager diagrammatically.
- List out the current trends in e-retailing.
- List out the Factors Influencing in the location of a New Retail outlet.

#### **REFERENCE BOOKS:**

1. Suja Nair; Retail Management, HPH.
2. Karthic – Retail Management, HPH.
3. S.K. Poddar & others – Retail Management, VBH.
4. R.S. Tiwari; Retail Management, HPH.

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#### **QUESTION PAPER (THEORY)**

**(Applicable to BBA C-1, C-2, C-3, C-4, C-5, and C-6 Papers)**

**Time: 02 Hours**

**Max. Marks: 60**

##### **PART-A**

Answer ALL of the following questions

**5 X 2 = 10**

- Q1** a)  
b)  
c)  
d)  
e)

##### **PART-B**

Answer any FOUR of the following questions

**4 X 5 = 20**

**Q2 -Q7**

##### **PART-C**

Answer any Three of the following questions

**3 X 10 = 30**

**Q8 - Q12**

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**Open Elective Papers Across the Faculty for B.Sc. (Basic/Hons.),  
BCA (Basic/Hons.), BBA (Basic/Hons.), and B.Sc.  
(Basic/Hons.)/Integrated M.Sc. (Five Years) Degree in Molecular  
Biology Programmes**

**Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**Details of Course of Study: I and II Semesters**

| <b>Sem.</b> | <b>Open Elective Papers<br/>(L+T+P)</b>                                     | <b>Teaching<br/>hours/<br/>week</b> | <b>Credits</b> | <b>Internal<br/>Assessment<br/>Marks (C1 + C2)</b> | <b>Semester End<br/>Examination<br/>Marks (C3)</b> |
|-------------|-----------------------------------------------------------------------------|-------------------------------------|----------------|----------------------------------------------------|----------------------------------------------------|
| <b>I</b>    | OE-1: Human Rights<br>(Political Science) (3+0+0)                           | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-2: Human Resources<br>Management (Public<br>Administration) (3+0+0)      | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-3: Public Personnel<br>Administration (Public<br>Administration) (3+0+0) | 3                                   | 3              | 40                                                 | 60                                                 |
| <b>II</b>   | OE-1: Indian Polity: Issues<br>and Concerns (Political<br>Science) (3+0+0)  | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-2: International<br>Relations (Political Science)<br>(3+0+0)             | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-3: Management of NGO's<br>(Public Administration)<br>(3+0+0)             | 3                                   | 3              | 40                                                 | 60                                                 |
|             | OE-4: State Administration<br>(Public Administration)<br>(3+0+0)            | 3                                   | 3              | 40                                                 | 60                                                 |

**I SEMESTER**

**OE-1: HUMAN RIGHTS (THEORY):            3 Credits            45 Hrs.**

**Course Outcome:** This course aims to introduce the students to basic concepts and practices of Human Rights in the global and local domain. This course also exposes them to certain recent issues confronting the Human Rights debates.

**Learning Outcome:** After completing this course student will be able to;

- Explain the basic concept of Human Rights and its various formulations.

- Have necessary knowledge and skills for analyzing, interpreting, and applying the Human Rights standards and sensitize them to the issues.
- Develop ability to critically analyse Human Rights situations around them.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

**Unit-I: 15 Hrs.**

**Chapter-1:** Meaning, nature, scope and Classification of Human Rights.

**Chapter-2:** The Human Rights of First generation (Civil and Political Rights), Second generation (Economic, Social and Cultural Rights), Third generation (Collective Rights) and Fourth generation (Subjective Rights).

**Chapter-3:** Universal Declaration of Human Rights, RTI as Human Right.

**Unit-2: 15 Hrs.**

**Chapter-4:** Human Rights and Fundamental Rights, Fundamental Rights and Fundamental Duties in India.

**Chapter-5:** National Human Rights Commission (NHRC) -Composition and its function.

**Chapter-6:** Karnataka State Human Rights Commissions (KSHRCs) – Composition and its functions.

**Unit-3: 15 Hrs.**

**Chapter-7:** National Commission for SCs/STs, Minorities' Commission, Women Commission.

**Chapter-8:** Major issues and concerns of Human Rights- Discrimination and violence against women, children, Dalits and Minorities, Child Labour and Bonded Labour.

**Chapter-9:** Challenges to Human Rights.

**Exercise:**

- ❖ Group Discussion on Human Rights and its types (comparison of Western and Eastern concept of Human Rights).
- ❖ Students can be asked to do collage making and present the same.
- ❖ Find out the different types of complaints received by NHRC and bring out the end results on any one of such case.
- ❖ In order to make it more participatory learning, the students are required to visit the website of NHRC ([www.nhrc.nic.in](http://www.nhrc.nic.in)), wherein at the left-hand side, a link is provided to the 'instructions. After going through the guidelines issued by NHRC's, briefly explain the guidelines on – Custodial death/rape, Encounter death, and Guidelines on arr.

**REFERENCE BOOKS**

1. Baxi Upendra (ed.), The Right to be Human, Lancer International, Crawford, New Delhi, 1987.

2. James(ed.), The Rights of People, Oxford, New York, 1988.
3. Craston, M. What are Human Rights, Bodely Head, London, 1973.
4. RhondaL. Callaway & Julie Harrelson-Stephens, "International Human Rights", Published by viva books private limited, New Delhi, 2010.
5. Janusz Symonides, "Human Rights Concept and Standards", Rawat Publications, New Delhi, 2019.
6. Sunil Deshta and KiranDeshta, "Fundamental Human Rights", Deep and Deep Publications, New Delhi, 2011.
7. Donnelly, Jack and Rhoda Howard (ed.), International Handbook of Human Rights, Westport, Connecticut: Greenwood Press, 1987.
8. Donnelly, Jack, Universal Human Rights in Theory and Practice, New Delhi, 2005.
9. Tapan Biswal, "Human Rights Gender and Environment", Viva Books Private Limited Publishers, New Delhi 2006
10. Satya.P. Kanan, "Human Rights Evolution and Development", Wisdom Press, New Delhi 2012.
11. Gerwith, Human Rights: Essays on Justification and Application, University of Chicago Press, Chicago,1982.
12. Khan, Mumtaz Ali, Human Rights and the Dalits, Uppal Publishing House, New Delhi, 1995.
13. V.T. Patil, "Human Rights Developments in South Asia", Authors Press Publishers, Delhi 2003.
14. Dr. S.K. Gupta, "Statewise Comprehensive Information on Human Right Violation", Published by ALP Books, Delhi. 2009
15. Acharya, B.C. A Handbook of Women Human Rights, Wisdom Press, New Delhi, 2011.
16. South Asia Human Rights Documentation Centre, Introducing Human Rights, Oxford, New Delhi, 2006.
17. Lillich, R. International Human Rights: Law Policy and Practice, Boston: Little Brown and Co., 1991 2<sup>nd</sup>Edn.

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## **OE-2: HUMAN RESOURCES MANAGEMENT (THEORY):            3 Credits        45 Hrs.**

**Objective:** To help students understand, appreciate and analyze work force at the managerial and non-managerial levels. The course also facilitates learning of various concepts, new trends and skills required for Planning, managing and development of human resources for organizational effectiveness.

**Learning Outcome:** At the end of the course the students shall;

- Understand the scope and importance of Human Resource Management.
- Develop ability to take appropriate decisions in Human Resource Management.
- Understand the process involved in the Recruitment, Training, Managing Discipline and Grievance.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial,

Interactive Sessions, Self-guided Learning Materials, Open Educational Resources (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

**Unit-I: 15 Hrs.**

**Chapter-1:** Definition, Concept, Features, Objectives, Functions, Scope and Development of Human Resource Management, Human Resource Practices-Challenges to HR executives.

**Chapter-2:** Personnel Management in India-Functions of the Labour Welfare Officer, Difference Between Personnel Management and Human Resource Management.

**Chapter-3:** Personnel Policies: Meaning, types and process.

**Unit-2: 15 Hrs.**

**Chapter-4:** Recruitment & Selection: Concepts, sources and Methods, Human Resource Development.

**Chapter-5:** Training, Model and Methods.

**Chapter-6:** Managing Discipline, Managing Grievance, Employee Counselling.

**Unit-3: 15 Hrs.**

**Chapter-7:** Concept-Process of Employee Empowerment.

**Chapter-8:** Empowerment in Indian Scenario.

**Chapter-9:** Empowerment in Global Scenario, IT and HR.

**Exercise:**

- ❖ Visit the Labour office and list the staff along with their designations.
- ❖ Attend any job interview and write the process of Recruitment.
- ❖ Write the experience of attending the Job interview.

**REFERENCE BOOKS**

1. Cascio W F and Nambudiri R; 'Managing Human Resources' – Productivity, Quality of Worklife, Profits, Mc Graw Hill, Latest Edition.
2. Noe R A, Hollenbeck JR, Gerhart B and Wright P M, 'Human Resource Management' – Gaining a competitive advantage, Mc Graw Hill, Latest Edition
3. Beardwell, Ian and Len Holden; 'Human Resource Management'; Macmillan India Ltd.; Latest Edition.
4. Dessler, Gary; 'A Framework for Human Resource Management'; Pearson Education India; Latest Edition.

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**OE-3: PUBLIC PERSONNEL ADMINISTRATION (THEORY): 3 Credits 45 Hrs.**

**Objective:** This course will aim at creating awareness about the evolution and growth of the discipline. To make students learn about basic principles of Public Personnel Administration. and to give clarity of basic concepts.

**Learning Outcome:** At the end of the course the students shall;

- To explain the basic concepts of Public Personnel Administration.
- To know the methods of recruitment of Public Servants.
- Understand the Rights and Duties of Employee.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

**Unit-I: 15 Hrs.**

**Chapter-1:** Civil services – meaning, importance, features and functions of civil services.

**Chapter-2:** Recruitment - Types, Merits, demerits.

**Chapter-3:** Training – Types, aims and objective.

**Unit-2: 15 Hrs.**

**Chapter-4:** Promotion, its principles – Merits and Demerits.

**Chapter-5:** Morale.

**Chapter-6:** Discipline – Formal and Informal Disciplinary measures.

**Unit-3: 15 Hrs.**

**Chapter-7:** Salary.

**Chapter-8:** Retirement - Need for Retirement, Retirement benefits.

**Chapter-9:** Employee Unions, Associations, Rights and Duties of the Employees.

**Exercise:**

- ❖ Students can visit government offices in their respective places.
- ❖ Students must work for one day in any government office in their locality.
- ❖ Debates can be conducted for students. Students will interview public officials.

**REFERENCE BOOKS**

1. Public Administration – Principles and Practice by A.R.Tyagi.
2. Public Administration by Bhambhri.
3. Public Administration Theory and practice – by M.P Sharma.
4. Principles of Public Administration by Avasthi & Maheshwari.

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## II SEMESTER

### OE-1: INDIAN POLITY: ISSUES AND CONCERNS (THEORY): 3 Credits 45 Hrs.

**Course Outcome:** To make the students aware on different issues that exists in Indian polity. Through this paper student need to understand the emerging issues and their causes to the Indian Democracy.

**Learning Outcome:** After completing this course student will be able to;

- Understand the reasons behind the causes of these issues and also the constitutional provisions that existed.
- Familiarize with the debates that emerged.
- Be able to suggest the measures to control such issues.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

#### Unit-I: 15 Hrs.

**Chapter-1:** National Integration and Social Harmony - Meaning and importance of National Integration and Essentials of National Integration.

**Chapter-2:** Society and Politics in India: Caste, Class, Ethnicity and Gender, role and Impact on Indian Polity.

**Chapter-3:** Language- Role and Constitutional Provisions, Issues.

#### Unit-2: 15 Hrs.

**Chapter-4:** Religion and Traditions-Role and Constitutional Provisions.

**Chapter-5:** Development and Inclusiveness: Issues and Concerns.

**Chapter-6:** Regionalism – Reasons for the Growth, Forms and Measures.

#### Unit-3: 15 Hrs.

**Chapter-7:** Corruptions- Causes and Measures.

**Chapter-8:** Terrorism- Types, Causes and Measures.

**Chapter-9:** Celebrating Diversity – Consensus and Challenges.

**Exercise:**

- ❖ Classify the major factors which are an impediment to National Integration and give your suggestions.
- ❖ Identify the terrorist's group in the world.
- ❖ Make a point on 2011 Anti- Corruption movement in India.

### REFERENCE BOOKS

1. M. Galanter, 'The Long Half-Life of Reservations', in Z. Hasan, E. Sridharan and R. Sudarshan (eds.) India's Living Constitution: Ideas, Practices, Controversies, New Delhi: Permanent Black, 2002.
2. C. Jaffrelot, 'The Politics of the OBCs', in Seminar, Issue, 2005.

3. Singh, M.P. & Saxena, R. Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning, 2008.
4. Vanaik, A. & Bhargava, R. (eds.) Understanding Contemporary India: Critical Perspectives. New Delhi: Orient Blackswan, 2010.
5. Dunkin Jalaki "Bharatadalli Jativyavste ideye?", Malladahalli Publication, Malladahalli.

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## **OE-2: INTERNATIONAL RELATIONS (THEORY): 3 Credits 45 Hrs.**

**Course Outcome:** This course aims to introduce the students to basic concepts, Institutions and Issues of Global Politics. This course also exposes them to the Understanding OF Power Politics of Regional and Global level.

**Learning Outcome:** After completing this course student will be able to;

- Understand and reflect on basic concepts, Institutions and Issues of International Relations Global Politics.
- Develop and deepen the sense of Cosmopolitanism
- To acquire General knowledge for Competitive exam.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

### **Unit-I: 15 Hrs.**

**Chapter-1:** Meaning, Nature, scope and Importance of International Relations.

**Chapter-2:** Key Concepts- National Power, National interest, National Security, Diplomacy, Balance of Power, Collective security, Deterrence.

**Chapter-3:** India and her Neighbors- Pakistan and China.

### **Unit-2: 15 Hrs.**

**Chapter-4:** World Organizations- UN, Principles and Objectives, Major Organs, Working of UN, Achievements and Failures.

**Chapter-5:** UNESCO, WHO, ILO, WB.

**Chapter-6:** Regionalism in World Politics- Meaning and Importance- SAARC, ASEAN, EU, OPEC, SHANGHAI. COOPERATION Organization, BRICS.

### **Unit-3: 15 Hrs.**

**Chapter-7:** Global Issues- Poverty, Development, Environment.

**Chapter-8:** Military alliances- NATO, SEATO, NSG, QUAD (India, America, Japan, Australia).

**Chapter-9:** Pacific settlement of International Disputes.

#### **Exercise:**

- ❖ Group discussion on Issues affecting India and her Neighbors.
- ❖ Students will be engaged in critical evaluation of global and Regional Institutions.

- ❖ Students will be asked to debates on contemporary issues of World Politics.

### REFERENCE BOOKS

1. Palmer and Perkins-International Relations.
2. H.J Morgenthau, Politica among Nations.
3. Mahendra Kumar, Theoretical Aspects of International Relations.
4. Prakash Chandra, International politics.
5. S.C Singhal, introduction to Word politics.
6. JC Johari, international Relations and politics.
7. U Sharma, International Relations.
8. Rumki Basu, International Relations.

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### OE-3: MANAGEMENT OF NGO'S (THEORY): 3 Credits 45 Hrs.

**Course Objectives:** To acquire specific knowledge on NGO management. To understand the basic concepts and principles involved in managing NGOs. To understand the Project Management Dimensions, Planning and its implementation. To enhance skills and techniques for Resource Mobilization.

**Learning Outcome:** After completing this course student will be able to;

- Learn the functions of NGO management along with its legal structure.
- Understand about Project management Dimensions, Planning and its implementation.
- Acquire the Skills and techniques of project evaluation / Resource Mobilization.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

#### Unit-I: 15 Hrs.

**Chapter-1:** Management: Meaning, Definition, Concepts, Objectives and Functions.

**Chapter-2:** NGO's: Meaning, Definition, Concepts, Types, Functions, Role of NGO's in Community Development.

**Chapter-3:** Organizational Structure of NGO's as per Trust and Society Registration Acts.

#### Unit-2: 15 Hrs.

**Chapter-4:** Foreign contributions and Regulation Act (FCRA) - Statutory Obligations- Income Tax Exemption (80-G, 12-A, & 35AC): Rules and Regulation.

**Chapter-5:** Resource Mobilization: Methods and Techniques of Fund Raising - International, National and Local Levels.

**Chapter-6:** Leadership in the NGO's Context - Practice of Human Resource Management in NGO's - Human Resource Management and role of creating change agents - Staffing, Recruiting, Induction and Training.

**Unit-3:****15 Hrs.**

**Chapter-7:** CSR Activities: Definition, concepts and need - Concentration areas of CSR, Role of Social Workers in CSR.

**Chapter-8:** Concept, Meaning, Definition and Types of projects, Projects Implementation and Management: Project Planning Matrix, Project Cycle Management- Identification and Formulation of Details Projects Report (DPP) with reference to Action AID and Save the Children.

**Chapter-9:** Monitoring and Evaluation (PERT and CPM), Rural Appraisal (PRA): Tools and Techniques, SWOC (Strengths, Weaknesses, Opportunities, Challenges) Analysis.

**Exercise:**

- ❖ Learn the process involved in the Registration of NGO.
- ❖ Make a list of NGO's and their role in your locality.
- ❖ Prepare a proposal on child issues. Importance of Project Planning (On any Topic).

**REFERENCE BOOKS**

1. Behera M. C, Globalizing Rural Development. New Delhi: Sage, 2006.
2. Chowdhry Paul, Administration of Social Welfare Programmes in India, Bombay: Somaia, 1973.
3. Emmanuvel. S. Fernando, Prospect from Problems, Mumbai: St. Francis Xavier's Church, 1999.
4. Ginsbery Leon. H, Social Work Evaluation – Principles and Methods, Singapore: Allyn and Bacon, 2001.
5. Jack Rothman, John John E. Tropman, Strategies of Community Intervention, Illinois: P.E. Peacock, 2001.
6. Joel S.G.R Bhose, NGO's and Rural Development Theory and Practice, New Delhi: Concept, 2003.
7. Julie Fisher, Non-Governments – NGO's and the Political Development of the Third World, New Delhi: Rawat, 2003.
8. Clark John, Voluntary Organizations: Their Contribution to Development, London: Earth Scan, 1991.
9. Jain R.B, NGO's in Development Perspective, New Delhi: Vivek Prakasan, 1995.
10. Sakararan and Rodrigues, Handbook for the Management of Voluntary Organization, Madras: Alfa, 1983.

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**OE-4: STATE ADMINISTRATION (THEORY): 3 Credits 45 Hrs.**

**Course Objectives:** This course will aim at creating awareness about the evolution and growth of the discipline. To make students learn about basic ideas of State Administration. And to give clarity of basic concepts.

**Learning Outcome:** After completing this course student will be able to;

- To explain the basic concepts of state administration.
- To know the working of state administration.
- To know the role played by different authorities in state administration.

**Pedagogy:** The course shall be taught through the Bridge Courses, Lecture, Tutorial, Interactive Sessions, Self-guided Learning Materials, Open Educational Recourses (OER) as reference materials, Practical Exercises, Assignments, Seminars, Group Discussions and Week-end Counseling Classes.

**Unit-I:** **15 Hrs.**

**Chapter-1:** Constitution Frame work of States in India, Governor: Appointment Powers & Functions.

**Chapter-2:** Chief Minister: Powers, Role and Position. Council of Ministers.

**Chapter-3:** State Legislature. Organisation and Structure of State Administration.

**Unit-2:** **15 Hrs.**

**Chapter-4:** State Secretariat and Directorate: Organisation, role and Functions.

**Chapter-5:** Chief Secretary: Role and Position in State Administration.

**Chapter-6:** State Planning Board. Divisional Commissioner: Powers, Functions and Position.

**Unit-3:** **15 Hrs.**

**Chapter-7:** District Administration: Evolution, Features and Functions. District Collector: Evolution, Appointment, Functions and Position.

**Chapter-8:** Police Administration at District Level: Organisation and Functions. Role and Functions of Superintendent of Police, Other Functionaries.

**Chapter-9:** Sub-District Level: Sub-Divisional Magistrate, Block Development and Panchayat Officer, Tehsildar.

**Exercise:**

- ❖ Students can visit government offices in their respective places.
- ❖ Students must work for one day in any government office in their locality.
- ❖ Debates can be conducted for students. Students will interview public officials.

#### REFERENCE BOOKS

1. Indian Administration by Avasthi and Avasthi.
2. Introduction to the Constitution of India by Basu, D.D.
3. Indian Administration by Fadia and Fadia.
4. The Indian Constitution – Corner Stone of a Nation by Granville Austin.
5. Indian Administration by S.R Maheswari.

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**SCHEME OF EXAMINATION**  
**(Common for all open elective papers across the faculty)**

**Internal Assessment Evaluation (40 Marks)**

|                                                           | C1 Marks  | C2 Marks  |
|-----------------------------------------------------------|-----------|-----------|
| Test-1                                                    | 10        | ---       |
| Seminar/Presentation/Group Discussion/Assignment/ Quiz    | 10        | ----      |
| Test-2                                                    | ---       | 10        |
| Assignment/Book reviews/Reports on field visits/ Seminars | ---       | 10        |
| Total                                                     | <b>20</b> | <b>20</b> |

**QUESTION PAPER: THEORY EXAMINATION**  
**(Applicable to all Open Elective papers)**

**Time: 02 Hours**

**Max. Marks: 60**

**PART-A**

Answer any FIVE of the following (Equal weightage be given for all units of the syllabus) **5 x 2 = 10**

- Q1** a)  
 b)  
 c)  
 d)  
 e)  
 f)  
 g)

**PART-B**

Answer any FIVE of the following (Equal weightage be given for all units of the syllabus) **5 x 10 = 50**

**Q2 – Q9**

Sub-questions a), b) c) with a marks pattern of 3, 4, 5, 6 be given for questions 2-9.

