**Syllabus**

**2021-2022 Onwards**

**M.Sc. BIOCHEMISTRY**

**UNIVERSITY DEPARTMENT**

**2025-2026**

**Program Code: BCHA**

**Bharathiar University**

**(A State University, Accredited with “A++” Grade by NAAC and 26th Rank among Indian Universities by MHRD-NIRF)**

**Coimbatore 641 046, INDIA**

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| **Program Educational Objectives (PEOs)** | |
| Upon completion of **M. Sc. Biochemistry** program, the graduates are expected to attain. | |
| PEO1 | The skills to communicate the concepts and results of their laboratory experiments through effective writing and/or oral communication using discipline standards for reporting and citation. |
| PEO2 | Students will have critical thinking and scientific inquiry in the performance, design, interpretation and documentation of laboratory experiments to the level suitable to succeed at an entry level position in biochemical industries. |
| PEO3 | The summer training, industrial visit & project work help the students to know the practical aspects about the subject. |
| PEO4 | Theory and Knowledge: Upon completion of the biochemistry sequence, students are able to recognize and demonstrate the structure, chemical properties, and reactions of the biomolecules and their biopolymers to predict chemical properties and reactivity |
| PEO5 | Instrumentation: Upon completion of the degree, students are able to understand the theoretical concepts of analytics and instruments that are commonly used in most biochemistry fields, which will help them to excel in relevant fields. |
| PEO6 | The course aims to develop the students in understanding the areas that are widely used as well as on advanced scientific methods This is achieved via lectures, classes, seminars and a problem-based learning exercise. |
| PEO7 | Student would suggest, evaluate and interpret biochemical investigation in a given clinical situation and apply knowledge to solve clinical problems |
| PEO8 | Ability to participate in and report the team work-based investigations of problem-based assignments |
| PEO9 | Build on their knowledge to understand highly advanced and specialized courses in future. |
| PEO10 | Ability to contribute their knowledge and experiences gained during the course to professional and/or communal activities in developing the society. |
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**MSc. Biochemistry-Programme Specific Outcomes (PSOs)**

After the successful completion of the MSc. Biochemistry program, students are expected to

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| PSO1 | Enrich the knowledge to recognize, integrate, and demonstrate the chemical, physical and structural properties of biomolecules and their biopolymers |
| PSO2 | Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and industries |
| PSO3 | Expect to diagnose the pathogenic microbes in the laboratory by applying the knowledge of microbial culture techniques |
| PSO4 | Impart practical skills and scientific knowledge of metabolic pathways to detect defects and evaluate solutions for various metabolic disorders |
| PSO5 | Expertise incell signalling and cellular and molecular biology to organize and execute research initiatives in pertinent areas |
| PSO6 | Design, synthesise and characterize nanoparticles for biomedical applications |

**MSc. Biochemistry-Programme Outcomes (POs)**

On successful completion of the MSc. Biochemistry program,

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| PO1 | Ability to acquire and apply the knowledge of biochemistry |
| PO2 | Ability to perform competently in research laboratories |
| PO3 | Identify Biochemistry problems |
| PO4 | To function well both individually and in multidisciplinary teams, with the ability to lead |
| PO5 | Apply ethical principles in the field of Biochemistry |
| PO6 | Impart knowledge effectively with the general society |
| PO7 | Broaden the knowledge of Biochemistry by providing information about societal and environmental issues on a global scale |
| PO8 | Strengthen the skills and motivation to engagein lifelong,self-directed learning activities |
| PO9 | Ability to increase the knowledge of contemporary issues in allied fields |
| PO10 | To participate and succeed in competitive examinations |