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**Open Elective Papers of Physical Education for B.Sc. (Basic/Hons.),  
BCA (Basic/Hons.), BBA (Basic/Hons.), and B.Sc.  
(Basic/Hons.)/Integrated M.Sc. (Five Years) Degree in Molecular  
Biology Programmes**

**Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**Details of Course of Study: I and II Semesters**

| <b>Sem.</b> | <b>Open Elective Papers<br/>(L+T+P)</b>    | <b>Teaching<br/>hours/<br/>week</b> | <b>Credits</b> | <b>Internal<br/>Assessment<br/>Marks (C1 + C2)</b> | <b>Semester End<br/>Examination<br/>Marks (C3)</b> |
|-------------|--------------------------------------------|-------------------------------------|----------------|----------------------------------------------------|----------------------------------------------------|
| <b>I</b>    | OE-1: Self Defence (1+0+2)                 | <b>1 + 4</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |
|             | OE-2: Sports Event Management (2+0+2)      | <b>2 + 2</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |
|             | OE-3: Yoga and Fitness (1+0+2)             | <b>1 + 4</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |
| <b>II</b>   | OE-4: Adventurous Sports (3+0+0)           | <b>1 + 4</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |
|             | OE-5: Physical Fitness for Careers (3+0+0) | <b>1 + 4</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |
|             | OE-6: Sports and Recreation (3+0+0)        | <b>1 + 4</b>                        | <b>3</b>       | <b>40</b>                                          | <b>60</b>                                          |

**I SEMESTER**

**OE-1: SELF DEFENCE (THEORY/PRACTICAL): 3 Credits; 14 + 56 Hrs.**

**Unit-1: Theory:** **14 Hrs.**

- Importance and need of self-defense.
- Types of Defensive Skills.
- Conditioning Exercises - General and Specific Exercises.
- Development of Strength and Speed. Development of coordinative abilities.

**Unit-2: Practicals:** **56 Hrs.**

- Basic Skills for Self – Defense.
- Martial Arts.
- Kick Boxing and Wrestling.
- Defensive Skills with and without sticks (Lathi).
- Report Preparation, Records and PPT.

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**OE-2: SPORTS EVENT MANAGEMENT (THEORY/PRACT): 3 Credits; 28 + 28 Hrs.****Unit-1: Theory: 28 Hrs.**

- Meaning, Definition and importance of Sports Management.
- Scope of Sports Event Management.
- Principles of Sports Event Management.
- Major and Minor Sports Events.
- Traditional Games Management.

**Unit-2: Practicals: 28 Hrs.**

- Organization of Indoor Sports and Games Events.
- Project on Outdoor Sports and Games Events.
- Visits to Sports Clubs, Sports Stadiums, IPL, KPL and LeagueTournaments.
- Organization of Intramural - Sports Events, Sports Fests, Traditional Games Fest.
- Report Preparation, Records and PPT.

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**OE-3: YOGA AND FITNESS (THEORY/PRACTICAL): 3 Credits; 28 + 28 Hrs.****Unit-1: Theory: 14 Hrs.**

- Importance of Yoga and Fitness.
- Types and Principles of Asanas.
- Fitness Components.
- General and Specific Conditioning and its importance.
- Specific Exercises for Strength, Speed, Agility, Flexibility, Coordinative abilities. Yoga, Fitness and Personality.
- Nutrition for Fitness.

**Unit-2: Practicals: 56 Hrs.**

- General and Specific Warm up.
- Aerobics/Zumba/Dance.
- Asanas.
- Recreation for Fitness.
- Report Preparation, Records and PPT.

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**II SEMESTER****OE-4: ADVENTUROUS SPORTS (THEORY/PRACTICAL): 3 Credits; 14 + 56 Hrs.****Unit-1: Theory: 14 Hrs.**

- Importance of Adventure Sports.
- Types and Principles of Asanas.
- Definition, Classification, History- Development, Scope, Importance and Objectives.
- Types of Adventure Activities.
- Mountaineering – Trekking, Rock Climbing, Single Rope, Water Sports –River Rafting, Cannoning, Boating.

- Recent Trends in Adventure Sports.
- Job Opportunities in Adventure Sports.

**Unit-2: Practicals:****56 Hrs.**

- Fitness, Conditioning, Warming Up, Specific Exercises, Cooling Down.
- Practical, teaching, demonstration, training, technical training.
- Planning and Organizing-Mountaineering, Trekking, Rock Climbing, Single Rope, Para Sailing, Water Sports, etc
- Report Preparation, Records and PPT.

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**OE-5: PHYSICAL FITNESS FOR CAREERS (THEORY/PRACTICAL): 3 Credits; 14 + 56 Hrs.****Unit-1: Theory:****14 Hrs.**

- Importance of Yoga and Fitness
- Physical Standards: Men and Women
- Standard Fitness Tests:
- Fitness Tests for Defence Forces, PSI, Police Constable, Fire Force, Forest Department, Professional Courses-Sports & Physical Education
- General and Specific Conditioning and its importance
- Specific Tests for Strength Test, Speed Test, Agility Test, Flexibility Test, Coordinative abilities, etc
- Mode of Selections and Qualifying Standards

**Unit-2: Practicals:****56 Hrs.**

- General and Specific Warm up.
- Training for Endurance, Speed, Strength, Agility, Flexibility etc.
- Required Physical Fitness Tests: Strength Test, Speed Test.
- Agility Test, Flexibility Test, Coordinative abilities, etc.

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**OE-6: SPORTS AND RECREATION (THEORY/PRACTICAL): 3 Credits; 14 + 56 Hrs.****Unit-1: Theory:****14 Hrs.**

- Meaning, Definition and Concept of Fitness and Recreation
- Objectives, Characteristics and Principles of Fitness and Recreation
- Importance, Purpose, Benefits of Fitness and Recreation
- Types of Recreation
- Recreation through Sports and Games
- Use of Leisure Time Activities and their educational values

**Unit-2: Practicals:****56 Hrs.**

- Traditional, Folk and Indigenous Games
- Three Days outdoor camp and Hiking
- Cycling, tie up with District/ State Association
- Visit to Recreational Clubs.

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**Formative Assessment**

|            | <b>C1 Marks</b> | <b>C2 Marks</b> | <b>C3 Marks</b> |
|------------|-----------------|-----------------|-----------------|
| Theory     | 05              | 05              | 60              |
| Practicals | 15              | 15              | --              |
| Total      | 20              | 20              | 60              |

**QUESTION PAPER: THEORY EXAMINATION****(Applicable to all Open Elective papers of Physical Education)****Time: 02 Hours****Max. Marks: 60****PART-A**

Answer any FIVE of the following (Equal weightage be given for all units of the syllabus) **5 x 2 = 10**

- Q1** a)  
b)  
c)  
d)  
e)  
f)  
g)

**PART-B**

Answer any FIVE of the following (Equal weightage be given for all units of the syllabus) **5 x 10 = 50**

**Q2 - Q9**

Sub-questions a), b) c) with a marks pattern of 3, 4, 5, 6 be given for questions 2-9.

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**Ability Enhancement Compulsory Course (AECC)-Languages for  
B.Sc. (Basic/Hons.), B.C.A. (Basic/Hons.), B.B.A. (Basic/Hons.) and  
B.Sc. (Basic/Hons.)/Integrated Master (Five years) Degree in  
Molecular Biology**

**Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**Language: KANNADA**

PÀ£ÀßqÀ CzsÀåAiÀÄ£À ¢ÀÄAqÀ½, À¨sÉAiÀÄ £ÀqÁªÀ½

²ÄÊ,ÀÆgÄÄ «±Äé«zÁâ®AiÄÄzÄ ,ÄéAiÄÄvÄÛ PÄ-ÉÄdÄUÄ¼ÄÄ  
 CCüxÄiÄÄ²ÄÄ Chapter VI section 6.5 of the states relating to Autonomous College, Ref:  
 AiÄÄÄ.PÄ.²ÄÊ/C.²ÄÄ,À/883/2021-22 çÉÁAPÄ:8-11-2021 gÄ G-ÉÄÛRzÄAvÉ  
 AiÄÄÄ²ÄgÄd PÄ-ÉÄfÉÄ PÉÆoÄr ,ÄASÉâ: 37 gÄ°è çÉÁAPÄ: 26-11-2021 gÄAzÄÄ  
 ±ÄÄPÄæ²ÄgÄ PÄÉÄßqÄ CzsÄâAiÄÄÉÄ ²ÄÄAQÄ½AiÄÄ ,Ä`sÉ PÄgÉAiÄÄ-ÄVvÄÄÛ.  
 ,Ä`sÉAiÄÄ°è F PÉ¼ÄPÄAQÄ «µÄAiÄÄUÄ¼ÄÉÄÄß ,Ä²ÄðÉÄÄ²ÄvÄçAzÄ  
 CAVÄPÄj,Ä-Ä-ÄvÄÄ.

| Sl. No. | Members                 | Position | Signature/<br>Remarks |
|---------|-------------------------|----------|-----------------------|
| 1.      | qÁ. f. ²æÃxªÁ,À         | Chairman | Sd/                   |
| 2.      | qÁ. JA. J,ï. ¢À,ÀAvÀ    | Member   | Sd/                   |
| 3.      | qÁ. JA.  . gÉÃSÁ        | Member   | Sd/                   |
| 4.      | ºÉZi. Dgï. gÀ«PÀÄªÀiÁgÀ | Member   | Sd/                   |
| 5.      | PÉ. JZi C£Àß¥ÀÆtð       | Member   | Sd/                   |
| 6.      | qÁ. ¹.r. ¥ÀgÀ±ÀÄgÁªÀÄ   | Member   | Sd/                   |
| 7.      | qÁ. JA. ±ÀAPÀgÀ         | Member   | Sd/                   |
| 8.      | qÁ. PÉ. .Ë¨sÁUÀåªÀw     | Member   | Absent                |

- 1) 2021-22EE ±EEPAetAPA ,A°xazA gA¶OçAAiAA ²PAetxw (NEP) CEÀeAiAA  
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 æÀÄAqÀ½ ¹éÃPÀj¹ B.Sc., Molecular Biology, B.B.A. and B.C.A. ¥ÀzÀ«UÀ½UÉ  
 ¥ÀævÉâPÀ ¥ÀoÀâPÀæªÀªÀÆÀÄß C¼ÀªAr¹PÉÆ¼ÀÄîªÀAvÉ  
 wÃªAiÁð¶,À-Á-ÄvÀÄ.
- 2) CBSC ¥ÀoÀâPÀæªÀªÀÆÀ°è LzÀÄ æÀÄvÀÄÛ DgÀÆÉ ZÀvÀÄðªÀiÁ,ÀzÀ B.Sc.,  
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¥ÀoÀâPÀæªÀÄzÀ°èªÀÄÄPÀÛDAIÉÄÌÜÉ (Open Elective) CªÀPÁ±À ¢ÄrzÀÝjAzÀ  
 °ÉÆ,À ¥ÀoÀâPÀæªÀÄªÀÆÀÄB ZÀað¹gÄÆ¹,À-Á-ÄvÀÄ.

- 3) LzÄÄ æÀµÄðZÄ ,AAAiÉÆÄfvÄ CtÄfÄæÄ±Ä,ÄÜç «µÄAiÄÄZÄ°è PÄÆÄßqÄ "sÄµÉAiÄÄÆÄÄß "ÉÆÄçü,Ä"ÉÄPÄVgÄÄæÄÄZÄjAzÄ ©. J¹ÜÉ æUÄçü¥Är¹gÄÄæÄ ¥ÄoÄâPÄææÄÄæÄÆÉßÄ æÄÄÄAzÄÄæÄj,ÄÄæÄAvÉ J¹Äè ,ÄzÄ,ÄâgÄÄ wÄæÄAiÄðÆÄ PÉÊUÉÆAqÄgÄÄ.
- 4) °ÉÆ,Ä ²PÄët æÄwAiÄÄ (NEP) æÄÄPÄÜ DAIÉÄì (Open Elective) 5 æÄÄvÄÄÜ 6ÆÉÄAiÄÄ ZÄvÄÄæÄAiÄð,ÄzÄ ¥Äæ±Éß¥ÄwæPÉAiÄÄÆÄÄß æÄÄvÄÄÜ NEP AiÄÄ æÉÆzÄ®ÆÉAiÄÄ ZÄvÄÄæÄAiÄð,ÄzÄ ¥Äæ±Éß¥ÄwæPÉAiÄÄ æÄiÄzÄjAiÄÄÆÄÄß CÆÄÄæÉÆÄç,Ä¹Ä-ÄvÄÄ.
- 5) gÄ¶ÖçÄAiÄÄ ²PÄët æÄwAiÄÄ°è 40 CAPÄUÄ½ÜÉ EgÄÄæÄ DAvÄjPÄ æÄiÉ®âæÄiÄ¥ÄÆÄÄÆÄÄß ¹1 ÜÉ 20 CAPÄUÄ¼ÄÄ, ¹2 ÜÉ 20 CAPÄUÄ¼ÄÄ JAzÄÄ «"sÄV¹PÉÆ¼ÄÄ¹ÉÄPÉAzÄÄ ,ÄÆa,Ä¹Ä-ÄvÄÄ. EzÄgÄ°è MAZÄÄ æAiÉÆÄfvÄ PÄgÄâ 10 CAPÄUÄ½ÜÉ æÄÄvÄÄÜ QgÄÄ¥ÄjÄPÉè 10 CAPÄUÄ½ÜÉ JAzÄÄ wÄæÄAiÄðÆÄ PÉÊUÉÆ¼ÄÄ¹Ä-ÄvÄÄ.
- 6) 2021-22 ÆÉÄ ,Ä°ÆÄ PÄÆÄßqÄ ¥ÄjÄPÄè æÄÄAqÄ½AiÄÄ ,ÄzÄ,ÄâgÄÄUÄ¼Ä °É,ÄgÄÄUÄ¼ÄÆÄÄß ,ÄÆa,Ä¹Ä-ÄvÄÄ.
- 7) 2021-22 ÆÉÄ ,Ä°ÆÄ PÄÆÄßqÄ ¥ÄjÄPÄè æÄÄAqÄ½AiÄÄ ,ÄzÄ,ÄâgÄÄUÄ¼Ä °É,ÄgÄÄUÄ¼ÄÆÄÄß ,ÄÆa,Ä¹Ä-ÄvÄÄ.

26-11-2021  
Mysuru

Chairman,  
BOS in Kannada

### Details of Course of Study: I and II Semesters

| <b>Sem.</b> | <b>Discipline Core/<br/>Paper (L+T+P)</b> | <b>Teaching<br/>hours/<br/>week</b> | <b>Credits</b> | <b>Internal<br/>Assessment<br/>Marks (C1 +<br/>C2)</b> | <b>Semester<br/>End<br/>Examination<br/>Marks (C3)</b> |
|-------------|-------------------------------------------|-------------------------------------|----------------|--------------------------------------------------------|--------------------------------------------------------|
| <b>I</b>    | AECC: (L1-1): Kannada<br>(3+0+0)          | <b>4</b>                            | <b>3</b>       | <b>40</b>                                              | <b>60</b>                                              |
| <b>II</b>   | AECC: (L1-2): Kannada<br>(3+0+0)          | <b>4</b>                            | <b>3</b>       | <b>40</b>                                              | <b>60</b>                                              |

²ÉÆ,À gÁ¶ÖçÃAiÀÄ ²PÀèt ðAw 2020gÀ ÇÈÄÄ,ÁgÀ  
 PÀÈÀßqÀ ``sÁµÁ ¥ÀòÀâPÀæ³ÄÄ 2021-2020 £ÉÃ ±ÉÊPÀètÂPÀ ,Á°ðAzÀ  
 ÇÈÄÈAiÀÄ

©.J¹ì. É«Ä,ÀÖgï-1

Course Title

©. J1.-PÀ£ÀßqÀ "sÁµÁ ¥ÀoÀa

| « <b>ÀgÀUÀ¼ÄÄ</b>                 | “ <b>ÉÆÃzÀÉÁ C<sup>à</sup>Àçü</b> |
|-----------------------------------|-----------------------------------|
| WÀIPÀ-1 PÀÈÀßqÀ ÉÁqÀÄ-ÉÄÄr-aAvÀÉÉ | 13/14                             |
| WÀIPÀ-2 “sÀÆ«Ä                    | 13/14                             |
| WÀIPÀ-3 æÉÊeÁÖðPÀ                 | 13/14                             |
| æÄÄÉÉÆÃzsÀæÄÄð                    |                                   |
| WÀIPÀ-4 ,ÀAQÄtð                   | 13/14                             |

**WÀIPÀ -1 PÀÈÀßqÀ ÉÁqÀÄ-ÉÄÄr-aAvÀÉÉ:**

PÀÈÀßqÀ ÉÁqÀÄ gÀÆ¥ÄÄUÉÆAqÀzÀÝjAzÀ ¥ÁægÀA©ü<sup>1</sup> CzÀgÀ <sup>2</sup>æÃæÄÄAwPÉ, æÉÊ<sup>2</sup>µÀÖöävÉ, CzÀgÀ “ÉÆÄPÀzÀÈ¶Ö, PÀ-Á ¥ÄæPÁgÀUÀ¼À°èÉÀ ,ÀæÄÈzÀbvÉ, gÁdQÄAiÄÄ ,ÀæAiÁfPÀ aAvÀÉÉUÀ¼À ,ÉÉéÆ¥ÄdÖvÉ, CzÀgÀ “sÈUÉÆÄ½PÀ ,ËAzÀAiÄÄð, ««zsÀ PÉèÄvÀæUÀ¼À°èÉÀ ,ÁzsÀPÀgÀÄ, æÄ°ÄvÀézÀ zÀ¼ÄÄæ½UÀ¼ÄÄ, “sÁgÀvÀ æÄvÀÄÜ «±ÄéPÉÌ PÀÈÀßqÀzÀ PÉÆqÀÄUÉUÀ¼ÄÄ EæÄÁUÀ¼À°è PÉ®æÆÄÄß DAiÄÄÄÝ ¥ÀoÀåæÆÄÄß gÀÆ! ,ÀææÀ æÄÆ®PÀ «zÁÿðUÀ¼À°è ÉÁqÀÄ - ÉÄÄr PÄÄjvÀ C©üæAiÁÉÀæÆÄÄß eÁUÀÈvÀUÉÆ½,ÀææÄzÀÄ F WÀIPÀzÀ GzÉÝÄ±æÄVgÀÄvÀÜzÉ

**WÀIPÀ -2 “sÀÆ«Ä:**

“sÀÆ«ÄAiÄÄÄ æÄÆÄÄµÀågÀ æÄÆ®gÀAUÀæÄVzÉ. “sÀÆ«ÄAiÄÄÄ ÉÀæÄä æÄÆ®zÉÄæÄvÉAiÄÄÆ øËzÄÄ. DzÀÝjAzÀ-ÉÄ “sÀÆ«ÄvÀ-Ä JÉÄÄßæÄÄzÀÄ DgÁzsÀÉÉAiÄÄ ÉÉ-É æAiÁvÀææÀ®, CzÄÄ ÉÀæÄä C¹ÜvÀézÀ ,ÀAUÀwAiÄÄÆ DVzÉ. “sÀÆ«Ä-Ä-æzÉ, “sÀÆ«ÄAiÄÄ fÄæÀ ,ÀA¥ÆÆÄæ®UÀ½®èzÉ æÄÆÄÄµÀågÀ C¹ÜvÀéæÉÄ EgÀ-ÁgÀzÄÄ. “sÀÆ«ÄAiÄÄ M¼AUÄÄ, øÉÆgÀUÄÄ F J®èæÄÄ ÉÀæÄä ,Àæ®vÀÆÜ øËzÄÄ. dæÄ-ÁÝjAiÄÄÆ øËzÄÄ. EwÜÅafÀ PÁ®WÀÌÖzÀ°è “sÀÆ«ÄAiÄÄÄÄÄß æÄÆÄÄµÀågÀÄ ±ÉÆÄµÀuÉ æAiÁqÀÄvÀÜ §AczÀÄÝ æÄÆÄÄPÀ®zÀ C¹ÜvÀéæÉÄ DvÀAPÀæÆÄÄß JzÄÄj,ÀÄwÜzÉ. F “sÁUÄzÀ°è “sÀÆ«ÄAiÄÄ æÉÊeÁÖðPÀ «**ÀgÀUÉ-ÄAzÀ »rzÄÄ**, DgÀA“sÀçAzÀ E°èAiÄÄvÀÈÀPÀ æÄÆÄÄµÀågÀÄ “sÀÆ«ÄAiÄÄÄÄÄß ÉÉÆÄqÀÄvÀÜ §AcgÀÄæÀ zÀÈ¶ÖPÉÆÄÈUÀ¼ÄÆÄÄß ¥ÀoÀåæÄV EqÀ§øÄÄzÄÄ. DgÁzsÀÉÉ-ÄAzÀ »rzÄÄ E®èzÀ CçüPÁgÀæÆÄÄß “sÀÆ«ÄAiÄÄ æÉÄÄ-É zÀ-Á-Ä,ÀææÄÄzÀgÀvÀÈÀPÀ ¥ÀoÀå æÀ,ÀÄÜUÀ¼ÄÆÄÄß Dj¹PÉÆ¼ÄÄæÄÄzÄÄ. d®,ÀA¥ÆÆÄæ®UÀ½AzÀ »rzÄÄ, CçgÀÄUÀ¼ÄÄ, PÀÈ¶ F J®èæÆÄÆß M¼AUÉÆ¼ÄÄæÄÄzÄÄ, “sÀÆ«ÄAiÄÄ æÉÄÄ°ÉÀ æÄÆÄÄµÀågÀ CwPÀææÄÄtçAzÁUÄÄæÀ zÄÄµÀÖjuæÄÄUÀ½UÉ MvÀÄÜPÉÆqÀÄæÄÄzÄÄ ,ÀæÄPÁ°ÆÉÀ, DvÀAPÀUÀ¼À »ÉÉß-ÉAiÄÄ°è C¥ÉÄPÀëtÄÄAiÄÄ. ,Á»vÀåzÀ æÄvÀÄÜ ,Á»vÉåvÀgÀ DPÀgÀUÀ¼AzÀ®Æ ¥ÀoÀåUÀ¼ÄÆÄÄß Dj¹PÉÆAqÀÄ “sÀÆ«ÄAiÄÄ æÄ°ÄvÀéææÆÄÄß «zÁÿðUÀ¼UÉ æÄÆÄÄjPÉ æAiÁrPÉÆqÀÄæÄÄzÄÄ F “sÁUÄzÀ GzÉÝÄ±æÄVgÀÄvÀÜzÉ.

**WÀIPÀ -3 æÉÊeÁÖðPÀ æÄÆÉÉÆÃzsÀæÄÄð:**

DzsÄÄðPÀ “sÁgÀwÄAiÄÄ ,ÀæAiÁdæÄÄ JzÄÄj,ÀÄwÜgÀÄæÀ æÄÄÄrÀ ,Àæ®UÀ¼À°è MAzÄÄ æÉÊeÁÖðPÀ æÄÆÉÉÆÃzsÀæÄÄðzÀPÉÆgÀvÉ, ,ÀA¥æzÀ-ÄPÀ, «çüæÁç §zÄÄQÆÀ





- 1.C.  $\text{O}^{\circ}\text{E}\text{E}\text{A}\text{B} \text{ } \text{O}\text{V}\text{E}\text{U}\text{A}\text{A} \text{ } \text{O}^{\circ}\text{E}\text{E}^{\circ}\text{P}\text{E}\text{I}^{\circ}\text{E}$  - dEÀ¥ÀzÀ  
 D. aUÀjUÀAUÀ¼À ZÉ®Ä« - zÀ.gÁ. ``ÉÄzÉæ  
 2. PÉA¥ÄÄ VtÂ - aÀ,ÄÄzÉÄzÀæ  
 3. §Ä`ÉÆØÄdgī ,ÀA,Àìøw - fÁUÉÄ±i °ÉUÀqÉ

**WÀIPÀ: 3 aÉÊeAÖxPÀ aÄÄÉÉÆÄzsÀÄÄö**

1. C. MAzÉÄMAzÀÄ ``Áj °ÉÆgÀ§xß - ©.n. ®°vÁ fÁAiÀÄPi  
 D. PÀvÉÜ aÄÄvÄÄÜzsÀÄÄö -  
 1zÀÝ°AUÄAiÄÄä  
 2. PÀaÁö`ÉÆ (PÁzÀA§jAiÄÄDAiÄÄÝ ``sÁUÀ) - PÉ.!. ¥ÀçtðZÀAzÀæ  
 vÉÄd'É  
 3. fÀaÄÄä C¼AvÉAiÄÄfÀÄß «ÄÄgÀ`ÁgÀzÀzÉÄaÄgÀÄ - PÉ. ²aÄgÀaÄÄ  
 PÁgÀAvÀ

**WÀIPÀ: 4 ,ÀAQÄtö**

1. C. ZÀjvÉæAiÉÄAzÀgÉ... - JZi.J.ï. CÉÄÄ¥ÀÄÄÄ  
 E. JgÀqÄÄ `ÉÆÄIUÀ¼ÄÄ - aÄÄÄÄfÀÄ¼î gÀaÉÄÄ±i ``Á§Ä  
 2. 'E°èAiÄiÁgÀÆ aÄÄÄRåGÀ®è, AiÄiÁgÀÆ CÄÄÄÄRåGÀ®è - PÀÈ¥ÁPÀgÀ  
 ,ÉÄfÁx  
 3. ,ÉAzÀAiÄÄö aÄÄvÄÄÜ aÉÄÊstÚ - gÁaÄÄ aÄÄÉÉÆÄ°ÀgÀ  
 `ÉÆÄ»AiÄiÁ

,ÀA¥ÁzÀPÀgÀÄ  
 qÁ. «dAiÄÄ®Qëöä

,À°À ,ÀA¥ÁzÀPÀgÀÄ  
 qÁ. J.ï. EAçgÀaÄÄä  
 qÁ. JA. zÉÄaÄÄÄÄtÂÜ  
 qÁ. fÁUÀgÀvÀßaÄÄä  
 qÁ. dAiÄÄ±ÄAPÀgÀ  
 °À®UÀÆgÀÄ

\*\*\*\*\*

**©.©.J. : ,É«Ä,ÄÖgī-1**

Course Title: ©.©.J - PÀfÀßqÀ ``sÁµÁ ¥ÀoÀä aÄaÄ°ÁgÀ

xÀÄö°Àt PÀfÀßqÀ

«aÄgÀUÀ¼ÄÄ

**``ÉÆÄzÀÉÁ CÄÄcÜ**

WÀIPÀ-1 PÀfÀßqÀ fÁqÄÄ-

13/14

fÀÄÄraAvÀfÉ

WÀIPÀ-2 DzSÄÄxPÀvÉ

13/14

WÀIPÀ-3 PÄÄIÄA§

13/14

WÀIPÀ-4 ,ÀAQÄtö

13/14

**WÀIPÀ – 1: PÀfÀßqÀ fÁqÄÄ-fÄÄr aAvÀfÉ**

¥ÀzÀ« ¥ÀoÀåUÀ¼À°è PÀÈÀßqÀ ÉÁqÀÄ-ÈÄÄr aAvÀÉÉUÀ¼ÀÄ æÄvÀÄÛ PÀÈÀßqÀ  
 “sÁµÁ ,AA,ÀìøwUÉ EgÀÄàÀ §oÀÄæÄÄT DAiÀiÁæÄUÀ¼ÀÉÄÄß ¥ÀjUÀtÀ¹ WÀIPÀ-1  
 CÈÄÄßgÀÆ,À-ÁVzÉ. gÁµÀÖæPÀ« PÀÄÉÉA¥ÀÄ CæAgÀ PÀÈÀßqÀAræÄÄ- æÄÄÆÄÄßr  
 “ÉÄRÈÀ. qÁ.ºÁ.æÀiÁ.ÉÁAiÀÄPÀgÀæAgÀ ‘PÀÈÀßqÀPÀiÄÖæÀ PÉ®,À’ “ÉÄRÈÀ æÄvÀÄÛ  
 oÀÄ-Ä¼ÀUÉÉ¼À ÉÁgÁAiÀÄtgÁAiÀÄgÀ ‘GzÀAiÀÄæÁUÀ° ÈÀæÄä ZÉ®ÄæÀ PÀÈÀßqÀ  
 ÉÁqÀÄ’ - PÀæÈÄæÀÈÄÄß CzsÀåAiÀÄÈPÉÌ EqÀ-ÁVzÉ. EzÀjAzÀPÀÈÀßqÀ ÉÁqÀÄ-  
 ÈÄÄRaiÀÄ §UÉÍ °ÉaÑÈÀ C©üæÀiÁÈÀ æÄÄÆqÀÄæÄÄzÀ®èzÉÄ PÀÈÀßqÀzÀ »jæÉÄ-  
 UÀjæÉÄAiÀÄÈÄÄß ¥ÀjZÀ-Ä,À-ÁUÀÄvÀÛzÉ.

## WÀIPÀ – 2: DzsÄÄxPÀvÉ

PÀ¼ÉzÀ ±AvÀæÀiÁÈÀÇAzÀ dUÀvÀÄÛ DzsÄÄxPÀvÉAiÀÄ eÉÆvÉUÉ  
 æÄÄÄSÁæÄÄTAiÀÄÈÄÄß ÈÀqÉ,ÀÄvÀÛ-ÉÄ §AczÉ. DzsÄÄxPÀvÉAiÀÄÄ  
 DPÀµÀøUÉAiÀÄÆ °ÉzÄÄ. §zÀ-ÁæÀuÉAiÀÄ ¥æQæAiÉÄAiÀÄÆ °ÉzÄÄ. ,Àæ®Æ °ÉzÄÄ,  
 zÀÄgÀAvÀæÀÇ °ÉzÄÄ. æÄÄÄRåæV æÄÄÆgÀÉÉAiÀÄ dUÀwÛÈÀ gÁµÀÖæUÀ¼À  
 «µÀAiÀÄzÀ°è EzÄÄ ÈÈÄÆß °ÉZÄÄÑ ,AAQÄtðÁVzÉ. DzsÄÄxPÀvÉAiÀÄÄ ,ÀæiÁfPÀ  
 vÁgÀvÀæÄåUÀ¼ÀÈÄÄß æÄj¹PÉÆ¼Àî®Ä EgÀÄà ¥ÀjºÁgÀ æÀiÁUÀð JAzÉÄ  
 “sÁ« ,À-ÁVvÀÄÛ. PÀ®PÀææÉÄÄT DzsÄÄxPÀ «zÀåAiÀÈÀUÀ¼ÀÄ ±ÉæÄtÄPÀgÀtæÈÄÄß  
 ÈÈÄÆß §®¥Àr,ÀÄwÛÉ JÈÄÄßæÀ ,ÀvÀå FUÀ §AiÀÄ-ÁUÀÄwÛzÉ. DzsÄÄxPÀvÉAiÀÄ  
 ¥AgÀ æÄvÀÄÛ «gÉÆÄzsÀzÀ DA±ÀUÀ¼gÀæÀ ¥ÀoÀåUÀ¼ÀÈÄÄß ,AAiÉÆÄf¹zÀgÉ  
 «zÀÄyðUÀ½UÉ DzsÄÄxPÀvÉAiÀÄ ,ÀµÀÖavÀæt¹UÀÄvÀÛzÉ.

## WÀIPÀ - 3: PÀÄIÄA§

,ÀæiÁdzÀ æÄÆ® WÀIPÀ PÀÄIÄA§, ,ÀæiÁdzÀJ®è ,AA,ÉÜUÀ¼ÀÆ (zÁA¥ÀvÀå, ÉßæÀ,  
 ¥æ“sÄAvÀé æÀiÉ®æ æÄæÀ,ÉÜ EvÁæç) oÀÄiÄÖæÄÄzÉÄ F æÄÆ® WÀIPÀÇAzÀ  
 PÀÄIÄA§zÀ DzsÁgÀ ,ÀÜA“sæÁV UÀAqÀ-oÉAqÀwAiÀÄgÀÈÄÄß  
 UÀÄgÀÄw,À-ÁUÀÄwÛzÉ JÈÄÄßæÄÄzÄÄ ædÁzÀgÀÆ, C°è UÀAqÁ½PÉAiÀÄ  
 æÄæÀ,ÉÜAiÀÄ°è CzÄÄ ±ÉæÄtÄÄPÀÈvÀ ,À«ÄÄPÀgÀtæÁUÀÄvÀÛzÉ. UÀAqÀÄ  
 PÉÄAzÀæzÀ°èzÀÝgÉ “°ÉtÄÜ CAæÈÀ°ègÀæÀ¹Üw EzÀPÉÆÌAzÄÄ «µæÄÄvÉAiÀÄÈÄÄß  
 vÁgÀÄvÀÛzÉ. EzÀgÀeÉÆvÉ eÉÆvÉUÉÄ °ÉtÄÜ PÀÄIÄA§zÀ PÀtÄÜ JÈÄÄßæÀ  
 zsÉÆÄgÀuÉAiÀÄÆ CµÉÖÄ ¥æ§®æÁV ZÁÜAiÀÄ°èzÉ. æÄPÀi¼À æÉÄÄÈÀ æÉÆzÀ®  
 æÄvÀÄÛ UÁqsæÁzÀ ¥æ“sÄÄ PÀÄIÄA§zÉÝÄ DVgÀÄvÀÛzÉ. vÁ¼Éä ,æw, vÁåUÀ,  
 ±ææÀÄ, ,À»µÀÄÜvÉ, MUÀiÄÖ EvÁæç UÀÄtUÀ¼ÀÈÉß®è ÉÁæÀ PÀ°AiÀÄæÄÄzÀ  
 PÀÄIÄA§ æÄæÀ,ÉÜ-ÄAzÀ-ÉÄ, ,ÀæiÁdzÀ æÄÆ® WÀIPÀ PÀÄIÄA§ JA§  
 zsÉÄAiÀÄzÉÆAÇUÉ æÄgÁæÄ PÁgÀAvÀgÀ “ÉiÖzÀ fÄæÀ PÁzÀA§jAiÀÄ DAiÀÄÝ “sÁUÀ  
 ‘PÀtÄÉAiÀÄ æÄÄzÀÄPÀ PÀ«vÉ’ oÁUÀÆ “ÆÈÄ æÄÄµÁÜPigÀæAgÀ ‘§qæAgÀ  
 æÄUÀ¼ÀÄ °ÉtÜ®è’ ¥ÀoÀåæÈÄÄß EqÀ-ÁVzÉ. F “sÁUÀzÀ°è PÉiÄA©PÀ ¥Àj,ÀgÀzÀ  
 avÀæt, ÉßæÀ oÁUÀÆ PÀÄIÄA§zÀ DzsÁgÀ ,ÀÜA“sæÁV PÀÄIÄA§zÀ  
 AiÀÄdæAiÀÈÄÈÄÄß UÀÄgÀÄw,À-ÁUÀÄvÀÛzÉ. §qÀ °ÉtÄÜæÄUÀ¼À æÄzÀÄæÉ  
 ,ÀAzÀ“sÄðzÀ°è JzÀÄgÁUÀ §oÀÄzÀzÀ ,ÀæÄ,ÉåUÀ¼À M¼ÀÈÉÆÄlZÀ avÀæt«zÉ.  
 PÀtÄÉAiÀÄ æÄÄzÀÄPÀ PÀ«vÉAiÀÄ°è «±É PÀÄIÄA©AiÀÄ PÀµÀÖzÀ°è F “sÄÄzÀ  
 ÈÉÉ EzÀgÀµÉÖÄ ,Áé©üPÀæÁV zÉÈæÀÈÄÄß awæ¹zÀÝgÉ. PÀÄIÄA§ æÄæÀ,ÉÜAiÀÄ  
 çPÀÄi-zÉ,ÉUÀ¼ÀÈÄÄß M¼ÀUÉÆ¼Àî®æ ¥ÀoÀåUÀ¼ÀÈÄÄß ,À»vÀå æÄvÀÄÛ  
 ,À»vÉåAvÀgÀ æÄÆ®UÀ¼AzÀ ,AAUÀæ»¹ ¥ÀoÀåUÀ¼ÀÈÄÄß gÀÆ,À§oÀÄzÀÄ.

**WÀIPÀ- 4: ᳚AAQĩtđ**

«zÁÿđUÀ¼À°è ᳚ÀiÁÉÀ«ĀAiÀĀvÉAiĀĀ ᳚Àā᳚᳚ÁjPÀ zÀÈŲÖPÉĒĒÉÀ᳚ÉÀĀß  
 °É¼Ē,ĀĀ᳚ĀĀzĀĀ. ᳚Àā᳚᳚᳚ÁgÀzÀ°è ᳚ÀiĒ-ĀāzsÁjvÀ UĀĀtUÀ¼ÁÉÀĀß  
 D¼᳚᳚᳚᳚᳚PÉĒ¼᳚᳚᳚᳚᳚᳚᳚ ᳚ÉæĀgÉĀĒ,ĀĀ᳚ĀĀzĀĀ. ᳚Àā᳚᳚᳚᳚Á ᳚ĀĀvĀĀŲ,Āé,ĀŲ  
 §zĀĀQĒĀ ᳚d CxĀđ᳚᳚᳚᳚᳚ ᳚w½,ĀĀ᳚ĀĀzĀĀ. «zÁÿđUÀ¼À°è ᳚ÀiÁÉÀ«ĀAiÀĀvÉ  
 ᳚Àā᳚᳚᳚᳚ÁjPÀ zÀÈŲÖPÉĒĒÉÀ ᳚ÁUĀĒ ᳚Àā᳚᳚᳚᳚ÁgÀzÀ°è ᳚ÀiĒ-ĀāzsÁjvÀ UĀĀtUÀ¼ÁÉÀĀß  
 C¼᳚᳚᳚᳚᳚PÉĒ¼᳚᳚᳚᳚᳚᳚᳚ ᳚ÉæĀgÉĀĒ,ĀĀ᳚Ā ᳚nÖĒĀ°è ᳚Ā,ĀĀzĒĒĒzĀæ C᳚᳚᳚᳚  
 ᳚᳚᳚᳚᳚᳚᳚UÀ¼Ā ᳚vĀā,ĀvĀāUÀ¼Ā, ĒĒĒ᳚᳚᳚᳚᳚᳚᳚ ᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚ C᳚᳚᳚᳚ UĀAqĀ-  
 °ÉAqĀw dUÀ¼Ā ᳚ÁUĀĒ r.«.fAiĀ᳚᳚᳚᳚᳚ ᳚Ā½UÉĒĒzĀĀ ÉĀA©PÉ-ĒĒĒÉĒ᳚᳚᳚᳚᳚᳚  
 CzsĀāAiĀĒÉĒPÉĒ EqĀ-ĀVzÉ.

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**᳚᳚᳚᳚᳚᳚᳚ ZĀvĀĀđ᳚᳚᳚᳚ ᳚. ᳚. J. -2021-22 ÉĒĒ,Ā°ÉĀ PĒÉĀßqĀ ᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚**  
**᳚᳚᳚᳚᳚᳚᳚ UĀAUÉĒwæ -01 JĒĒ.E.᳚ ᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚**

**WÀIPÀ: 1 PĒÉĀßqĀ ÉĀqĀĀ ÉĀĒr ᳚AvĀÉÉ**

1. C. ᳚ÁAiĀĀwzÉ ᳚᳚᳚᳚ ÉĀĒr (PĒ᳚ÉĒ) - PĒ᳚᳚ÉĒ᳚᳚

D. PĒÉĀßqĀ ᳚ÀiÁzsĀā᳚᳚ (PĒ᳚ÉĒ) -

PÉ.J.Ē.ÉĀgĀ¹A᳚᳚,Āé«Ā

2. ᳚dUĀ°èÉĒ gĀtĀ (PĀxÉ) - ²æĀ᳚᳚᳚᳚

3. ÉĒÉĀß PĒÉĀßqĀ dUĀvĀĀŲ (ĒĒĒÉĒ)

**WÀIPÀ: 2 Dz᳚᳚᳚᳚᳚᳚**

1. C. ᳚ĀĀ᳚᳚᳚-Ā eÁvĀPĀ (PĒ᳚ÉĒ) - f.J.Ē. ²᳚᳚᳚᳚᳚᳚᳚᳚᳚

D. ᳚Á᳚᳚᳚᳚᳚ (PĒ᳚ÉĒ) - PÉ.JA. ᳚Ā,ĀĀz᳚᳚᳚᳚

2. qĀA§gĀĀ §AzĀĀzĀĀ (PĀxÉ) - zĒĒ᳚᳚᳚᳚᳚᳚

᳚᳚᳚᳚᳚᳚᳚᳚

3. mÉ°᳚sÉĒĒĒ (ĒĒĒÉĒ) - J.JĒĒ. ᳚᳚᳚᳚᳚᳚᳚᳚

**WÀIPÀ: 3 PĒĒiĀ᳚᳚**

1. C. ᳚Ā½ÉĒ ᳚᳚᳚᳚᳚ (PĒ᳚ÉĒ) - ᳚Ā᳚.w.ÉĀ

D. C᳚᳚᳚ (PĒ᳚ÉĒ) - JĒ.᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚

2. vĀĀA©zĀPÉĒqĀ (PĀxÉ) - ²æĀ᳚᳚᳚᳚᳚

3. UĀÈ᳚²PĒĒt (UĀzĀā) - ᳚᳚᳚᳚᳚᳚᳚᳚ ᳚᳚᳚᳚᳚᳚᳚

**WÀIPÀ: 4 ᳚AAQĩtđ**

1. C. ᳚ĀeÉ LzĀgĀ ᳚᳚᳚᳚ (ZĒ᳚᳚᳚᳚᳚᳚᳚) - PÉ.J.Ē.

᳚,ĀgĒC᳚᳚᳚᳚᳚᳚

D. AiĀĀĀzĀ᳚ (PĒ᳚ÉĒ) - ᳚,Ā«vĀ ÉĀUĀ᳚᳚᳚᳚᳚᳚᳚᳚

2. ᳚᳚᳚᳚᳚᳚᳚ ᳚Q᳚PÉĒAqĀ zÉ᳚᳚ (PĀxÉĒ) - ᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚

vÉĀd¹é

3. ᳚ÀiÁÉÀ«ĀAiÀĀvÉ-MAzĀĀ C᳚¹PÉ (ĒĒĒÉĒ) - §gĀUĀ᳚᳚᳚᳚᳚᳚

gĀ᳚᳚᳚᳚᳚᳚᳚᳚᳚᳚

**ƳÀæzsÁ£À ,ÀAƳÁzÀPÀgÀÄ**                      **,ÀAƳÁzÀPÀgÀÄ**

qÁ.«dAiÀÄPÀÄ³ÀìAj J,j. PÀjPÀ¬ï                      ²æÃ PÀÈµÀÚªÀÄÆwð æÉÊ,ÀÆgÀÄ

**,À°À ,ÀAƳÁzÀPÀgÀÄ**

qÁ. JA. J,j. æÉÃzÀ ;        ²æÃ «dAiÀÄ °À£ÀÆgÀÄ

qÁ. r. ƳÀÅgÀÄµÉÆvÀÜªÀÄ ; qÁ. JA. J£ï. PÀ«vÁ

\*\*\*\*\*

©.1.J. ,É«Ä,ÀÖgï - 1

| Course Title                          | ©.¹J.-PÀÈÀßqÀ ¨sÁµÁ<br>¥ÀoÀå |
|---------------------------------------|------------------------------|
| «ªÀgÀUÀ¼ÀÄ                            | ¨ÉÉÃzsÀÉÁÇªÀÇü               |
| WÀIPÀ-1 PÀÈÀßqÀ ÉÁqÀÄ-ÉÄÄr-<br>aAvÀÉÉ | 13/14                        |
| WÀIPÀ-2 DPÁ±À                         | 13/14                        |
| WÀIPÀ-3 vÁgÀÄtå                       | 13/14                        |
| WÀIPÀ-4 ,ÀAQÃtð                       | 13/14                        |

**WAIPA -1 PÀÈÀßqÀ ÈÁqÀÄ-ÈÄÄr-aAvÀÈÉ:** PÀÈÀßqÀ ÈÁqÀÄgÀÆ¥ÀÄÜÉÆAqÀzÀÝjAzÀ ¥ÁægÀA©ü¹ CzÀgÀ ²æÄªÄAwPÉ, æÉ²µÀÖöävÉ, CzÀgÀ ´ÉÆPÀzÀÈ¶Ö, PÀ´Á ¥ÀæPÁgÀUÀ¼À°èÈÀ ,ÀªÄÈzÀbvÉ, gÁdQÄAiÄÄ ,ÁªAiÁfPÀ aAvÀÈÉUÀ¼À ,ÉÆéÄ¥ÀdÖvÉ, CzÀgÀ ´sËUÉÆÄ½PÀ ,ËAzÀAiÄÄð, ««zsÀ PÉëÄvÀæUÀ¼À°èÈÀ ,ÁzsÀPÀgÀÄ, ¢ÄÄ°AvÀézÀ ZÀ¼ÀÄª¼UÀ¼ÀÄ, ´sÁgÀvÀ ¢ÄÄvÀÄÜ «±ÁéPÉìPÀÈÀßqÀzÀ PÉÆqÀÄÜÉUÀ¼ÀÄ ÈªÄÅUÀ¼À°è PÉ®ªÈÄÄßDAiÄÄÄÝ ¥ÀoÀªªÈÈÄÄßgÀÆ! ,ÄªªÄÄzÀÄ. PÀÈÀßqÀ ÈÁqÀÄ - ÈÄÄrAiÄÄ §UÉUÉ «zÁÿðUÀ¼À°è C©üªAiÁÈÄ ¢ÄÄvÀÄÜUÈgÀªªÈÈÄß ¨ÉÄñ ,ÀªªÄGzÉÝÄ±À F ¥ÀoÀªUÀ½VgÀÄvÀÜzÉ.