**BHARATHIAR UNIVERSITY: COIMBATORE 641 046**

**M. Sc. Biochemistry Curriculum (University Department)**

*(For the students admitted during the academic year 2025 – 26 onwards)*

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| **Course**  **Code** | **Title of the Course** | **Credit** | **Hours** | | | | | **Maximum Marks** | | |
| **Theory** | **Practical** | | | | **CIA** | **ESE** | **Total** |
| **FIRST SEMESTER** | | | | | | | | | | |
| 13A | Biomolecules and  Bioenergetics | 4 | 4 | - | | | | 25 | 75 | 100 |
| 13B | Cell and Molecular  Biology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 13C | Analytical Biochemistry | 4 | 4 | - | | | | 25 | 75 | 100 |
| 13D | Microbiology | 4 | 4 |  | | | | 25 | 75 | 100 |
| 13P | Biochemistry, Cell biology and Microbiology | 4 | - | 6 | | | | 25 | 75 | 100 |
| 1EA | Genetics and Developmental Biology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 1EB | Nutritional Biochemistry |
| GS108 | Supportive I | 2 | 2 | - | | | | 12 | 38 | 50 |
| **Total** | | 26 | 22 | 6 | | | | 162 | 488 | 650 |
| **SECOND SEMESTER** | | | | | | | | | | |
| 23A | Enzymology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 23B | Intermediary metabolism | 4 | 4 | - | | | | 25 | 75 | 100 |
| 23C | Human Physiology and Molecular Physiology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 23D | Immunology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 23P | Enzymology and  Immunology Lab | 4 | - | 6 | | | | 25 | 75 | 100 |
| 2EB | Animal Biotechnology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 2EC | Nano science and  Technology |
| GS102 | Supportive II | 2 | 2 | - | | | | 12 | 38 | 50 |
|  | Summer Training\* |  |  |  | | | |  |  |  |
| **Total** | | 26 | 22 | 6 | | | | 162 | 488 | 650 |
| **THIRD SEMESTER** | | | | | | | | | | |
| 33A | Clinical Biochemistry | 4 | 4 | - | | | | 25 | 75 | 100 |
| 33B | Recombinant DNA  Technology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 33C | Drug Biochemistry | 4 | 4 | - | | | | 25 | 75 | 100 |
| 33D | Biostatistics and Research  Methodology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 33P | Clinical Biochemistry &  Molecular Biology Lab | 4 | - | 6 | | | | 25 | 75 | 100 |
| 3EC | Plant Biochemistry and  Environmental Biotechnology | 4 | 4 | - | | | | 25 | 75 | 100 |
| 3ED | Biology of Cancer and Stem  cell |
| GS109 | Supportive III | 2 | 2 | - | | | | 12 | 38 | 50 |
|  | Summer Training\* | 2 | - | - | | | | 50 |  | 50 |
|  | Online Course for a period  of 4 weeks duration \*\* | - | - | - | | | | - | - | - |
| **Total** | | 28 | 22 | 6 | | | | 212 | 488 | 700 |
| **FOURTH SEMESTER** | | | | | | | | | | |
|  | Certification Course in Bioinformatics### | | 1 | 4 | | 4 | | 50 | - | 50 |
|  | Health & Wellness\*\*\* | | 1 | 4 | | 4 | | 100 |  | 100 |
|  | Project work\*\*\*\* | | 8 | - | | - | | 100 | 100 | 200 |
|  | Value added Course# | | - | 20 | | 25 | | 50 | - | 50 |
|  | Job oriented Course## | | - | 20 | | 25 | | 50 | - | 50 |
| **Total** | | | 10 |  | 48 |  | 58 | 350 | 100 | 450 |
| **Grand Total** | | | 90 | 114 | | 76 | | 886 | 1564 | 2450 |

**\*Summer Training:** All the students have to undergo summer training for a period of minimum 30 days. Final reports have to be submitted which will be evaluated.

**\*\***All the students should be required to complete online courses offered by **SWAYAM, MOOCs or NPTEL** by the end of 3rd semester. Online courses have an extra credit (other than 90 credits) 4-week program carries 2 credit

\*\*\*Compulsory course on Health and wellness with 1 credit.

**\*\*\*\*Project Work:** The report is the bonafide work carried out by the candidate under the guidance of a faculty authenticated and countersigned by the HOD. This project work must be presented and defended by the candidate in the department attended by all faculties and reviewed by an external examiner along with paper publication.