**WAIPA -2 DPÁ±Ä:** DPÁ±Ä«Ä «±ÁévÄäPÄ vÄvÄéUÄ¼Ä°è MAZÄÄ äÄiÄvÄæäÄ®èzÉ,  
äÄiÄÉÄäÄ ,ÄAPÄÄ®äÄÄÄÄß ¥ÉÉgÉAiÄÄÄäÄ ±ÄQÜUÄ¼Ä°è MAZÁVzÉ. DPÁ±ÄäÄÄÄÄß  
¥ÄAZÄ`sÄÉvÄUÄ¼Ä°è MAZÁV ¥ÄgÄUÄtÄ,ÄÄäÄÄzÄÄÉzÉÄPÁgÄtPÉì «±ÁévÄäPÄ  
vÄvÄéUÄ¼ÄÄ vÄäÄäcÉÄAvÄ ±ÄQÜUÄ¼Ä PÁgÄtPÁíV äÄiÄvÄæäÄ®èzÉ  
äÄÄÉÄÄµÄägÄC°ÄAPÁgÄPÉìPÁgÄt«®è JÉÄÄßäÄ ,ÄvÄäÄÄÉÄÄß w½,ÄäÄÄ  
PÁgÄtPÁìVaiÄÄÆ äÄÄÄRä. «,ÁÛgÄ, OÉÄßvÄä, ¤,ÁéxÄðvÉ,  
PÉÆìÄÖzÄtÄAiÄÄzÄOzÄAiÄÄð, vÉgÉzÄ äÄÄÉÄ,ÄÄì, GÉÄßwÄPÁgÄtztÄ°èAiÉÄÄ  
ÉÉìÖzÄÈ¶ÖEAvÄ°Ä CÉÉÄPÄ PÁgÄtUÄ½UÄV DPÁ±ÄäÄÄ ÄÄÄÄä äÄiÄzÄjUÄ¼Ä°  
MAZÁVzÉ. NeÉÆÄfi ¥ÄzÄgÄPÉìMzÄVgÄÄäÄDvÄAPÄäÄÇ  
,ÉÄjzÄAvÉDPÁ±ÄäÄÄÄÄßPÄÄjvÄ äÉÉeÄÖ¤PÄ ÉÉ´ÉUÄ¼ÄÄÄÄß ¥ÄoÄäÄÄÄÄ  
M¼ÄUÉÆAqÄgÉ CzÄPÉÆìAzÄÄ ,äÄÄUÄævÉ¹UÄÄvÄÛzÉ. ÄÄPÄävÄæ äÄiÄ°PÉUÄ¼ÄÄ,  
zsÄÆäÄÄPÉÄvÄÄUÄ¼ÄÄ, äÄÄ¼É, äÉÆÄqÄ, UÄÄqÄÄUÄÄ 1r®Ä EAxÄ ¥ÄæxÄ«ÄPÄ

„ÀAUÀwUÀ½AzÀ »rzÄCzÀgÀ àÀtðÉÁvÀäPÀ «àÀgÀUÀ½gÀäàÀ ¥ÀoÀåUÀ¼ÀÉÀÄB Dj¹PÉÆ¼Àî§ºÀÄzÀÄ.

**WÀIPÀ -3 vÁgÀÄtå:** vÁgÀÄtåàÀÀ àÄÆÀÄµÀå §zÀÄQFÀCwDPÀµÀðPÀ, µuÁðAiÀÄPÀPÀ-ÁàÄcÜAiÀiÁVzÉ. F C³ÀcÜAiÀÄ°èÈÀ vÀ®ètUÀ¼ÀÄ, DPÀµÀðuÉUÀ¼ÀÄ, D«ÄµÀUÀ¼ÀÄ àÄÄAvÁzÀàÀÄCw «²µÀÖàVzÀÄY C³ÀÈÀ àÀQÜvÀé àiÁUÀÄ«PÉUÉ vÀ¼À°ÀcAiÀiÁVgÀÄvÀÛzÉ. ºÄÄqÀÄUÁnPÉ àÄvÀÄÛ d³Á-ÁYjUÀ¼À ÈÄqÄÄ«ÈÀ zÀéAzÀéUÀ¼ÀÉÄÄB àÄvÀÄÛ F C³ÀcÜAiÀÄ°èÈÀ M½vÀÄ-PÉqÀPÀÄUÀ¼ÀÉÄÄB, Á»vÀä "sÁUÀUÀ¼À àÄÄSÉÈÈÀ w½¹PÉÆqÀÄàÀÄzÀÄ. fÄàÈÈzÀ àÄºAvÀézÀWÀiÖàÁzÀ F C³ÀcÜAiÀÄ°èÈÀ àÄÈÄÄÄi àiÁUÀÄàvÀÛ ZÀ°, ÄwÛzÀÄYpÀÈÄ, ÄUÁjPÉ, DzÀ±ÄðUÀ¼ÀÄ, "sæ³ÈÄUÀ¼ÀÄ, ºÉÆ, ÄvÀÈÄzÀ, ºÄÄqÀÄPÁ, |æw ¥ÀætAiÀÄUÀ¼À, É¼ÉvÀ, ¥æw"sÉ àÄÄAvÁzÀàÀÄUÀ¼À §UÉÍ Cj³ÀÈÄÄB àÄÄEr, Ääºè „Á»vÀäzÀ ÈÉgÀàÈÄÄB w½¹PÉÆqÀÄàÄzÀÄ.

**WÀIPÀ -4 „AAQÄtð:** vÁAwæPÀ «µÀAiÀÄUÀ¼ÀÉÄÄB PÀÈÀßqÀzÀ°ègÀÆ|, Ä-ÉÄPÁzÀ CUÀvÀävÉUÀ¼ÀÉÄÄB w½¹PÉÆqÀÄàÄzÀÄ EACÈÀ vÀAvÀæeÁÖÈAiÀÄÄUÀzÀ°èCzÀPÉiCUÀvÀäàÁzÀPÀÈÀßqÀàÈÄÄBqÀÆ|, Ääà vÀgÀ-ÉÄw µÄqÄÄàÄzÀÄ. UÀtPÀPÉëÄvÀæzÀ°èPÀÈÀßqÀàÈÄÄB ¥ÄjuÄàÄPÁjAiÀiÁV §¼Ä, ÄäàÄzÀPÉi «zÀäyðUÀ¼ÀÉÄÄB „ÄÄÓUÉÈ½, ÄäàÄzÀÄ, UÀtPÀPÉëÄvÀæPÉi „ÄASÄcÜ¹zÀ vÁAwæPÀ «µÀAiÀÄUÀ¼ÀÉÄÄB GzÁºÀgÀuÉ E-äÄÄ-ï, PÀÈÀßqÀ CAvÀeÁð® vÁtUÀ¼ÀÄ, PÀÈÀßqÀ vÀAvÀæA±UÀ¼ÀÄ, PÀÈÀßqÀ «Q¹rAiÀiÁ àÄÄAvÁzÀ ¥Äj"sÄµÉAiÀÄÈÄÄBPAÈÀßqÀzÀ°è w½¹, ÄäàÄzÀÄ.

**¥ÀæxÀàÄZÀvÀÄàAiÁð, À ©. ¹. J. - 2021-22 ÈÉÄ, Á°ÈÀ PÀÈÀßqÀ ¥ÀoÀå¥ÄÄ, ÄÛPÀ**

**UÀtPÀUÀAUÉÈÄwæ - 1 JÈi.E. |. ¥ÀoÀåPÀæàÄÄ**

**WÀIPÀ - 1 PÀÈÀßqÀ ÈÄqÄÄ-ÈÄÄr-aAvÀÈÉ**

1. C. PÀÈÀßrUÀgÀvÀ-Ä - JA. UÉÈÄ«AzÀ ¥ÉÈ  
D. PÀÈÀßqÀ ÈÄÄr - DÈÄAzÀPÀAzÀ
2. PÀÈÄðPÀ: EIO ºÉ, ÀgÀÄPÉÆiO àÄÄAvÀæ - PÄä³ÈA¥ÄÄ
3. PÀÈÀßqÀ àÄÈÄÄ, Äi - ºÁ.àAiÁ. ÈÁAiÀÄPÀ

**WÀIPÀ - 2 DPÁ±À**

1. C. DPÁ±À - „ÀgÀdÆPÁlìgÀ D. àÉÈÄqÀUÀ¼À „ÄàÄ  
- CUÀæºÁgÀPÀÈµÀUáàÄÄÈwð
2. DPÁ±ÀPÉi µÄ° ¥ÀgÀzÉ - "ÉÈ¼ÄàÄgÀÄ  
àÄºààÄÄzìPÀÄAkÄ
3. G¹ÁìàÈÈÖÖAiÀÄgÉÈÄZÀPÀ - ÈÈÄPÀ - ©.J.j. ±ÉÈ®eÁ

**WÀIPÀ - 3 vÁgÀÄtå**

1. C. J®èà¼É®èà¼É®èà¼ÄÄ - ¥ÄÄ. w. ÈÀ
2. D. §qÀàÈÈÁzÀgÉ KÈÄÄ |æAiÉÄ - „AvÀåÈÄAzÀ ¥ÁvÉÈæÄi
3. MAzÄÄ SÄ, ÄV ¥AvÀæ - «ÈÄAiÀiÁMPÀÄiAzÀ

4.  $\circ\Delta\epsilon\circ\Delta g\acute{E}Ai\grave{A}\ddot{z}\grave{A}\grave{A}g\grave{A} C^{\circ}\Delta\pm\grave{A}\grave{A}P\grave{A}v\acute{E}U\grave{A}\%A\ddot{A}$

- <sup>1</sup>. Dgĩ. ZAAzÀæ±ÉĀRgĩ

#### WÀIPÀ - 4 ,ÀAQĀtō

1. C. E°èKÉÁzÀgÀÆ §gÉ-Āj - JA. Dgĩ. PÀªĀĀ®  
 $\text{°ÉÆUÀ,ÉAiĀĀ°èzÉ °sÀÆ«Ā}$  - «°sÁ
2. PÀÉÀßqĀ ¢ĀĀvĀĀŪPĀA¥ĀÆĀlgĩ - n. f. <sup>2</sup>æĀȳcũ
3. C. PÀÉÀßqĀzÀ°èUĀtPĀzÀ §¼ĀPÉAiĀĀ Ew°Á,Ā, °É¼ĀªĀtĀUÉ ¢ĀĀvĀĀŪ °ÉÆ,Ā  
 $\text{,ÁzsĀāvÉUĀ}\%A\ddot{A}$ .  
 PÀÉÀßqĀ °sÁµÉ ¢ĀĀvĀĀŪ vĀAvÁæA±ĀUĀ}\%A\ddot{A}.  
 PÀÉÀßqĀzÀ°èUĀtPĀzÀ §¼ĀPÉUÉ ±Āæ«Ā¹zĀ vĀAvĀædŌgĀĀUĀ}\%A\ddot{A} ¥ĀjZĀAiĀĀ.

¥ĀæzsÁĒĀ ,ĀA¥ĀzĀPĀgĀĀ

,ĀA¥ĀzĀPĀgĀĀ

qÁ. «dAiĀĀPĀĀªAiĀj,ĩ. PĀjPĀ°ĩ

qÁ. PÉ.f. PĀ«vĀ

,Ā°Ā ,ĀA¥ĀzĀPĀgĀĀ

<sup>2</sup>æĀ C±ÉÆĀPĀ JZĩ.PÉ.

qÁ. ċÉĀ±Ā PÉ. J,ĩ.

qÁ. JA. JĒĩ. PĀ«vĀqÁ.

wæĀªÉĀtĀ

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PÀÉÀßqĀ °sÁµĀ ¢ĀiĀzĀj ¥Āæ±Éß¥ĀwæPÉ

PÀÉÀßqĀ °sÁµĀ ¢ĀiĀzĀj ¥Āæ±Éß¥ĀwæPÉ (©.J¹. ©.©.J ¢ĀĀvĀĀŪ ©.¹.J, ¢ĀĀvĀĀŪ

5 ¢ĀµĀđzĀ ,ĀAAiÉÆĀfvĀ CtĀfĀªĀtĀ±Ā,ĀŪċ)

(1,2,3 ¢ĀĀvĀĀŪ 4ÉĒ ZĀĀvĀĀªAiĀđ ,zĀ J°Āè ¥ĀzĀ« PÉÆĀ,ĩđUĀ½UÉ CĒĀéAiĀĀ)

CªĀcũ: 2 UĀAmÉ

UĀjµĀ× CAPĀUĀ}\%A\ddot{A}: 60

- 1] C) MAzĀĀ °sÁUĀzĀ °sÁªĀªÆĀĀß ,ĀAzĀ°sĀđ ,Ā»vĀ «ªĀj¹ 04  
 $\text{JgĀqĀĀ PĀªÆĀzĀ PĀArPÉUĀ}\%A\ddot{A}\text{ß PÉÆqĀ°ÉĀPĀĀ}$   
 D) DgĀĀ ¥ĀzĀUĀ½UÉ CxĀđ §gÉ-Āj °ĀvĀĀŪ ¥ĀzĀUĀ}\%A\ddot{A}\text{ß } (1\frac{1}{2}\times 6)=03  
 $\text{PÉÆqĀ°ĀUĀĀvĀŪzÉ}$   
 E) JgĀqĀĀ «µĀAiĀĀUĀ}\%A\ddot{A}\text{ß PĀĀjvĀĀ n¥ĀĀtĀ §gÉ-Āj } (1\frac{1}{2}\times 2)=03  
 $\text{ªĀĀÆgĀĀ «µĀAiĀĀUĀ}\%A\ddot{A}\text{ß PÉÆqĀ°ĀUĀĀvĀŪzÉ}$
- 2] C) ÉĀ®Āĩ ¢ĀPĀªĀUĀ}\%A\ddot{A} ,ĀAzĀ°sĀđ ,ĀégĀ,ĀªªÆĀĀß «ªĀj¹ (2\frac{1}{2}\times 4)=10  
 $\text{DgĀĀ ¢ĀPĀªĀUĀ}\%A\ddot{A}\text{ß PÉÆqĀ°ĀUĀĀvĀŪzÉ}$
- 3] C) MAzĀĀ ¢ĀPĀªĀzĀ°è GvĀŪj¹. LzĀĀ ¥Āæ±ÉßUĀ}\%A\ddot{A}\text{ß } (1\times 5)=05  
 $\text{PÉÆqĀ°ĀUĀĀvĀŪzÉ}$   
 D) ©nŌgĀĀªĀ ,ĀŪ}\%A\ddot{A}\text{ß °sĀwđªĀiĀr } (1\times 5)=05
- 4] C) MAzĀĀ ¥Āæ±ÉßUÉ ,ĀAQē¥ĀŪªĀV GvĀŪj¹. JgĀqĀĀ 05  
 $\text{¥Āæ±ÉßUĀ}\%A\ddot{A}\text{ß PÉĀ}\%A\ddot{A}\text{°ĀUĀĀvĀŪzÉ}(1\text{ ¢ĀĀvĀĀŪ } 2\text{ ÉĒ } W\grave{A}IP\grave{A}\grave{C}Az\grave{A})$   
 D) MAzĀĀ ¥Āæ±ÉßUÉ ,ĀAQē¥ĀŪªĀV GvĀŪj¹. JgĀqĀĀ 05  
 $\text{¥Āæ±ÉßUĀ}\%A\ddot{A}\text{ß PÉĀ}\%A\ddot{A}\text{°ĀUĀĀvĀŪzÉ}(3\text{ ¢ĀĀvĀĀŪ } 4\text{ ÉĒ } W\grave{A}IP\grave{A}\grave{C}Az\grave{A})$
- 5] C) MAzĀĀ ¥Āæ±ÉßUÉ GvĀŪj¹. JgĀqĀĀ ¥Āæ±ÉßUĀ}\%A\ddot{A}\text{ß } 10  
 $\text{PÉĀ}\%A\ddot{A}\text{°ĀUĀĀvĀŪzÉ}$



(1  $\text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\ 2\text{E}\ddot{\text{E}}\text{A}\ \text{W}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{E}\ddot{\text{A}}\text{R}\ddot{\text{E}}\ddot{\text{A}}\ \text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\ ,\ddot{\text{A}}\text{t}\ddot{\text{U}}\text{P}\ddot{\text{A}}\text{x}\ddot{\text{E}}\ \text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\ \text{P}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{A}\text{Sj}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{C}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{I}}\ \text{a}\ddot{\text{A}}\text{i}\ddot{\text{A}}\text{r}\text{P}\ddot{\text{E}}\text{E}\frac{1}{4}\ddot{\text{A}}\text{i}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\text{z}\ddot{\text{E}}\ )$

D)  $\text{MAz}\ddot{\text{A}}\ddot{\text{A}}\ \text{A}\ddot{\text{A}}\text{e}\pm\text{E}\ddot{\text{B}}\text{U}\ddot{\text{E}}\ \text{Gv}\ddot{\text{A}}\ddot{\text{U}}\text{j}^1\ .\ \text{Jg}\ddot{\text{A}}\text{q}\ddot{\text{A}}\ddot{\text{A}}\ \text{A}\ddot{\text{A}}\text{e}\pm\text{E}\ddot{\text{B}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ 10$   
 $\text{P}\ddot{\text{E}}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{A}\text{U}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\text{z}\ddot{\text{E}}\ )$

(3  $\text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\ 4\text{E}\ddot{\text{E}}\text{A}\ \text{W}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{E}\ddot{\text{A}}\text{R}\ddot{\text{E}}\ddot{\text{A}}\ ,\ddot{\text{A}}\text{t}\ddot{\text{U}}\text{P}\ddot{\text{A}}\text{x}\ddot{\text{E}}\ \text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\ \text{P}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{A}\text{Sj}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{C}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{I}}\ \text{a}\ddot{\text{A}}\text{i}\ddot{\text{A}}\text{r}\text{P}\ddot{\text{E}}\text{E}\frac{1}{4}\ddot{\text{A}}\text{i}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{U}}\text{z}\ddot{\text{E}}\ )$

**LzÀÉÉAiÀÄ, DgÀÉÉAiÀÄ ZÀvÀÄaAiÁð,ÀzÀ aÄÄPÀÜ**  
**DAiÉÄiAiÀÄ AÀÀaPÀæaÄÄ**

V  $\text{E}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{GU}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ \text{«P}\ddot{\text{A}}\ ,\ddot{\text{A}}\ \text{Dz}\ddot{\text{s}}\ddot{\text{A}}\ddot{\text{A}}\text{P}\ddot{\text{A}}\ \text{P}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{Bq}\ddot{\text{A}}\ \text{E}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ \text{A}\ddot{\text{J}}\text{Z}\ddot{\text{A}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\ \text{q}\ddot{\text{A}}\ .\ \text{Vj}\ddot{\text{A}}\ddot{\text{I}}\ \text{P}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{O}}\text{q}\ddot{\text{i}}\ \text{C}\ddot{\text{A}}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ \text{'v}\ddot{\text{A}}\ddot{\text{A}}\text{W}\ddot{\text{A}}^{\text{®}}\text{P}\ddot{\text{i}}\text{'}\ \text{E}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{Y}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

$\text{d}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\text{v}\ddot{\text{i}}\ \text{P}\ddot{\text{A}}\text{--}\ddot{\text{A}}\text{lt}\ddot{\text{A}}\ \text{C}\ddot{\text{A}}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ \text{'dv}\ddot{\text{E}}\text{Vg}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\ \text{Z}\ddot{\text{A}}\text{A}\text{Cg}\ddot{\text{A}}\text{'}\ \text{E}\ddot{\text{A}}\text{IP}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{Y}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

VI  $\text{Dv}\ddot{\text{A}}\ddot{\text{A}}\text{Z}\ddot{\text{A}}\text{jv}\ddot{\text{E}}\ddot{\text{A}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\ \text{GU}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ \text{«P}\ddot{\text{A}}\ ,\ddot{\text{A}}\ \text{f}\ddot{\text{A}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{Z}\ddot{\text{A}}\text{jv}\ddot{\text{E}}\ddot{\text{A}}\ \text{J}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{g}\ddot{\text{E}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{A}\text{?}\ \text{P}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{Bq}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{°}\ddot{\text{e}}\ \text{S}\ddot{\text{A}}\text{Cg}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ \text{f}\ddot{\text{A}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ \text{Z}\ddot{\text{A}}\text{jv}\ddot{\text{E}}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ \text{M}\ddot{\text{I}}\ddot{\text{A}}\ddot{\text{O}}\ \text{E}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{I}}\ \text{q}\ddot{\text{A}}\ .\ ^1\text{z}\ddot{\text{A}}\ddot{\text{Y}}\text{°}\text{AU}\ddot{\text{A}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ \text{C}\ddot{\text{A}}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ddot{\text{A}}\ \text{Hg}\ddot{\text{A}}\ddot{\text{A}}\text{P}\ddot{\text{E}}\ddot{\text{A}}\text{j}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{Y}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

$\text{H}\ddot{\text{A}}\ddot{\text{A}}\text{i}\ddot{\text{A}}^2\ddot{\text{A}}\ddot{\text{A}}\ \text{C}\ddot{\text{A}}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ \text{'E}\ddot{\text{A}}\text{Q}\ \text{'E}\ddot{\text{q}}\ddot{\text{A}}\text{U}\ddot{\text{A}}\ddot{\text{A}}\text{'}\ \text{Dv}\ddot{\text{A}}\ddot{\text{A}}\text{P}\ddot{\text{A}}\text{v}\ddot{\text{E}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\ \text{A}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\text{R}\ \text{D}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{Y}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

**HgÀÄ PÉÄj**

**SÄUÄ – 1**

$\text{L}\ddot{\text{E}}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{E}}\text{g}\ddot{\text{A}}\ \text{°E}\ddot{\text{A}}\text{E}^{\text{®}}\ )$

$\text{a}\ddot{\text{A}}\ddot{\text{A}}\text{°}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{A}}\ \text{U}\ddot{\text{A}}\text{A}\ddot{\text{C}}\ddot{\text{U}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ \text{a}\ddot{\text{A}}\text{i}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{A}}\ \text{P}\ddot{\text{E}}\ddot{\text{A}}\frac{1}{2}\text{z}\ddot{\text{A}}\ \text{v}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ )$

$\text{P}\ddot{\text{E}}\ddot{\text{A}}\frac{1}{4}\text{z}\ddot{\text{A}}\ \text{P}\ddot{\text{A}}\text{tz}\ddot{\text{A}}\ ,\ddot{\text{A}}\text{AU}\ddot{\text{A}}\text{w}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

$\text{U}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{E}}\text{A}\text{°}\ ,\ddot{\text{A}}\text{é}\text{«}\ddot{\text{A}}\ \text{C}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{E}}\text{v}\ddot{\text{A}}\ \text{«z}\ddot{\text{A}}\ddot{\text{A}}\text{y}\ddot{\text{ð}}\text{A}\text{°}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ )$

$\text{C}\ddot{\text{E}}\ddot{\text{A}}\ddot{\text{A}}\text{S}\ddot{\text{A}}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\ddot{\text{A}}\ )$

$\text{S}\ddot{\text{A}}\ ,\ddot{\text{A}}\ \text{A}\ddot{\text{A}}\text{e}\text{P}\ddot{\text{A}}\text{g}\ddot{\text{A}}\text{t}\ )$

$\text{«Z}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ddot{\text{A}}\text{C}\ \text{A}\ddot{\text{J}}\mu\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{U}}\ \text{a}\ddot{\text{A}}\text{v}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{U}}\ \text{«Z}\ddot{\text{A}}\text{g}\ddot{\text{A}}\ddot{\text{A}}\text{C}\ ,\ddot{\text{A}}\text{a}\ddot{\text{A}}\text{i}\ddot{\text{A}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\pm\ddot{\text{A}}\ )$

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**aÄÄPÀÜ DAiÉÄi : PÀÉÀBqÀ SÄµÄ aAiÁzÄj AÀæ±ÉBwæPÉ**

**LzÀÉÉÄ ZÀvÀÄaAiÁð,À**

**CÀÄCü: 3 UÄAmÉ**

**UÄjµÄ× CAPÀUÄ¼ÄÄ: 40**

1] C)  $\text{MAz}\ddot{\text{A}}\ddot{\text{A}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{z}\ddot{\text{A}}\ \text{S}\ddot{\text{A}}\text{a}\ddot{\text{A}}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ ,\ddot{\text{A}}\text{Az}\ddot{\text{A}}\text{S}\ddot{\text{A}}\ddot{\text{O}}\ )$

04

$\ ,\ddot{\text{A}}\text{»v}\ddot{\text{A}}\ \text{«a}\ddot{\text{A}}\text{j}^1\ \text{Jg}\ddot{\text{A}}\text{q}\ddot{\text{A}}\ddot{\text{A}}\ \text{S}\ddot{\text{A}}\text{U}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ )$

$\text{P}\ddot{\text{E}}\ddot{\text{A}}\text{q}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{P}\ddot{\text{A}}\ddot{\text{A}}\ )$

D)  $\text{Dg}\ddot{\text{A}}\ddot{\text{A}}\ \text{A}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{2}\text{U}\ddot{\text{E}}\ \text{Cx}\ddot{\text{A}}\ddot{\text{ð}}\ \text{Sg}\ddot{\text{E}}\text{--}\ddot{\text{A}}\text{j}\ \text{°A}\ddot{\text{v}}\ddot{\text{A}}\ddot{\text{A}}\ddot{\text{U}}\ (1\frac{1}{2}\times 6) = 03$

$\text{A}\ddot{\text{A}}\text{z}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ \text{P}\ddot{\text{E}}\ddot{\text{A}}\text{q}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{P}\ddot{\text{A}}\ddot{\text{A}}\ )$

E)  $\text{Jg}\ddot{\text{A}}\text{q}\ddot{\text{A}}\ddot{\text{A}}\ \text{«}\mu\ddot{\text{A}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ \text{P}\ddot{\text{A}}\ddot{\text{A}}\text{jv}\ddot{\text{A}}\ddot{\text{A}}\ \text{n}\ddot{\text{A}}\ddot{\text{A}}\text{t}\ddot{\text{A}}\ (1\frac{1}{2}\times 2) = 03$

$\text{Sg}\ddot{\text{E}}\text{--}\ddot{\text{A}}\text{j}\ \text{a}\ddot{\text{A}}\ddot{\text{A}}\text{Eg}\ddot{\text{A}}\ddot{\text{A}}\ \text{«}\mu\ddot{\text{A}}\text{Ai}\ddot{\text{A}}\ddot{\text{A}}\text{U}\ddot{\text{A}}\frac{1}{4}\ddot{\text{A}}\text{E}\ddot{\text{A}}\ddot{\text{A}}\text{B}\ )$

$\text{P}\ddot{\text{E}}\ddot{\text{A}}\text{q}\ddot{\text{A}}\text{E}\ddot{\text{A}}\text{P}\ddot{\text{A}}\ddot{\text{A}}\ )$

- 2] C) £Á®lgÀ ,ÀAzÀ`sàð ,ÁégÀ,Àå GvÀÛj¹ (2½x4) =10  
(¥ÀÆªÁðxÀð ¢ÀÄvÀÛ GvÀÛGÁzsÀðUÀ¼À£ÀÄß  
UÀªÀ£ÀzÀ°èlÄÖPÉÆAqÄÄ) DgÄÄ  
ªÁPÀåUÀ¼À£ÀÄß PÉÆqÀ`ÉÃPÄÄ
- 3] C) MAzÄÄ ¥Àæ±ÄßUÉ GvÀÛj¹ JgÀqÄÄ 10  
¥Àæ±ÉßUÀ¼À£ÀÄß PÉÆqÀ`ÉÃPÄÄ
- D) MAzÄÄ ¢ÁPÀåzÀ°è GvÀÛj¹. LzÄÄ (1x5)=05  
¥Àæ±ÉßUÀ¼À£ÀÄß PÉÃ¼Ä`ÉÃPÄÄ
- E) ©lÖ ,ÀÜ¼ÀªÀ£ÀÄß `sÀwðªÀiÁr (1x5)=05

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³ÄÄPÀÛ ÐÄÍÄÌ : PÀ£ÀßQÀ "sÁµÄ ³ÄìÁZÀj ¥Àæ±Éß¥ÀwæPÉ  
 ÐgÀ£ÉÄìÄÄ ZÀvÄÄ³ÄìÁð,À

**Càçü: 3 UÀAmÉ**

UÀjμÀ× CAPÀUÀ¼ÀÄ: 40

- |    |                                                                                                                                                                       |            |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1) | MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. JgÀqÀÄ<br>¥Àæ±ÉßUÀ¼À£ÀÄß PÉ£EqÀ¨ÉÃPÀÄ                                                                                                          | 10         |
| 2) | MAzÀÄ ¥Àæ±ÉßUÉ GvÀÛj¹. JgÀqÀÄ<br>¥Àæ±ÉßUÀ¼À£ÀÄß PÉ£EqÀ¨ÉÃPÀÄ                                                                                                          | 10         |
| 3) | „AAQë¥ÀÛ³ÁV GvÀÛj¹ (¥ÁvÀæ, WÀl£É CxÀ³Á<br>„Àß³ÉÃ±ÀUÀ¼À£ÀÄß PÉÃ¼ÄÄ³ÀÄzÀÄ) ³ÄÄ£EgÀÄ<br>«µÀAiÀÄUÀ¼À£ÀÄß PÉ£lÄÖ AiÀiÁ³ÀÄzÁzÀgÀ£<br>JgÀqÀÄ «µÀAiÀÄUÀ½UÉ GwÛj¹ J£Àß¨ÉÃPÀÄ   | (2x5) = 10 |
| 4) | „AAQë¥ÀÛ³ÁV GvÀÛj¹ (¥ÁvÀæ, WÀl£É, CxÀ³Á<br>„Àß³ÉÃ±ÀUÀ¼À£ÀÄß PÉÃ¼ÄÄ³ÀÄzÀÄ) ³ÄÄ£EgÀÄ<br>«µÀAiÀÄUÀ¼À£ÀÄß PÉ£lÄÖ AiÀiÁ³ÀÄzÁzÀgÀ£<br>JgÀqÀÄ «µÀAiÀÄUÀ½UÉ GvÀÛj¹ J£Àß¨ÉÃPÀÄ | (2x5) = 10 |

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**Language: ENGLISH****BOARD OF STUDIES: PROCEEDINGS**

The meeting of the Board of Studies in English (UG) of Yuvaraja College, Mysuru, was held at 10.30 a.m. on 15-11-2021, at the Department of English, Yuvaraja's College, University of Mysore, Mysuru.

| Sl. No. | Members                                                                                     | Position | Signature/<br>Remarks |
|---------|---------------------------------------------------------------------------------------------|----------|-----------------------|
| 1.      | Dr. K. Yeshoda Nanjappa, Professor,<br>Dept. of English, Yuvaraja College, Mysuru.          | Chairman | Sd/                   |
| 2.      | Dr. P. Venkatesh, Associate Professor,<br>Maharaja's College, Mysuru                        | Member   | Sd/                   |
| 3.      | Dr. Priya Uthaiah I, Assistant Professor, Govt.<br>First Grade College (Autonomous), Mandya | Member   | Sd/                   |
| 4.      | Dr. G. Nataraju, Chairman, DOS in English,<br>Karnataka State Open University, Mysuru       | Member   | Sd/                   |
| 5.      | Prof. M.H. Rudramuni, Professor (Retd.),<br>DOS in English, Manasagangotri, Mysuru.         | Member   | Absent                |

**Resolutions Passed:**

1. The Board after discussions and deliberations framed and passed the syllabus for the English Course (AECC – L2- I and L2 – 2) for the I and II semesters of the B. Sc/BCA/BBA Programmes under NEP 2020 to be implemented from the current academic year (2021-2022).
2. The Board also framed and passed the syllabus (Introduction to Phonetics – I and II) for the Skill Enhancement Course (SEC) for V and VI semesters of the existing BSc Programme (prior to implementation of NEP 2020).
3. The Board also framed the question paper pattern for AECC – L2- I and L2 – 2 and SEC.
4. The Board resolved to retain the current III and IV semester English Language Syllabus (AECC) for B. Sc/BCA/BBA Programmes without any changes.
5. The Board constituted the Panel of Examiners for the constitution of BOE in English for 2021-2022 to be submitted to the Controller of Examinations, Yuvaraja's College.
6. The Board also constituted the Panel of Examiners for the English course in the B.Sc., BBA and BCA programmes for the academic year 2021-2022 to be submitted to the Controller of Examinations, Yuvaraja's College, Mysuru.

15-11-2021  
Mysuru

Chairman,  
BOS in English

### Details of Course of Study: I and II Semesters

| Sem. | Discipline Core/<br>Paper (L+T+P) | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment Marks<br>(C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|------|-----------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| I    | AECC: (L2-1): English<br>(3+0+0)  | 4                          | 3       | 40                                        | 60                                        |
| II   | AECC: (L2-2): English<br>(3+0+0)  | 4                          | 3       | 40                                        | 60                                        |

### I SEMESTER

#### Course Objectives:

- ❖ To introduce basic grammar through ample practice exercises for effective language learning.
- ❖ To teach to use vocabulary appropriately and grammatical structures correctly.
- ❖ To adopt strategies for developing effective reading and listening skills while engaging students in using correct pronunciation.
- ❖ To instill confidence and develop competence in students in order to communicate in grammatically correct English.
- ❖ Develop the skill to translate texts from one language to another.

#### Programme outcome:

- Students will be able to enrich their vocabulary and enhance their comprehension skills.
- They will acquire grammatical competence and communicative skill which in turn will improve their command over English.
- Students will acquire greater fluency in English which is an important dimension of language learning.

**AECC: L2-1: ENGLISH (THEORY):            3 CREDITS        56 HRS.**

#### A. Course Book

#### Poetry:

1. Opportunity - John James Ingalls.
2. Sita – Toru Dutt.
3. The Road Not Taken – Robert Frost.
4. There Will Come Soft Rains – Sara Teasdale.
5. The Mountain and the Squirrel – Ralph Waldo Emerson.
6. Piano – D.H. Lawrence.
7. Women – Alice Walker.

#### Prose:

1. Forgetting our Own History – Sudha Murthy.
2. When I Dread Failure – A J Cronin.
3. Jadav Peyang: The Forest Man.
4. A Born Dreamer – Chitra Mandal.

**B. Work Book****Language Component and Language Skills**

1. Articles.
2. Prepositions.
3. Verb – Tense and Subject-verb Agreement.
4. Punctuation.

**Language Skills (for Class work):**

Reading and Listening skills, Comprehension, Translation.

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**II SEMESTER****Course Objectives:**

- ❖ To adopt strategies for developing effective reading and listening skills while engaging students in using correct pronunciation.
- ❖ To introduce basic grammar through ample practice exercises for effective language learning.
- ❖ To teach the students to use vocabulary appropriately and grammatical structures correctly.
- ❖ To instil confidence and develop competence in students in order to communicate in grammatically correct English.

**Programme outcome:**

- Students will be able to enrich their vocabulary and enhance their comprehension skills.
- They will acquire grammatical competence and communicative skill which in turn will improve their command over English.
- Students will acquire greater fluency in English which is an important dimension of language learning.

**AECC: L2-2: ENGLISH (THEORY):                      3 CREDITS                      56 HRS.**

**A. Course Book****Poetry:**

1. Nature – H.W. Longfellow.
2. The Village Song – Sarojini Naidu.
3. Musee de Beaux Arts – W.H Auden.
4. Courage – Anne Sexton.
5. The Peace of Wild Things - Wendell Berry.
6. Shoulders – Naomi Shihab Nye.
7. Remember - Joy Hajro.
8. War is Kind – Stephen Crane.

**Prose:**

1. Lalajee – Jim Corbett.
2. The Boat – A P J Abdul Kalam.
3. The Role of Ancient Indian Universities - Jayant V. Narlikar.

4. Chief Seattle's Letter to the President of United States, 1854.

### B. Work Book

#### Language Component and Language Skills

1. Combining sentences with appropriate conjunctions.
2. Adverbs and Adjectives.
3. Words often confused.
4. One-word Substitutes.

#### Language Skills (for Class work):

Reading and Listening skills, Dialogue Writing.

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### QUESTION PAPER: THEORY EXAMINATION (For AECC: L2-1, and AECC: L2-2 Papers)

Time: 02 Hours

Max. Marks: 60

#### PART-A

- Q1** Answer **ALL** of the following (Objective type questions from Poetry and Prose): **8 x 1 = 8**
- a)
  - b)
  - c)
  - d)
  - e)
  - f)
  - g)
  - h)

#### PART-B

- Q2** Answer any **TWO** of the following (Reference to context- Poetry). **2 x 4 = 8**
- a)
  - b)
  - c)
  - d)

#### PART-C

- Answer any **TWO** of the following (Essay type questions-Poetry). **2 x 6 = 12**
- Q3 – Q6**

#### PART-D

- Answer any **TWO** of the following (Essay type questions on Prose). **2 x 6 = 12**
- Q7 – Q10**

#### PART-E

- Answer any **ALL** of the following (Grammar and composition). **4 x 5 = 20**
- Q11** Articles/ Conjunctions.
- Q12** Prepositions/ Adjectives and Adverbs.
- Q13** Verb and Tense (Subject- Verb Agreement/ Concord)/ Words often confused.
- Q14** Punctuation/ One word Substitutes.

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## Language: SANSKRIT

The syllabi and Scheme of examination approved by the University of Mysore, was adopted as such without any changes.

### Details of Course of Study: I and II Semesters

| Sem. | Discipline Core/<br>Paper (L+T+P) | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|------|-----------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| I    | AECC: (L1-1): Sanskrit<br>(3+0+0) | 4                          | 3       | 40                                        | 60                                        |
| II   | AECC: (L1-2): Sanskrit (3+0+0)    | 4                          | 3       | 40                                        | 60                                        |

### I SEMESTER

#### Learning Objectives:

- ❖ It gives introduction to Sanskrit poetry.
- ❖ It inspires to read the Raghuvamsham Mahakavyam.
- ❖ It helps to build the foundation for Sanskrit vocabulary.
- ❖ It supports the formation of sentences in Sanskrit.
- ❖ It assists in comprehension skills.

#### Learning Outcomes:

- The student gets motivated to compose poems.
- The student imbibes the noble qualities.
- The student develops conviction in scriptures.
- The student learns Sanskrit speaking skills.
- The student will be confident in learning new texts of Sanskrit.

**Pedagogy:** Lecture, Interaction and Deliberation, Group Discussion, Learning and teaching in the class, Creation of a situation, Enacting a dramatic scene, Fieldwork or Assignment, Excursion, Written examination, Internal Assessment, Promoting research activities, Usage of Multimedia, Conducting Continuous and comprehensive Evaluation.

#### AECC: L1-1: SANSKRIT POETRY, GRAMMAR AND COMPREHENSION (THEORY)

3 CREDITS

56 HRS.

- B.Sc.**     **Unit-1:** Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr. M. Shivakumara Swamy (Page 1-24).  
**Unit-2:** Selected portions from Raghuvamsham I Sarga (1-50 Shlokas).  
**Unit-3:** Vocabulary building Samskrita Vyavahara Sahastri (page1-18).  
Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204).  
Comprehension Shevadhi-2 (page 133).
- BCA**     **Unit-1:** Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr. M. Shivakumara Swamy (Page 1-24).  
**Unit-2:** Selected Shlokas from Neetishataka of Bartruhari (1-40 Shlokas).



**Unit-3:** Vocabulary building Samskrita Vyavahara Sahastri (page1-18).  
 Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204).  
 Comprehension Shevadhi-2 (page 133).

**BBA Unit-1:** Introduction to Classical Sanskrit Poetry – Samskrita Sahitya Parampare - By Dr. M. Shivakumara Swamy (Page 1-24).  
**Unit-2:** Selected portions from Bhagawad Gita Chapter 3 (1-43 Shlokas).  
**Unit-3:** Vocabulary building Samskrita Vyavahara Sahastri (page1-18).  
 Karaka prakarana – Samskrita Gadya Padya Vallari – (Page 201-204)  
 Comprehension Shevadhi-2 (page 133).

### REFERENCE BOOKS:

1. Samskrita Sahitya Parampare - By Dr.M. Shivakumara Swamy, Bharavi Publication, Bengaluru. RPT 1987 (Page 1-24).
2. Raghuvamsha Mahakavya - Kalidasa.
3. Srimad Bhagawadgita – Vyasa.
4. Neetishataka – Bhartruhari.
5. Samskrita Vyavahara Sahastri – Samskrita Bharati, (Delhi-Bengaluru) Page 1-18.
6. Samskrita Gadya Padya Vallari – (Page 201-204), Government of Karnataka, Karnataka Textbook Society (R) Bengaluru. RPT -2012-13.
7. Shevadhi-2 – Government of Karnataka, Bengaluru. RPT-2019. Page 133.

**Digital Resources:** [www.archive.org](http://www.archive.org) ; <https://www.wikipedia.org/>

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## II SEMESTER

### Learning Objectives:

- ❖ It gives introduction to Sanskrit prose.
- ❖ It inspires to read the complete Bharata Sangraha.
- ❖ It helps to gain the knowledge about various forms of nouns.
- ❖ It supports the formation of sentences in Sanskrit.
- ❖ It assists in translation skills.

### Learning Outcomes:

- The student gets motivated to make out similar works in Sanskrit literature.
- The student imbibes the noble qualities depicted in Sanskrit literature.
- The student acquires grammatical skills.
- The student learns Sanskrit speaking skills.
- The student will be confident in learning new texts of Sanskrit.