# Students need to complete one Value Added Course before completion of M. Sc Degree

##Students need to complete one Job Oriented Course before completion of M. Sc Degree

### Students need to complete Certification course in Bioinformatics

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| **CO-SCHOLASTIC COURSES** | | | | | | | | | | | | |
|  | Health & Wellness | 1 | - | | - | | | 100 | - | | 100 | |
| **ONLINE COURSES** | | | | | | | | | | | | |
|  | Swayam, MOOC Course etc., | - | | - | | - | 50 | | | - | | 50 |
| **VALUE ADDED COURSES** | | | | | | | | | | | | |
|  | Value Added Course - I | - | | 20 | | 25 | 50 | | | - | | 50 |
|  | Value Added Course - II | - | | 20 | | 25 | 50 | | | - | | 50 |
| **Job oriented COURSES** | | | | | | | | | | | | |
|  | Job oriented Course - I | - | | 20 | | 25 | 50 | | | - | | 50 |
|  | Job oriented Course - II | - | | 20 | | 25 | 50 | | | - | | 50 |
| The scholastic courses are only counted for the final grading and ranking. However, for the  award of the degree, the completion of co-scholastic courses is also mandatory. | | | | | | | | | | | | |

First Semester

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| **Course code** | **13A** | **BIOMOLECULES AND BIOENERGETICS** | **L** | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core – 13A** | **4** | | √ | | | **-** | **4** |
| **Pre-requisite** | | **Basic Knowledge in Biology** | **Syllabus Version** | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. This course emphasizes on various biomolecules and its significance. 2. To enable the students to learn the basic functions, structures and biological importance of lifeless chemical compounds. 3. On successful completion of the course the students should have understood the significance of the complex biomolecules, polysaccharides, lipids, proteins, nucleic acids, vitamins and minerals. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Helps to understand about the polysaccharides and its types. | | | K1 & K2 | | | | | |
| 2 | Gives a clear understanding about the lipids and its role. | | | K1 & K2 | | | | | |
| 3 | A Clear Knowledge regarding amino acids and protein characterization. | | | K2 & K3 | | | | | |
| 4 | Provides the structure and properties of Nucleic acids. | | | K2 & K3 | | | | | |
| 5 | Gives an idea about energy level and its synthesis. | | | K1, K2 & K3 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | **Water and Carbohydrates** | | | **15 Hours** | | | | | |
| Water - Unique properties, weak interactions in aqueous systems, ionization of water, buffers. Classification, chemical properties of carbohydrates, Chemistry and biological roles of homo and heteropolysaccharides. Structural elucidation of polysaccharides; Oligosaccharides – lectin interaction in biochemical processes. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides). | | | | | | | | | |
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| **Unit:2** | **Lipids** | | | **15 Hours** | | | | | |
| Classification of Lipids, Biological significance of lipids, Fatty acids and their physicochemical properties. Structure and properties of Prostaglandins. Storage lipids - triacylglycerol and waxes. Structural lipids in membranes - glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols, structure, distribution and role of membrane lipids. Lipids as signals, cofactors and pigments. | | | | | | | | | |
| **Unit:3** | **Amino acids** | | | | | **11 Hours** | | | |
| Amino acids–classification, structure and physicochemical properties, chemical synthesis of peptides - solid phase peptide synthesis. Proteins – classification, purification, and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins. Conformation of proteins - Ramachandran plots. Denaturation of proteins. Apoprotein and Prosthetic group- Porphyrins – Structure and properties of porphyrins – heme, Chlorophyll and Cytochromes. | | | | | | | | | |
| **Unit:4** | **Nucleic acids** | | | | | **11 Hours** | | | |
| Nucleotides- structure and properties, physicochemical properties of nucleic acids, cleavage of nucleic acids by enzymatic methods, non – enzymatic transformation of nucleotides and nucleic acids, methylation, Sequencing, chemical synthesis of DNA. Three-dimensional structure of DNA. Types of DNA-ssDNA, dsDNA, H-DNA, G4 DNA. Different forms of DNA – circular DNA and Supercoiling. Types of RNA mRNA, tRNA, rRNA, SnRNA, SiRNA, HnRNA, miRNA. Structure of t-RNA. Nucleotides as source of energy, components of coenzymes, second messengers. | | | | | | | | | |
| **Unit:5** | **Thermodynamics** | | | | | **11 Hours** | | | |