**Pedagogy:** Lecture, Interaction and Deliberation, Group Discussion, Learning and teaching in the class, Creation of a situation, Enacting a dramatic scene, Fieldwork or Assignment, Excursion, Written examination, Internal Assessment, Promoting research activities, Usage of Multimedia, Conducting Continuous and comprehensive Evaluation.

**AECC: L1-2: SANSKRIT PROSE, GRAMMAR AND TRANSLATION (THEORY)**  
**3 CREDITS** **56 HRS.**

- B.Sc.**     **Unit-1:** Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K. Siddagangaiah. (page 591-638).  
**Unit-2:** Bharata Sangraha – By Lakshmana Suri – Adi parva and Sabha Parva.  
**Unit-3:** Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12); Identifying Sandhi – “Sandhihi” – G. Mahabaleshwara Bhat (Page 1-31); Translation from Sanskrit to Kannada/English (Unseen Sentences).
- BCA**     **Unit-1:** Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K. Siddagangaiah. (page 591-638).  
**Unit-2:** Dashakumaracharitam – Dandi – Chapter 1 – Poorvapeethika.  
**Unit-3:** Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12); Identifying Sandhi – “Sandhihi” – G. Mahabaleshwara Bhat (Page 1-31); Translation from Sanskrit to Kannada/English (Unseen Sentences).
- BBA**     **Unit-1:** Introduction to Sanskrit Gadya Literature - Samskrita Bhashashastra Mattu Sahitya Charitre – Dr K Krishnamurthy, Vidwan Ranganathasharma and Vidwan H.K. Siddagangaiah. (page 591-638).  
**Unit-2:** Kadambari – By Banabhatta – Shukanasopadesha and Chandrapeda Vidyabhyasa.  
**Unit-3:** Identifying Namapadas – Samskrit Shabdachandrika (page 1 to 12); Identifying Sandhi – “Sandhihi” – G. Mahabaleshwara Bhat (Page 1-31); Translation from Sanskrit to Kannada/English (Unseen Sentences)

**REFERENCE BOOKS:**

1. Bharata Sangraha - Lakshmanasuri.
2. Kadambari - Banabhatta.
3. Dashakumaracharitam – Dandi
4. Samskrit Shabdachandrika (page 1 to 12) – Vidwan N. Ranganatha Sharma, Vidyabharati Grantha mala -3, Sringeri. 1995.
5. “Sandhihi” – G. Mahabaleshwara Bhat (Page 1-31) Samskrita Bharati, Bengaluru. RPT-2017.
6. **Digital Resources:** [www.archieve.org](http://www.archieve.org) ; <https://www.wikipedia.org/>

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**Language: HINDI****BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Hindi held on 17<sup>th</sup> October, 2021 in the Department of Hindi, Yuvaraja College, Mysuru.

| Sl. No. | Members                  | Position | Signature/<br>Remarks |
|---------|--------------------------|----------|-----------------------|
| 1.      | Dr. JAYAPRAKASH D.R      | Chairman | Sd/                   |
| 2.      | Dr. VASANTHI M           | Member   | Sd/                   |
| 3.      | Dr. VASUDEVASHETTI       | Member   | Sd/                   |
| 4.      | Dr. BASAVARAJ K. BARAKER | Member   | Sd/                   |

The Chairman welcome the members of BOS and placed agenda of meeting before the Board. The Board discussed the NEP (National Education Policy). New syllabus of Language Hindi for BSc/B.B.A/B.C.A. Under the following title and approved the same year 2021 onwards.

**BSC/BBA/BCA**

I HINDI KAHANI + Prayojanmulak Hindi

II HINDI KAVITHA + Anuvaad Khoushal

III HINDI NATAK SAHITYA + Sanchaar Madyam aur Hindi.

IV HINDI LAGHU UPANYAS + Bhasha ki Vivid Rup (Karyalae Bhasha, Media Bhasha, Vanijya Bhasha, Machine Bhasha)

HINDI KAHANI KI VIKAS YATRA

I HINDI KATHA ASHTAK---By Reetha Gowda,  
Karyalayee Patrachaar, Alekhan, Tippan, Prathivedan.

II HINDI KAVITHA + Translation

Padya chayan by --Sushma Agarwal

Anuvaad abyaas.

Place: Mysuru

CHAIRMAN

Date: 17/11/2021

**Details of Course of Study: I and II Semesters**

| Sem. | Discipline Core/<br>Paper (L+T+P) | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|------|-----------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| I    | AECC: (L1-1): Hindi (3+0+0)       | 4                          | 3       | 40                                        | 60                                        |
| II   | AECC: (L1-2): Hindi (3+0+0)       | 4                          | 3       | 40                                        | 60                                        |

राष्ट्रीय शिक्षा नीति के तहत चार वर्ष के स्नातक उपाधि हेतु निर्मित  
हिंदी पाठ्यक्रम

|                                                                                             |         |  |
|---------------------------------------------------------------------------------------------|---------|--|
| डॉ. प्रतिभा मुदलियार<br>प्रो. हिंदी अध्ययन विभाग, मैसूर विश्वविद्यालय, मैसूर-6              | अध्यक्ष |  |
| डॉ. बसवराज के बारकेर<br>असोसिएट प्रोफेसर. हिंदी अध्ययन विभाग,<br>मैसूर विश्वविद्यालय, मैसूर | सदस्य   |  |
| डॉ. शालिवाहन कोल्लुरे<br>असोसिएट प्रोफेसर. हिंदी अध्ययन विभाग,<br>महाराणी कॉलेज, मैसूर      | सदस्य   |  |
| डॉ. प्रभूसेन<br>सहायक प्रो. हिंदी अध्ययन विभाग,<br>कर्नाटक राज्य मुक्त विश्वविद्यालय, मैसूर | सदस्य   |  |
| डॉ. मंजुला, सरकारी प्रथम दर्जा महाविद्यालय, बेंगलूर                                         | सदस्य   |  |

इस पाठ्यक्रम की संरचना ऐसी की गई है कि इसके अध्ययन के पश्चात हिंदी साहित्य का विद्यार्थी यह जान सके कि साहित्य का विश्लेषण कैसे किया जाए, उसकी सराहना कैसे की जाए और दिए गए पाठ को पढ़ने की समझ किस प्रकार विकसित की जाए ताकि विद्यार्थी भाषा और साहित्य के उद्देश्य से भली भाँति परिचित हो सके। यह उल्लेखनीय है कि चयन आधारित क्रेडिट प्रणाली में हिंदी भाषा और साहित्य के पाठ्यक्रम की विशिष्ट भूमिका है। प्रस्तावित पाठ्यक्रम में हिंदी भाषा के तहत पांच स्ट्रीम्स बनायी गयी हैं, जिससे विद्यार्थी अपने अनुशासन के अनुसार हिंदी भाषा का अध्ययन कर सके। साथ ही ओपन इलेक्टिव, स्किल डेवलेपमेंट और वोकेशनल कोर्सिस का भी निर्माण हिंदी में रोजगार को ध्यान में रखकर किया गया है।

वर्तमान समय सूचना क्रांति का है। यह पाठ्यक्रम रोजगारपरक शिक्षा देने का कार्य भी करेगा जिससे इसके अध्ययन के बाद विद्यार्थी अपने जीवन का निर्वाह भी उचित ढंग से कर सके। भारत बहुभाषा भाषी देश हैं। विविधता में एकता भारत की पहचान है। इस बात को ध्यान में रखते हुए भाषा एवं साहित्य की दृष्टि से पाठ्यक्रम की रूपरेखा तैयार की गई है। इसमें उल्लेखित पाठों के अध्ययन के उपरान्त विद्यार्थी न केवल अपने विवेक को विकसित कर सकते हैं बल्कि विश्लेषण करने में भी समर्थ हो सकते हैं।

हिंदी के स्नातक पाठ्यक्रम का उद्देश्य - हिंदी के स्नातक पाठ्यक्रम का उद्देश्य निम्नांकित लक्ष्यों को प्राप्त करना है

- मूलभूत कौशल श्रवण, लेखन और अभिव्यक्ति का विकास करना।
- भाषा कौशल का विकास करना।
- उच्चारण और लिपि का सही ज्ञान कराना।
- विद्यार्थियों को संवेदनशील नागरिक बनाना।
- एक कुशल वक्ता का निर्माण करना।
- समाज और समुदाय के प्रति संवेदनशील दृष्टि का विकास करना।
- राष्ट्रीय चेतना का विकास करना।
- मानवीय मूल्यों के प्रति स्वस्थ दृष्टिकोण विकसित करना।

- स्थानीय से लेकर अखिल भारतीय साहित्य से परिचित कराना।
- विभिन्न साहित्यिक विधाओं की जानकारी देना।
- समाज के विभिन्न समुदायों के प्रति सहिष्णुता की भावना का विकास करना।
- साहित्यिक विमर्शों से परिचित करना।
- साहित्यिक पाठ और उनके संदर्भों में आलोचनात्मक प्रवृत्ति और कल्पनाशीलता का कौशल निर्माण करना।
- उच्च अध्ययन और अनुसंधान में बहुविषयक दृष्टिकोण स्थापित करना।
- विद्यार्थियों में समावेशी दृष्टिकोण, जिम्मेदार नागरिकता, नैतिक सोच और सामाजिक प्रतिबद्धता की भावना का निर्माण करना।
- रोजगार के लिए उचित व्यावसायिक कौशल में छात्रों को प्रशिक्षित करना।
- तकनीकी रूप से उन्नत विश्व में विद्यार्थियों को इसकी चुनौतियों और अवसरों के लिए तैयार करना।
- व्यावहारिक और अनुभवात्मक शिक्षण के लिए सक्षम करना।

#### स्नातकीय विशेषता

- विषय का ज्ञान
- संप्रेषण कौशल
- आलोचनात्मक दृष्टिकोण
- समस्याओं का समाधान
- विश्लेषणात्मक और तार्किक दृष्टि का विकास
- अनुसंधान कौशल
- वैचारिक स्पष्टता
- बहुसांस्कृतिकता
- नैतिक और सामाजिक मूल्य

**परिणाम (Out Come)** - इस पाठ्यक्रम के पठन पाठन की दिशा में निम्नलिखित परिणाम सामने आएंगे।

- हिंदी भाषा की आरंभिक स्तर से लेकर वर्तमान के बदलते रूपों की जानकारी प्राप्त की जा सकती है।
- भाषा के सैद्धान्तिक रूप के साथ साथ व्यावहारिक रूप भी जाना जा सकता है।
- उच्च शैक्षिक स्तर पर हिंदी भाषा किस प्रकार महत्वपूर्ण भूमिका निभा सकती, इससे संबंधित परिणाम प्राप्त हो सकते हैं।
- भाषागत मूल्यों को व्यावहारिक रूप को भी जान सकते हैं।
- प्रयोजनमूलक हिंदी, पत्रकारिता, अनुवाद आदि के अद्यापन, अध्ययन के द्वारा व्यावसायिकता की क्षमता में बढावा प्राप्त होगा।
- भारतीय साहित्य के अध्ययन से छात्रों के ज्ञान विस्तार तथा अभिव्यक्ति क्षमता में विकास होगा।



- साहित्य के माध्यम से सौंदर्यबोध, नैतिकता, सामाजिक समरसता, पर्यावरण संबंधी विषयों की समझ विकसित होगी।
- भाषायी और साहित्यिक क्षमता में सघन होंगे।
- गंभीर, समीक्षात्मक और स्वतंत्र चिंतन के लिए सक्षम होंगे।
- अपने विचारों को व्यक्त करने तथा बहुआयामी व्याख्याओं को समझने के लिए तैयार होंगे।
- रचनात्मकता में अभिरूचि का निर्माण होगा।
- साहित्येतिहास के अध्ययन से साहित्यकार के युगबोध का परिचय होगा।
- काव्यशास्त्रिय सिद्धान्तों के अध्ययन से विश्लेषण की क्षमता का निर्माण होगा।
- वर्तमान तकनीकी वातावरण में हिंदी के प्रयोग में दक्ष होंगे।
- अनुवाद, रिपोर्ट लेखन, कविता, कहानी आदि की प्रस्तुति का अनुभव प्राप्त करेंगे।

### शिक्षण पद्धति (Pedagogy)

सीखने की प्रक्रिया में हिंदी भाषा की दक्षता को मजबूत बनाना होगा। विद्यार्थी हिंदी भाषा में नएपन और वैश्विक माध्यम की निर्माण प्रक्रिया में सहायक बन सकें। अपनी भाषा में व्यवहार और निपुणता प्राप्त कर सकें। साहित्य की समझ विकसित कर सकें तथा आलोचनात्मक एवं साहित्यिक विवेक निर्मित किया जा सकें। इसलिए निम्नलिखित शिक्षण पद्धति का उपयोग किया जा सकता है।

- व्याख्यान
- संवाद एवं बहस
- सामूहिक चर्चा
- कक्षाओं में पठन-पाठन की पद्धति
- परिवेश का सृजन
- अभिनय पद्धति का प्रयोग
- क्षेत्रीय अथवा परियोजना कार्य
- अध्ययन से संबंधित पर्यटन
- प्रदर्शन कलाओं को वास्तविक रूप देना
- लिखित परीक्षा
- आंतरिक मूल्यांकन
- शोध सर्वेक्षण
- वाद-विवाद
- दृश्य-श्रव्य माध्यम का प्रयोग
- आलोचनात्मक मूल्यांकन पर बल

### मूल्यांकन पद्धति

सेमेस्टर के अनुसार परीक्षा परिणाम तैयार किये जाएं। सेमेस्टर के अंतर्गत आंतरिक मूल्यांकन, सतत मूल्यांकन और सत्र के अंत में ली जानेवाली परीक्षा सम्मिलित हो। प्रत्येक सेमेस्टर में निर्धारित कोर्स के लिए प्रश्नपत्र 100 अंकों का हो। जिसमें 30 अंक आंतरिक मूल्यांकन और सत्रांत परीक्षा में 70 अंक निर्धारित हैं।

आंतरिक मूल्यांकन में कक्षा में आयोजित की जानेवाली परीक्षा, मौखिक प्रस्तुतियाँ, संगोष्ठी, साक्षात्कार, लघु उत्तरीय प्रश्न और तकनीकी ज्ञान के परीक्षण के आधार पर मूल्यांकन किया जाना चाहिए। इस प्रकार विद्यार्थी का समग्र मूल्यांकन हो सकेगा। उक्त प्रश्नपत्र में तीन तरह के प्रश्न होने चाहिए बहुविकल्पीय, लघु उत्तरीय दीर्घ उत्तरीय, व्याख्या या संदर्भ। हिंदी साहित्य से संबंधित पाठ्यक्रम की संरचना का उद्देश्य यह है कि विद्यार्थी का क्षेत्रीय, राष्ट्रीय और वैश्विक संदर्भों में सही मूल्यांकन किया जा सके ताकि उसका पारदर्शी और उचित ढंग से मूल्यांकन हो।

**Syllabus for Ability Enhancement Compulsory Course  
B.Com. (AECC)**

**B.COM Ability Enhancement Compulsory Course**

| Semester | AECC                                              | Credit (L+3+T-1 +P-0)<br>4- Hours | Marks<br>60+40-100 |
|----------|---------------------------------------------------|-----------------------------------|--------------------|
| I        | हिंदी गद्य की विधाएँ + व्याकरण                    | 3                                 |                    |
| II       | कहानी संग्रह + मीडिया लेखन                        | 3                                 |                    |
| III      | कविता संग्रह+ सरकारी पत्राचार, पारिभाषिक शब्दावली | 3                                 |                    |
| IV       | हिंदी नाटक + कंप्यूटर और हिंदी                    | 3                                 |                    |

**B.Com. I Semester- Course Content for AECC**

| Title of the Subject/Discipline : हिंदी गद्य की विधाएं + व्याकरण                       |                                                                                                                                                                                                                                                                          |                                                                                                                                                             |                                                                                                                                                   |                |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Semester                                                                               | I                                                                                                                                                                                                                                                                        | Course Code : AECC-I-HINDI (B.Com.)Course Title/Discipline :<br>Collection of Prose + Grammar Text :<br>गद्य चयन- मनोज गुप्ता- मलिक एण्ड कंपनी जयपुर-302003 | Credits                                                                                                                                           | 3              |
|                                                                                        |                                                                                                                                                                                                                                                                          |                                                                                                                                                             | Hours                                                                                                                                             | 4              |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                          |                                                                                                                                                             |                                                                                                                                                   |                |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>हिंदी गद्य की विभिन्न विधाओं से परिचित होंगे।</li><li>गद्य के अध्ययन से रचनात्मक लेखन में रुचि उत्पन्न होगी।</li><li>हिंदी व्याकरण के अध्ययन से हिंदी भाषा के शुद्ध स्वरूप को समझेंगे।</li><li>भाषा कौशल का विकास होगा।</li></ul>  |                                                                                                                                                             |                                                                                                                                                   |                |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                                                           |                                                                                                                                                             | Suggested Pedagogy                                                                                                                                | Hours Per week |
| Unit I                                                                                 | हिंदी गद्य विधाओं का परिचय                                                                                                                                                                                                                                               |                                                                                                                                                             | <ul style="list-style-type: none"><li>संवाद एवं बहस</li><li>सामूहिक चर्चा</li><li>कक्षाओं में पठन-पाठन की पद्धति</li><li>परिवेश का सृजन</li></ul> | 16             |
| Unit II                                                                                | गद्य चयन- मनोज गुप्ता- उक्त पुस्तक से प्रथम 1-5 तक की गद्य विधाएँ                                                                                                                                                                                                        |                                                                                                                                                             |                                                                                                                                                   | 16             |
| Unit III                                                                               | गद्य चयन- मनोज गुप्ता- उक्त पुस्तक से प्रथम 6-5 तक की गद्य विधाएँ                                                                                                                                                                                                        |                                                                                                                                                             |                                                                                                                                                   | 16             |
| Unit IV                                                                                | लिंग, वचन, कारक, शब्द भेद- संज्ञा, सर्वनाम, विशेषण, क्रिया                                                                                                                                                                                                               |                                                                                                                                                             |                                                                                                                                                   | 16             |
| Recommended Learning Resources                                                         |                                                                                                                                                                                                                                                                          |                                                                                                                                                             |                                                                                                                                                   |                |
| Print Resources                                                                        | <ul style="list-style-type: none"><li>हिंदी व्याकरण- कामताप्रसाद गुरु – प्रभात प्रकाशन, दिल्ली</li><li>हिंदी व्याकरण रचना –संपा- गो, मो. दाभोलकर, अशोक कामत- प्रकाशन- गुरुकुल प्रकाशन पुणे</li><li>शिक्षार्थी व्याकरण- प्रो. नागप्पा- राजपाल एण्ड सन्स- दिल्ली</li></ul> |                                                                                                                                                             |                                                                                                                                                   |                |
| Digital Resources                                                                      | <a href="https://hi.wikipedia.org/wiki/{dYm">https://hi.wikipedia.org/wiki/{dYm</a>                                                                                                                                                                                      |                                                                                                                                                             |                                                                                                                                                   |                |



## B.Com II Semester Course Content for AECC-

| Title of the Subject/Discipline : कहानी संग्रह + मीडिया लेखन                           |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                   |                                                                                                                                                    |                |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Semester                                                                               | II                                                                                                                                                                                                                                                                                                                                                    | Course Code : AECC-1-HINDI (B.Com.) Course Title/Discipline : Collection of Short Stories+ Media Writing<br>Text- कथा संचयन- डॉ. शिवशरण कौशिक- नेशनल पब्लिशिंग हाउस, जयपुर-302003 | Credits                                                                                                                                            | 3              |
|                                                                                        |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                   | Hours                                                                                                                                              | 4              |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                   |                                                                                                                                                    |                |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>हिंदी कहानी के स्वरूप को समझने की योग्यता निर्माण होगी।</li><li>कहानी लेखन और पठन में रुचि निर्माण होगी।</li><li>सोशल मीडिया में लेखन में योग्यता प्राप्त होगी।</li><li>मीडिया लेखन के स्वरूप का ज्ञान प्राप्त होगा।</li></ul>                                                                                  |                                                                                                                                                                                   |                                                                                                                                                    |                |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                   | Suggested Pedagogy                                                                                                                                 | Hours Per week |
| Unit I                                                                                 | हिंदी कहानी का विकास क्रम                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                   | <ul style="list-style-type: none"><li>व्याख्यान</li><li>संवाद एवं बहस</li><li>सामूहिक चर्चा</li><li>समाचार पत्र में रिपोर्टिंग का अभ्यास</li></ul> | 16             |
| Unit II                                                                                | कथा संचयन- डॉ. शिवशरण कौशिक- प्रथम 1-5 तक का अध्ययन                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                   |                                                                                                                                                    | 16             |
| Unit III                                                                               | कथा संचयन- डॉ. शिवशरण कौशिक- अंतिम 6-10 तक का अध्ययन                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                   |                                                                                                                                                    | 16             |
| Unit IV                                                                                | समाचार संकलन और लेखन, रिपोर्ट लेखन, साक्षात्कार                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                   |                                                                                                                                                    | 16             |
| Recommended Learning Resources                                                         |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                   |                                                                                                                                                    |                |
| Print Resources                                                                        | <ul style="list-style-type: none"><li>1. पत्रकारिता की विभिन्न विधाएँ- डॉ.निशांत सिंह, राधा पब्लिकेशन्स, नई दिल्ली, 110002</li><li>2. मीडिया आयाम- प्रतिमान- -डॉ पृथ्वीनाथ पाण्डेय, जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li><li>3. पत्रकारिता की विविध विधाएँ- डॉ. राजकुमार श्रीवास्तव- जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li></ul> |                                                                                                                                                                                   |                                                                                                                                                    |                |
| Digital Resources                                                                      | <a href="https://hi.wikipedia.org/wiki/dYm">https://hi.wikipedia.org/wiki/dYm</a>                                                                                                                                                                                                                                                                     |                                                                                                                                                                                   |                                                                                                                                                    |                |

## Syllabus for Ability Enhancement Compulsory Course

## B.B.A. (AECC)

## B.B.A. Ability Enhancement Compulsory Course

| Semester | AECC                                    | Credit (L-3+T-1+P-0)<br>4 Hours | Marks-<br>60+40=100 |
|----------|-----------------------------------------|---------------------------------|---------------------|
| I        | हिंदी कहानी + हिंदी व्याकरण             | 3                               |                     |
| II       | हिंदी गद्य + प्रयोजन मूलक हिंदी         | 3                               |                     |
| III      | हिंदी कविता + समाचार लेखन और रिपोर्टिंग | 3                               |                     |
| IV       | हिंदी नाटक साहित्य + पत्रलेखन और आलेखन  | 3                               |                     |

## B.B.A I Semester Course Content for AECC-

| Title of the Subject/Discipline : हिंदी कहानी + व्याकरण                                |                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |                                                                                                                                          |                |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Semester                                                                               | I                                                                                                                                                                                                                              | Course Code : AECC-1-HINDI (B.B.A) Course<br>Title/Discipline : Collection of Short Stories+<br>Hindi Grammar<br><br>Text- कहानी कुंज- संपा. डॉ राजेन्द्र पोवार-राधाकृष्ण<br>प्रकाशन, दरियागंज, नई दिल्ली-110002 | Credits                                                                                                                                  | 3              |
|                                                                                        |                                                                                                                                                                                                                                |                                                                                                                                                                                                                  | Hours                                                                                                                                    | 4              |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |                                                                                                                                          |                |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>कहानी के पठन पाठन में रुचि उत्पन्न होगी।</li><li>कहानी-लेखन क्षमता का निर्माण होगा।</li><li>भाषायी शुद्धता के प्रति रुचि निर्माण होगी।</li><li>भाषा के प्रयोग में सक्षम होंगे।</li></ul> |                                                                                                                                                                                                                  |                                                                                                                                          |                |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                 |                                                                                                                                                                                                                  | Suggested Pedagogy                                                                                                                       | Hours Per week |
| Unit I                                                                                 | हिंदी कहानी का विकास क्रम                                                                                                                                                                                                      |                                                                                                                                                                                                                  | <ul style="list-style-type: none"><li>व्याख्यान</li><li>संवाद एवं बहस</li><li>भाषा कौशल का विकास</li><li>गतिविधि आधारित शिक्षण</li></ul> | 16             |
| Unit II                                                                                | कहानी कुंज- संपा. डॉ राजेन्द्र पोवार प्रथम 1-4 का अध्ययन                                                                                                                                                                       |                                                                                                                                                                                                                  |                                                                                                                                          | 16             |
| Unit III                                                                               | कहानी कुंज- संपा. डॉ राजेन्द्र पोवार. अंतिम 5-8 का अध्ययन                                                                                                                                                                      |                                                                                                                                                                                                                  |                                                                                                                                          | 16             |
| Unit IV                                                                                | लिंग, वचन, कारक , शब्द भेद- संज्ञा, सर्वनाम, विशेषण, क्रिया                                                                                                                                                                    |                                                                                                                                                                                                                  |                                                                                                                                          | 16             |

| Recommended Learning Resources ( |                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Print Resources                  | <ul style="list-style-type: none"> <li>कहानी कुंज- संपा. डॉ राजेन्द्र पोवार-राधाकृष्ण प्रकाशन, दरियागंज, नई दिल्ली-110002</li> <li>हिंदी व्याकरण- कामताप्रसाद गुरु – प्रभात प्रकाशन, दिल्ली</li> <li>हिंदी व्याकरण रचना –संपा. गो.मो. दामोदरकर, अशोक कामत- प्रकाशन- गुरुकुल प्रकाशन पुणे</li> <li>शिक्षार्थी व्याकरण- प्रो. नागप्पा- राजपाल एण्ड सन्स- दिल्ली</li> </ul> |
| Digital Resources                | <a href="https://hi.wikipedia.org/wiki/{dYm">https://hi.wikipedia.org/wiki/{dYm</a>                                                                                                                                                                                                                                                                                      |

## B.B.A II Semester Course Content for AECC-

| Title of the Subject/Discipline : हिंदी गद्य + प्रयोजन मूलक हिंदी                       |                                                                                                                                                                                                                                               |                                                                                                                                                                                  |         |   |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---|
| Semester                                                                                | I                                                                                                                                                                                                                                             | Course Code : AECC-1-HINDI (B.BA) Course<br>Title/Discipline :<br>Hindi Prose + Functional Hindi<br>Text- गद्य मंजुषा- डॉ राजकुमार सिंह परमार- मलिक एण्ड<br>कंपनी , जयपुर 302003 | Credits | 3 |
|                                                                                         |                                                                                                                                                                                                                                               |                                                                                                                                                                                  | Hours   | 4 |
| Formative Assessment Marks : 40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                               |                                                                                                                                                                                  |         |   |
| Learning Outcomes                                                                       | <ul style="list-style-type: none"> <li>हिंदी गद्य की विभिन्न विधाओं से परिचित होंगे।</li> <li>हिंदी के गद्यकारों से परिचित होंगे।</li> <li>हिंदी के प्रयोजनमूलक स्वरूप को समझ पायेंगे।</li> <li>हिंदी भाषा के महत्व को जान सकेंगे।</li> </ul> |                                                                                                                                                                                  |         |   |

| Unit No.                       | Course Content                                                                                                                                                                                                                                                                                                                                                                                                                 | Suggested Pedagogy                                                                                                    | Hours per week |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------|
| Unit I                         | हिंदी गद्य विधाओं का परिचय                                                                                                                                                                                                                                                                                                                                                                                                     | <div>➤ कक्षा व्याख्यान</div> <div>➤ सामूहिक चर्चा</div> <div>➤ गतिविधि आधारित कार्य</div> <div>➤ परिवेश निर्माण</div> | 16             |
| Unit II                        | गद्य मंजुषा- डॉ. राजकुमार सिंह परमार- प्रथम 3-7 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                       | 16             |
| Unit III                       | गद्य मंजुषा- डॉ. राजकुमार सिंह परमार- प्रथम 4-12 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       | 16             |
| Unit IV                        | आलेखन, टिप्पण, संक्षेपण, प्रतिवेदन, संक्षिप्तिकरण                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                       | 16             |
| Recommended Learning Resources |                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                |
| Print Resources                | <div><div>● कार्यालय आलेखन और टिप्पण- प्रकाशक- कर्नाटक महिला हिंदी सेवा समिति, बेंगलुर</div><div>● व्यावसायिक संप्रेषण- अनुपचंद भयानी- प्रकाशक- राजपास एण्ड सन्स, दिल्ली</div><div>● राजभाषा हिंदी राजकीय पत्रव्यवहार – डॉ. घनश्याम अग्रवाल, जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</div><div>● प्रयोजनमूलक हिंदी पारिभाषिक शब्दावली टिप्पण प्रारूपण- डॉ मधु धवन- जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</div></div> |                                                                                                                       |                |
| Digital Resources              | <a href="https://hi.wikipedia.org/wiki/{dYm}">https://hi.wikipedia.org/wiki/{dYm}</a>                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                |

## हिंदी भाषा का अध्ययन दो साल (चार सेमेस्टर)

**B.C.A.: Ability Enhancement Compulsory Course (AECC)**

| Semester | AECC                                     | Credit -3<br>(L-3+T-1+P-0) 4 hrs | Marks<br>60+40=100 |
|----------|------------------------------------------|----------------------------------|--------------------|
| I        | हिंदी निबंध साहित्य + कार्यालयी हिंदी    | 3                                |                    |
| II       | हिंदी कहानी साहित्य + प्रयोजनमूलक हिन्दी | 3                                |                    |

**B.C.A. I Semester Course Content for AECC-**

| Title of the Subject/Discipline : हिंदी निबंध साहित्य + कार्यालयी हिंदी                 |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                      |                                                                                                                                                  |                |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Semester                                                                                | I                                                                                                                                                                                                                                                                                                                                                                                                                | Course Code : AECC-I-HINDI (B.C.A)                                                                                                                                                   | Credits                                                                                                                                          | 3              |
|                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                  | Course Title/Discipline :<br>Hindi Easy + Functional Hindi (कार्यालयी हिंदी)<br><br>Text- निबंध- विचार रचना- विनोद तिवारी, लोकभारती प्रकाशन,<br>महात्मा गांधी मार्ग, ईलाहाबाद-211001 | Hours                                                                                                                                            | 4              |
| Formative Assessment Marks : 40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                      |                                                                                                                                                  |                |
| Learning Outcomes                                                                       | <ul style="list-style-type: none"><li>● गद्य के तत्वों के आधार पर निबंध रचने की क्षमता प्राप्त होगी ।</li><li>● छात्रों में पढ़ने की आदत का विकास होगा।</li><li>● वाचन कौशल, लेखन कौशल एवं वक्तृत्व कौशल प्राप्त कर सकते हैं।</li><li>● हिंदी पत्रव्यवहार से संबंधित सही जानकारी प्राप्त कर सकते हैं ।</li><li>● पत्र लेखन का स्वरूप समझकर व्यावहारिक जीवन में प्रयोग करने की क्षमता प्राप्त करते हैं।</li></ul> |                                                                                                                                                                                      |                                                                                                                                                  |                |
| Unit No.                                                                                | Course Content                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                      | Suggested Pedagogy                                                                                                                               | Hours Per week |
| Unit I                                                                                  | हिंदी निबंध की विकास यात्रा                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                      | <ul style="list-style-type: none"><li>➤ कक्षा व्याख्यान</li><li>➤ सामूहिक चर्चा</li><li>➤ गतिविधि आधारित कार्य</li><li>➤ परिवेशनिर्माण</li></ul> | 16             |
| Unit II                                                                                 | निबंध- विचार रचना- विनोद तिवारी- 1-6 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                      |                                                                                                                                                  | 16             |
| Unit III                                                                                | निबंध- विचार रचना- विनोद तिवारी – 7-12 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                      |                                                                                                                                                  | 16             |
| Unit IV                                                                                 | संक्षिप्तिकरण, आलेखन, टिप्पण, संक्षेपण, प्रतिवेदन                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                      |                                                                                                                                                  | 16             |
| Recommended Learning Resources                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                      |                                                                                                                                                  |                |
| Print Resources                                                                         | <ul style="list-style-type: none"><li>● कार्यालय आलेखन और टिप्पण- प्रकाशक- कर्नाटक महिला हिंदी सेवा समिति, बेंगलुर</li><li>● व्यावसायिक संप्रेषण- अनुपचंद भयानी- प्रकाशक- राजपास एण्ड सन्स, दिल्ली</li><li>● राजभाषा हिंदी राजकीय पत्रव्यवहार – डॉ. घनश्याम अग्रवाल, जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li></ul>                                                                                       |                                                                                                                                                                                      |                                                                                                                                                  |                |

|                   |                                                                                       |
|-------------------|---------------------------------------------------------------------------------------|
|                   | ● कामकाजी हिंदी शब्द –संरचना –गणपति मोटल- जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3 |
| Digital Resources | <a href="https://hi.wikipedia.org/wiki/dYm">https://hi.wikipedia.org/wiki/dYm</a>     |

## B.C.A II Semester Course Content for AECC-

| Title of the Subject/Discipline : हिंदी कहानी साहित्य + प्रयोजनमूलक हिन्दी             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                              |                                                                                                                                           |             |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Semester                                                                               | I                                                                                                                                                                                                                                                                                                                                                                                                                                          | Course Code : AECC-1-HINDI (B.C.A.)                                                          | Credits                                                                                                                                   | 3           |
|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            | Course Title/Discipline :<br>Hindi Short Stories + Functional Hindi                          | Hours                                                                                                                                     | 4           |
|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            | Text- हिंदी की प्रतिनिधि कहानियाँ- डॉ विराट- जवाहर पुस्तकालय, सदर बाजार मथुरा, यू. पी 201001 |                                                                                                                                           |             |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                              |                                                                                                                                           |             |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>कहानी के तत्वों के आधार पर कहानी रचने की क्षमता प्राप्त कर सकते हैं।</li><li>अपने सृजनात्मक विचारों और भावनाओं को व्यक्त करने की क्षमता उत्पन्न होगी।</li><li>हिन्दी के कथा साहित्य से संबंधित जानकारी प्राप्त कर सकते हैं।</li><li>प्रयोजनमूलक हिन्दी के प्रयोजनपरक स्वरूप की समझ निर्माण होगी।</li></ul>                                                                                           |                                                                                              |                                                                                                                                           |             |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                              | Suggested Pedagogy                                                                                                                        | Hours L/P/L |
| Unit I                                                                                 | कहानी का उद्भव और विकास                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                              | <ul style="list-style-type: none"><li>कक्षा व्याख्यान</li><li>सामूहिक चर्चा</li><li>गतिविधि आधारित कार्य</li><li>परिवेश निर्माण</li></ul> | 16          |
| Unit II                                                                                | हिंदी की प्रतिनिधि कहानियाँ- डॉ विराट- 1-4 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                              |                                                                                                                                           | 16          |
| Unit III                                                                               | हिंदी की प्रतिनिधि कहानियाँ- डॉ विराट- -4+8 का अध्ययन                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                              |                                                                                                                                           | 16          |
| Unit IV                                                                                | आलेखन, टिप्पण, संक्षेपण, प्रतिवेदन, प्रेस विज्ञप्ति                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                              |                                                                                                                                           | 16          |
| Recommended Learning Resources (                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                              |                                                                                                                                           |             |
| Print Resources                                                                        | <ul style="list-style-type: none"><li>कार्यालय आलेखन और टिप्पण- प्रकाशक- कर्नाटक महिला हिंदी सेवा समिति, बेंगलुर</li><li>व्यावसायिक संप्रेषण- अनुपचंद भयानी- प्रकाशक- राजपास एण्ड सन्स, दिल्ली</li><li>राजभाषा हिंदी राजकीय पत्रव्यवहार – डॉ. घनश्याम अग्रवाल, जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li><li>प्रयोजनमूलक हिंदी पारिभाषिक शब्दावली टिप्पण प्रारूपण- डॉ मधु धवन- जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li></ul> |                                                                                              |                                                                                                                                           |             |
| Digital Resources                                                                      | <a href="https://hi.wikipedia.org/wiki/dYm">https://hi.wikipedia.org/wiki/dYm</a>                                                                                                                                                                                                                                                                                                                                                          |                                                                                              |                                                                                                                                           |             |

## हिंदी भाषा का अध्ययन दो साल (चार सेमेस्टर)

## B.SC: Ability Enhancement Compulsory Course (AECC)

| Semester | AECC/                           | Credit -3<br>(L-3+T-1+P-0)<br>4 hrs | Marks-<br>60+40=100 |
|----------|---------------------------------|-------------------------------------|---------------------|
| I        | हिंदी कहानी + प्रयोजनमूलक हिंदी | 3                                   |                     |
| II       | हिंदी कविता + अनुवाद कौशल       | 3                                   |                     |



## B.SC. I Semester Course Content for AECC-

| Title of the Subject/Discipline : हिंदी कहानी + प्रयोजनमूलक हिन्दी                     |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                       |                                                                                                                                                                        |             |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Semester                                                                               | I                                                                                                                                                                                                                                                                                                                                                | Course Code : AECC-1-HINDI (B.SC.)<br>Course Title/Discipline :<br>Hindi Short Stories + Functional Hindi<br>Text- कथा अष्टक- रीता गौड- मलिक एण्ड कंपनी, जयपुर 302003 | Credits                                                                                                                                                                | 3           |
|                                                                                        |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                       | Hours                                                                                                                                                                  | 4           |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                       |                                                                                                                                                                        |             |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>कहानी के तत्वों के आधार पर कहानी रचने की क्षमता प्राप्त कर सकते हैं।</li><li>अपने सृजनात्मक विचारों और भावनाओं को व्यक्त करने की क्षमता उत्पन्न होगी।</li><li>हिन्दी के कथा साहित्य से संबंधित जानकारी प्राप्त कर सकते हैं।</li><li>प्रयोजनमूलक हिन्दी के प्रयोजनपरक स्वरूप की समझ निर्माण होगी।</li></ul> |                                                                                                                                                                       |                                                                                                                                                                        |             |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                       | Suggested Pedagogy                                                                                                                                                     | Hours L/P/L |
| Unit I                                                                                 | हिंदी कहानी की विकास यात्रा                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                       | <ul style="list-style-type: none"><li>➤ कक्षा व्याख्यान</li><li>➤ सामूहिक चर्चा</li><li>➤ गतिविधि आधारित कार्य</li><li>➤ परिवेश निर्माण, रचनात्मक अभिव्यक्ति</li></ul> | 16          |
| Unit II                                                                                | कथा अष्टक- रीता गौड- मलिक एण्ड कंपनी- प्रथम चार का अध्ययन                                                                                                                                                                                                                                                                                        |                                                                                                                                                                       |                                                                                                                                                                        | 16          |
| Unit III                                                                               | कथा अष्टक- रीता गौड- मलिक एण्ड कंपनी- अंतिम चार अध्ययन                                                                                                                                                                                                                                                                                           |                                                                                                                                                                       |                                                                                                                                                                        | 16          |
| Unit IV                                                                                | कार्यालयी पत्राचार, आलेखन, टिप्पण, प्रतिवेदन,                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                       |                                                                                                                                                                        | 16          |

| Recommended Learning Resources |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Print Resources                | <ul style="list-style-type: none"> <li>कार्यालय आलेखन और टिप्पण- प्रकाशक- कर्नाटक महिला हिंदी सेवा समिति, बेंगलूर</li> <li>व्यावसायिक संप्रेषण- अनुपचंद भयानी- प्रकाशक- राजपास एण्ड सन्स, दिल्ली</li> <li>राजभाषा हिंदी राजकीय पत्रव्यवहार – डॉ. घनश्याम अग्रवाल, जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li> <li>प्रयोजनमूलक हिंदी पारिभाषिक शब्दावली टिप्पण प्रारूपण- डॉ मधु धवन- जयभारती प्रकाशन, माया प्रेस रोड, इलाहाबाद-3</li> </ul> |
| Digital Resources              | <a href="https://hi.wikipedia.org/wiki/dYm">https://hi.wikipedia.org/wiki/dYm</a><br><a href="https://hi.wikipedia.org/wiki/hYXr_H hmZr">https://hi.wikipedia.org/wiki/hYXr_H hmZr</a>                                                                                                                                                                                                                                                          |

## B.S.C. II Semester Course Content for AECC-

| Title of the Subject/Discipline : हिंदी कविता + अनुवाद कौशल                            |                                                                                                                                                                                                                                                                 |                                                                                                                                    |         |   |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------|---|
| Semester                                                                               | I                                                                                                                                                                                                                                                               | Course Code : AECC-1-HINDI (B.SC.)                                                                                                 | Credits | 3 |
|                                                                                        |                                                                                                                                                                                                                                                                 | Course Title/Discipline :<br>Hindi Poetry + Translation<br>Text – पद्य चयन – डॉ. सुषमा अग्रवाल- नैशनल पब्लिशिंग हाउस, जयपुर-302003 | Hours   | 4 |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                                                 |                                                                                                                                    |         |   |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"> <li>कविता पढ़कर स्वयं कविता रचने की क्षमता प्राप्त करेंगे।</li> <li>हिन्दी के काव्य साहित्य की परिपूर्ण जानकारी प्राप्त करेंगे।</li> <li>अनुवाद करने में सक्षम होंगे।</li> <li>रचनात्मक अभिव्यक्ति का विकास होगा।</li> </ul> |                                                                                                                                    |         |   |

| Unit No.                       | Course Content                                                                                                                                                                   | Suggested Pedagogy                           | Hours L/P/L |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------|
| Unit I                         | हिंदी कविता की विकास यात्रा                                                                                                                                                      | ➤ कक्षा व्याख्यान                            | 16          |
| Unit II                        | पद्य चयन- डॉ सुषमा अग्रवाल- मै. गुप्त- भारत की श्रेष्ठता, सुमित्रानंदन पंत- बापू, सूर्यकांत त्रिपाठी निराला- वह तोड़ती पत्थर, दिनकर- हिमालय, सुभद्रा कुमारी चौहान- झाँसी की रानी | ➤ कविता पाठ<br>➤ अनुवाद का व्यावहारिक प्रयोग | 16          |
| Unit III                       | पद्य चयन-हरिवंश राय बच्चन- पथ की पहचान डॉ सुषमा अग्रवाल- भवानी प्रसाद मिश्र- गीत फरोश, केदारनाथ अग्रवाल- यह धरती है उस किसान की, नागार्जुन- प्रेत का बयान                        | ➤ सामूहिक चर्चा                              | 16          |
| Unit IV                        | अनुवाद अभ्यास<br>कन्नड/ अंग्रेजी से हिंदी, हिंदी से कन्नड या अंग्रेजी में अनुवाद                                                                                                 |                                              | 16          |
| Recommended Learning Resources |                                                                                                                                                                                  |                                              |             |

|                   |                                                                                                                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Print Resources   | <ul style="list-style-type: none"> <li>• कार्यालय आलेखन और टिप्पण- प्रकाशक- कर्नाटक महिला हिंदी सेवा समिति, बेंगलूर</li> <li>• व्यावसायिक संप्रेषण- अनुपचंद भयानी- प्रकाशक- राजपास एण्ड सन्स, दिल्ली</li> </ul> |
| Digital Resources | <a href="https://kavishala.in/@kavishala-labs/adhunik-hindi-kavita-ka-itihasa-kavishala-labs">https://kavishala.in/@kavishala-labs/adhunik-hindi-kavita-ka-itihasa-kavishala-labs</a>                           |

B.COM/B.B.A./B.C.A./B.SC/B.A/B.S.C/B.COM/B.B.A/B.C.A

**Syllabus for Open Electives**

| Semester | Open Elective                                                        | Credit (L+3+T-1+P-0)<br>4 hrs | Marks<br>60+40=100 |
|----------|----------------------------------------------------------------------|-------------------------------|--------------------|
| I        | संभाषण कला/ पर्यावरण संबंधी हिंदी साहित्य                            | 3                             |                    |
| II       | हिंदी भाषा और साहित्य का सामान्य परिचय / भूमंडलीकरण और हिंदी साहित्य | 3                             |                    |

For all the stream across the discipline Course Content for Open Elective –I Semester

| Title of the Subject/Discipline : संभाषण कला                                           |                                                                                                                                                                                                                                             |                                                                                     |                |
|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|
| Year                                                                                   | 1                                                                                                                                                                                                                                           | Course Code : OE-1-HINDI<br>(B.A./B.Com./ B.SC./ B.B.A./ B.C.A/B.S.W/C.C.J)         | Credits 3      |
| Sem.                                                                                   | 1                                                                                                                                                                                                                                           | Course Title/Discipline : संभाषण कला                                                | Hours 4        |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                                                             |                                                                                     |                |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"> <li>• छात्रों में अंतर्निहित संप्रेषण एवं बोलने की कला का विकास होगा।</li> <li>• लिखने की कला में निपुणता हासिल होगी।</li> <li>• मानक लेखन का अभ्यास होगा</li> <li>• व्यक्तित्व का विकास होगा</li> </ul> |                                                                                     |                |
| Unit No.                                                                               | Course Content                                                                                                                                                                                                                              | Suggested Pedagogy                                                                  | Hours Per week |
| Unit I                                                                                 | संभाषण कला का अर्थ, संभाषण के विभिन्न रूप- वार्तालाप, व्याख्यान संवाद विवाद, एकालाप                                                                                                                                                         | <ul style="list-style-type: none"> <li>• वार्तालाप</li> <li>• समूह चर्चा</li> </ul> | 16             |

|                                |                                                                                                                                                                                                                                                                        |                                                                                                                                                     |    |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Unit II                        | अवाचिक अभिव्यक्ति, जन संबोधन,<br>संभाषण कला के उपादान - भाषा ज्ञान, अंतराल ध्वनि, लहजा।                                                                                                                                                                                | <ul style="list-style-type: none"><li>परिवेश निर्माण</li><li>ICT और यू ट्यूब का प्रयोग</li><li>भिन्न भिन्न स्थानों पर वार्तालाप का अभ्यास</li></ul> | 16 |
| Unit III                       | संभाषण कला के विभिन्न रूप- उद्घोषणा, संचालन, आँखों देखा हाल,                                                                                                                                                                                                           |                                                                                                                                                     | 16 |
| Unit IV                        | वाचन कला, वाद-विवाद प्रतियोगिता समूह संवाद.                                                                                                                                                                                                                            |                                                                                                                                                     | 16 |
| Recommended Learning Resources |                                                                                                                                                                                                                                                                        |                                                                                                                                                     |    |
| Print Resources                | <ul style="list-style-type: none"><li>भाषण और संभाषण कूट दिव्य शक्ति- श्री राम शर्मा आचार्य- युग निर्माण योजना प्रेस, मथुरा</li><li>भाषण कला- डॉ. महेश शर्मा- ज्ञान गंगा दिल्ली</li><li>बोलचाल की हिंदी और संचार- डॉ. मधु धवन- वाणी प्रकाश, नई दिल्ली-110002</li></ul> |                                                                                                                                                     |    |
| Digital Resources              | <a href="https://hindi.mapsofindia.com/my-india/history/history-of-indian-cinema">https://hindi.mapsofindia.com/my-india/history/history-of-indian-cinema</a>                                                                                                          |                                                                                                                                                     |    |

## Course Content for Open Elective –II Semester

| Title of the Subject/Discipline : हिंदी भाषा और साहित्य का सामान्य परिचय               |                                                                                                                                                                                                              |                                                  |                                                                                                                                                                   |             |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Year                                                                                   | 1                                                                                                                                                                                                            | Course Code : OE-1-HINDI                         | Credits                                                                                                                                                           | 3           |
| Sem.                                                                                   | 1                                                                                                                                                                                                            | (B.A./B.Com./ B.Sc./ B.B.A./ B.C.A./B.S.W/C.C.J) | Hours                                                                                                                                                             | 4           |
| Course Title/Discipline : हिंदी भाषा और साहित्य का सामान्य परिचय                       |                                                                                                                                                                                                              |                                                  |                                                                                                                                                                   |             |
| Formative Assessment Marks :40 Summative Assessment Marks :60 Duration of ESA :64 hrs. |                                                                                                                                                                                                              |                                                  |                                                                                                                                                                   |             |
| Learning Outcomes                                                                      | <ul style="list-style-type: none"><li>छात्रों को हिंदी साहित्य के प्रति रुची उत्पन्न होगी।</li><li>हिंदी के प्रमुख रचनाकारों से परिचित होंगे</li></ul>                                                       |                                                  |                                                                                                                                                                   |             |
| Unit No.                                                                               | Course Content                                                                                                                                                                                               |                                                  | Suggested Pedagogy                                                                                                                                                | Hours L/P/L |
| Unit I                                                                                 | हिंदी भाषा का परिचय और विशेषताएँ                                                                                                                                                                             |                                                  | <ul style="list-style-type: none"><li>वार्तालाप</li><li>समूह चर्चा</li><li>परिवेश निर्माण</li><li>ICT और यू ट्यूब का प्रयोग</li><li>वार्तालाप का अभ्यास</li></ul> | 16          |
| Unit II                                                                                | हिंदी साहित्य का काल विभाजन और संक्षिप्त परिचय                                                                                                                                                               |                                                  |                                                                                                                                                                   | 16          |
| Unit III                                                                               | हिंदी साहित्य के प्रमुख कवियों का परिचय- कबीरदास,सूरदास, तुलसी, मैथिलीशरण गुप्त पंत. निराला, महादेवी वर्मा, दिनकर, अज्ञेय                                                                                    |                                                  |                                                                                                                                                                   | 16          |
| Unit IV                                                                                | हिंदी साहित्य के लेखकों का परिचय – प्रेमचंद, प्रसाद, यशपाल, भीष्म साहनी, कमलेश्वर, राजेन्द्र यादव, कृष्णा सोबती, मन्नु भंडारी, मृदुला गर्ग, नासिरा शर्मा                                                     |                                                  |                                                                                                                                                                   | 16          |
| Recommended Learning Resources                                                         |                                                                                                                                                                                                              |                                                  |                                                                                                                                                                   |             |
| Print Resources                                                                        | <ul style="list-style-type: none"><li>हिंदी साहित्य का संक्षिप्त इतिहास- गुलाबराय</li><li>हिंदी के कवि एवं लेखक</li><li>हिंदी साहित्य युग और प्रवृत्तियाँ- शिवकुमार शर्मा, अशोक प्रकाशन, नई दिल्ली</li></ul> |                                                  |                                                                                                                                                                   |             |
| Digital Resources                                                                      | <a href="https://hi.wikipedia.org/wiki/{dYm">https://hi.wikipedia.org/wiki/{dYm</a>                                                                                                                          |                                                  |                                                                                                                                                                   |             |



## QUESTION PAPER PATTERN

For Ability Enhancement Compulsory Course

B.Com., B.B.A, B.C.A, B.SC, B.A., B.SW,

| Qn. No.                    | Particulars                           |              | Marks | Total      |
|----------------------------|---------------------------------------|--------------|-------|------------|
| <b>SECTION – A</b>         |                                       |              |       |            |
| <b>I</b>                   | Objective Type Questions (Compulsory) | 10 out of 10 | 01    | 10         |
| <b>II</b>                  | Reference to Context                  | 2 out of 4   | 05    | 10         |
| <b>SECTION – B</b>         |                                       |              |       |            |
| <b>III</b>                 | Short Answer Questions                | 4 out of 7   | 05    | 20         |
| <b>SECTION – C</b>         |                                       |              |       |            |
| <b>IV</b>                  | Essay type Answer Questions           | 2 out of 4   | 10    | 20         |
| Total                      |                                       |              |       | <b>60</b>  |
| <b>Internal Assessment</b> | IA Test                               |              | 15    | 40         |
|                            | Assignment                            |              | 15    |            |
|                            | Seminar                               |              | 10    |            |
| Total                      |                                       |              |       | <b>100</b> |

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## Ability Enhancement Compulsory Course (AECC)- ENVIRONMENTAL STUDIES

### Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020 (2021-22 Batch Onwards)

#### BOARD OF STUDIES: PROCEEDINGS

Proceedings of the Board of Studies in Environmental Studies is as in the proceedings of Environmental Science.

#### Details of Course of Study: I and II Semesters

| Sem. | Discipline Core/<br>Paper (L+T+P)      | Teaching<br>hours/<br>week | Credits | Internal<br>Assessment<br>Marks (C1 + C2) | Semester End<br>Examination<br>Marks (C3) |
|------|----------------------------------------|----------------------------|---------|-------------------------------------------|-------------------------------------------|
| I    | AECC: Environmental studies<br>(2+0+0) | 3                          | 2       | 20                                        | 30                                        |
| II   | AECC: Environmental studies<br>(2+0+0) | 3                          | 2       | 20                                        | 30                                        |

### I SEMESTER

#### Course Objectives:

- ❖ Environmental Studies (AECC) is made compulsory core module syllabus framed by UGC for all the Indian Universities as per the directions given by the honorable Supreme court, which believed that, conservation of environment should be a national way of life and to be inculcated into the education process. The committee proposes a staggered implementation for this course. This facilitates the distribution of the teaching workload of an institution.
- ❖ To ensure the interdisciplinary spirit of the proposed curriculum, teaching must be carried out by the faculty who are trained at post-graduate (M.Sc.) and Ph.D. in the 'Environmental Science' subject only. A candidate who is qualified with UGC-NET/K-SET in the area of Environmental Science will be well-equipped to teach this curriculum.

**AECC: ENVIRONMENTAL STUDIES (THEORY):                      2 Credits    45 Hrs.**

**Unit-1: Introduction to Environmental Studies:** Multidisciplinary nature of environmental studies. Scope and importance; Concept of sustainability and sustainable development. **02 Hrs.**

**Unit-2: Ecosystems:** Ecosystem - Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the

following ecosystems: a) Forest ecosystem, b) Grassland ecosystem, c) Desert ecosystem. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). **6 Hrs.**

**Unit-3: Natural Resources: Renewable and Non-Renewable Resources:** Land resources and land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies. **8 Hrs.**

**Unit-4: Biodiversity and Conservation:** Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. **8 Hrs.**

**Unit-5: Environmental Pollution:** Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution, Nuclear hazards and human health risks. Solid waste management, Control measures of urban and industrial waste Pollution case studies. **8 Hrs.**

**Unit-6: Environmental Policies & Practices:** Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context. **7 Hrs.**

**Unit-7: Human Communities and the Environment:** Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions. and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). **6 Hrs.**

**Unit-8: Field work.** **5 Hrs.**

#### REFERENCE BOOKS:

1. Carson, R. (2002). Silent Spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. (1993). This Fissured Land: An Ecological History of India. Univ. of California Press.

3. Gleeson, B. and Low, N. (eds.) (1999). Global Ethics and Environment, London, Routledge.
4. Glejck, P. H. (1993). Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. (2006). Principles of Conservation Biology. Sunderland: Sinauer Associates.
6. Grumbine, R. Edward, and Pandit, M.K. (2013). Threats from India's Himalayadams. Science, 339: 36-37.
7. McCully, P. (1996). Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
8. McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Nandini, N. (2019). A text book on Environmental Studies (AECC). Sapna BookHouse, Bengaluru.
10. Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
11. Pepper, I.L, Gerba, C.P. & Brusseau, M.L. (2011). Environmental and Pollution Science. Academic Press.
12. Rao, M.N. & Datta, A.K. (1987). Waste Water Treatment. Oxford and IBHPublishing Co. Pvt. Ltd.
13. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012). Environment. 8th edition. John Wiley & Sons.
14. Rosencranz, A., Divan, S., & Noble, M. L. (2001). Environmental law and policy in India. Tripathi 1992.
15. Sengupta, R. (2003). Ecology and economics: An approach to sustainable development. OUP.
16. Singh, J.S., Singh, S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
17. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). (2013). Conservation Biology: Voices from the Tropics. John Wiley & Sons.
18. Thapar, V. (1998). Land of the Tiger: A Natural History of the Indian Subcontinent. Warren, C. E. (1971). Biology and Water Pollution Control. WBSaunders.
19. Wilson, E. O. (2006). The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. (1987). Our Common Future. Oxford University Press.

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**QUESTION PAPER: THEORY EXAMINATION  
(AECC: Environmental Studies)**

**Time: 1½ Hours**

**Max. Marks: 30**

**PART-A**

**Q1** Answer **ALL** of the following

**6 x 1 = 6**

- a)
- b)
- c)
- d)
- e)
- f)

**PART-B**

Answer any **FOUR** of the following

**4 x 6 = 24**

**Q2 – Q7**

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**Skill Enhancement Course (SEC)-DIGITAL FLUENCY  
Choice Based Credit System (CBCS) With Multiple Entries  
And Exit Options under New Education Policy (NEP) – 2020  
(2021-22 Batch Onwards)**

**BOARD OF STUDIES: PROCEEDINGS**

Proceedings of the Board of Studies in Digital Fluency is as in Computer Science.

**Details of Course of Study: I and II Semesters**

| Sem. | Skill Enhancement Course (Skill Based)<br>Paper (L+T+P) | Teaching hours/ week | Credits | Internal Assessment Marks (C1 + C2) | Semester End Examination Marks (C3) |
|------|---------------------------------------------------------|----------------------|---------|-------------------------------------|-------------------------------------|
| I    | SEC-1 (Skill Based): Digital Fluency (1+0+1)            | 1 +2                 | 2       | 20                                  | 30                                  |
| II   | SEC-1 (Skill Based): Digital Fluency (1+0+1)            | 1 +2                 | 2       | 20                                  | 30                                  |

**I and II SEMESTERS**

**SEC-1 (SKILL BASED): DIGITAL FLUENCY (THEORY/PRACTICAL):**

**2 Credits**

**15 +30 Hrs.**

**Course Outcomes:** At the end of the course the student should be able to:

Course outcomes are statements of observable student actions that serve as evidence of knowledge, skills and values acquired in this course. Have an intelligent conversation on the key concepts and applications of Artificial Intelligence (AI), Big Data Analytics (BDA), Internet of Things (IoT), Cloud Computing, and Cybersecurity.

- Develop holistically by learning essential skills such as effective communication, problem-solving, design thinking, and teamwork.
- Build his/her personal brand as an agile and expansive learner – one who is interested in horizontal and vertical growth.

**Unit-1:**

**04 Hrs.**

- ❖ Getting Started with Effective Communication Skills
- ❖ Practicing Effective Communication
- ❖ Overcoming Barriers to Effective Communication
- ❖ Getting Started with Creative Problem Solving & Critical Thinking
- ❖ Practicing Creative Problem Solving & Critical Thinking
- ❖ Overcoming Barriers to Creative Problem Solving & Critical Thinking
- ❖ Getting Started with Collaboration & Teamwork Skills
- ❖ Overcoming Barriers to Collaboration & Teamwork
- ❖ Getting Started with Innovation & Design Thinking
- ❖ Practicing Innovation & Design Thinking

**Unit-2:****04 Hrs.**

- ❖ Finance and Accounting (F&A)
- ❖ Banking and Insurance (B&I)
- ❖ E-Commerce and Retail (Ecom & Ret)
- ❖ Information Technology. (IT)
- ❖ Information Technology Enabled Services (ITeS)

**Unit-3:****04 Hrs.**

- ❖ An Overview of Artificial Intelligence
- ❖ Introduction to Machine Learning
- ❖ Introduction to Deep Learning
- ❖ An Overview of Big Data Analytics
- ❖ Database Management for Data Science
- ❖ Getting Started with Internet of Things
- ❖ Industrial Internet of Things or IIoT
- ❖ An Overview of Cloud Computing
- ❖ Service Models in Cloud Computing
- ❖ An Overview of Cybersecurity
- ❖ Types of Cyber Attacks

**Unit-4:****03 Hrs.**

- ❖ Applications of Artificial Intelligence
- ❖ Applications of Big Data Analytics
- ❖ Applications of IoT
- ❖ Applications of Cloud Computing
- ❖ Applications of Cybersecurity

**REFERENCES:**

1. The learning resources made available for the course titled "Future skill for Application /Digital 101" on Future Skills Prime Platform.

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**SCHEME OF EXAMINATION**

| <b>Assessment: Formative Assessment</b>                                                                                                                                                                            |                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Assessment Occasion</b>                                                                                                                                                                                         | <b>Weightage in Marks</b> |
| After watching videos of each topic, 05 marks tests are to be given by the students on Future Skills Prime Platform. The total marks earned by students is to be computed.                                         | No weightage              |
| Practical Sessions: A total of 05 activities from Module 1 and Module 2 and 03 activities from Module 03 need be completed by students. All the activities are expected to be done in teams of 02 -03 students per | 40%                       |



|                                                                                                                                                                                                                                                                              |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| team. Each session performance is assessed for 10 marks against announced rubrics for assessment. The total marks earned by students is to be computed.                                                                                                                      |                                                                                       |
| Summative Assessment: After completion of all 3 modules students will be giving Final Assessment with 30 questions (30 min) on Future Skills Prime platform. Students will have two attempts and those who score at least 50% marks will get certificate from NASSCOM-AICTE. | This assessment may be given 60% weight in computing the final grade of the students. |

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**QUESTION PAPER: THEORY EXAMINATION  
(SEC-1: Digital Fluency Paper)**

**Time: 1½ Hours****Max. Marks: 30****PART-A****Q1** Answer **ALL** of the following**6 x 1 = 6**

- a)
- b)
- c)
- d)
- e)
- f)

**PART-B**Answer any **FOUR** of the following**4 x 6 = 24****Q2 – Q7**

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## Skill Enhancement Course (SEC)- PHYSICAL EDUCATION, YOGA, SPORTS

### Choice Based Credit System (CBCS) With Multiple Entries And Exit Options under New Education Policy (NEP) – 2020 (2021-22 Batch Onwards)

#### Details of Course of Study: I and II Semesters

| Sem.      | Skill Enhancement Course<br>(Value Based)<br>Paper (L+T+P) | Teaching<br>hours/<br>week | Credits  | Internal<br>Assessment<br>Marks (C1 + C2) |
|-----------|------------------------------------------------------------|----------------------------|----------|-------------------------------------------|
| <b>I</b>  | SEC-1: Physical Education and Yoga (0+0+2)                 | <b>2</b>                   | <b>1</b> | <b>25</b>                                 |
|           | SEC-2: Health and Wellness (1+0+1)                         | <b>1+1</b>                 | <b>1</b> | <b>25</b>                                 |
| <b>II</b> | SEC-3: Physical Education and Sports (0+0+2)               | <b>2</b>                   | <b>1</b> | <b>25</b>                                 |

#### I SEMESTER

##### SEC-1 (VALUE BASED): PHYSICAL EDUCATION AND YOGA (PRACTICAL):

**1 Credit**

**28 Hrs.**

##### Unit-1: Physical Education:

- ❖ General & Specific warm up exercises
- ❖ Recreation Games and Fitness
- ❖ Any 2 Major Game and one minor game

##### Unit-2: Yoga:

- ❖ Shitalikarna Vyayama
- ❖ Suryanamaskara
- ❖ Basic Set of Yoga Asanas
- ❖ Basic Set of Pranayama & Meditation

#### REFERENCES:

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics.
2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
3. Nagendra, H. R. & Nagarathna, R. (2002). Samagra Yoga Chikitse. Bengaluru: Swami Vivekananda Yoga Prakasana.
4. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashthrothanna Prakashana.
5. D.M Jyoti, Yoga and Physical Activities (2015) lulu.com3101, Hillsborough, NC27609, United States

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**SEC-2 (VALUE BASED): HEALTH AND WELLNESS (THEORY/PRACTICAL):****1 Credit****28 Hrs.****Unit-1: Theory:**

- ❖ Meaning, Definition and Importance of Health and Wellness
- ❖ Dimensions of Health and Wellness.
- ❖ Role of Exercise in maintaining Health and Wellness.
- ❖ Causes of Stress & Stress relief through Exercise.
- ❖ Nutrition for Health and Wellness

**Unit-2: Practicals - Exercises for Health and Wellness:**

- ❖ Warming-Up.
- ❖ Stretching exercises.
- ❖ Strengthening Exercises.
- ❖ Cardiovascular Exercises.
- ❖ Flexibility and Agility Exercises.
- ❖ Relaxation

**Pedagogy:** The course shall be taught through Lecture, Practical, Interactive Sessions, Materials, Assignments, Seminars, Intramurals and Extramurals.

**Note:** The program shall be designed at college level for Specially challenged students.

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**II SEMESTER****SEC-3 (VALUE BASED): PHYSICAL EDUCATION AND SPORTS (PRACTICAL):****1 Credit****28 Hrs.****Unit-1: Physical Education & Sports:**

- ❖ Conditioning exercises.
- ❖ Aerobics & Calisthenics.
- ❖ One Major Game and One Indigenous Game (Basic Skills).
- ❖ One Track/Field Event.
- ❖ Intramural Competitions

**Note:** Due weightage in Assessment shall be given to Elite Sportsmen of the College

**REFERENCES:**

1. Muller, J. P. (2000). Health, Exercise and Fitness. Delhi: Sports.
2. IAAF Manual.
3. Vanaik. A (2005) Play Field Manual, Friends Publication New Delhi
4. M.J Vishwanath, (2002) Track and Field Marking and Athletics Officiating Manual, Silver Star Publication, Shimoga.
5. Steve oldenburg (2015) Complete Conditioning for Volleyball, HumanKinestics.

**Note:** Skills of Sports and Games (Game Specific books) may be referred.

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