| Principles of thermodynamics, free energy, enthalpy and entropy, Free energy changes in biological transformations in living systems. Redox potential, phosphate group transfer potential and ATP, High-energy compounds, oxidation and reduction reactions. Mitochondrial electron transport system – organization of components and importance. Substrate level phosphorylation, oxidative phosphorylation, Respiratory control, Mechanism and theories of oxidative phosphorylation. Respiratory chain inhibitors and uncouplers of oxidative phosphorylation. | | | | | | | | | |
| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | | | | |
| 1 | D. L. Nelson and M. M. Cox, *Lehninger Principles of Biochemistry* (8th Edition), W.H.Freeman, 2021 | | | | | | | | |
| 2 | D. Voet and J. G. Voet, *Biochemistry*, (5th Edition), Wiley & Sons, 2016. | | | | | | | | |
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| **Reference Books** | | | | | | | | | |
| 1 | J. M. Berg, J. L. Tymoczko and L. Stryer, *Biochemistry* (10th Edition), W.H. Freeman, 2023. | | | | | | | | |
| 2 | P. W. Kuchel, G. B. Ralston et al., Schaum's outline of theory and problems of biochemistry (3rd Edition) McGraw-Hill, 2009 | | | | | | | | |
| 3 | W. B. Wood, J. H. Wilson, R. M. Benbow, and L. E. Hood., *Biochemistry: A problems*  *approach,* (2nd Edition), Benjamin/Cummins Publishing Company, 1981. | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | |
| 1 | Biochemistry of Biomolecules  https://onlinecourses.swayam2.ac.in/cec20\_bt12/preview | | | | | | | | |
| 2 | Biomolecules: Structure, Function in Health and Disease  <http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/353> | | | | | | | | |
| 3 | Introduction to Carbohydrates  https://aklectures.com/lecture/carbohydrates/introduction-to-carbohydrates | | | | | | | | |
| 4 | Introduction to Nucleic Acids https:/[/www.youtube.com/watch?v=1Wc4jTH2v\_w&list=PL9jo2wQj1WCNG9mFuNBm](http://www.youtube.com/watch?v=1Wc4jTH2v_w&list=PL9jo2wQj1WCNG9mFuNBmJ) [J](http://www.youtube.com/watch?v=1Wc4jTH2v_w&list=PL9jo2wQj1WCNG9mFuNBmJ) 1m7x1skBNKw- | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | S | S | M | S | M | S |
| **CO3** | M | S | S | M | M | S | M | S | S | S |
| **CO3** | M | S | S | M | M | M | S | M | M | S |
| **CO4** | S | S | S | M | M | M | S | M | M | S |
| **CO5** | S | L | M | M | M | M | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **13B** | **CELL AND MOLECULAR BIOLOGY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - II** | **4** | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Awareness on structure and function of cell organelles and cell division** | **Syllabus**  **Version** | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To study the structure and function of cells and to know about extracellular Matrix and cell communication. 2. Understanding the function of intracellular organelles and cell cycle mechanism. Also, thorough understanding the replication process as well as DNA damage and repair mechanisms. 3. Upon completion of the course, students might also be thorough about transcription   Mechanism and its regulations as well as on translation and post translational modification of proteins. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The course material will provide clear understanding of structure and functions of cells. | | | | | K1 & K2 | | | |
| 2 | Students will advance their knowledge in cell cycle events and regulation of cell cycle at molecular level. | | | | | K1 & K2 | | | |
| 3 | The course will provide introduction to cancer and apoptosis. | | | | | K1 & K2 | | | |
| 4 | Students will learn their mechanism of replication, transcription and its regulation in detail. | | | | | K1 & K2 | | | |
| 5 | Course material provides detailed understanding of translation process,including proofreading and post translational modification of proteins. | | | | | K1, K3  & K4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
|  | | | | | | | | | |
| **Unit:1** | **Structure and Function of Cells** | | | **15 Hours** | | | | | |
| Structure and function of cells–prokaryotes and eukaryotes, difference, Structure and organization of membrane – structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active & passive transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Extracellular matrix, cell-cell communication. Extracellular Vesicles. | | | | | | | | | |
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| **Unit:2** | **Cell Components & Cell Division** | | | **15 Hours** | | | | | |
| Plasma membrane, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility and cell division: amitosis mitosis; meiosis and genetic recombination; regulation of cell cycle; factors and genes regulating cell cycle. | | | | | | | | | |
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| **Unit:3** | **Cancer and cell death** | | | | **10 Hours** | | | | |
| Cancer incidence and mortality; Origin of neoplastic cells; Types of Cancer: Benign Tumors Vs. Malignant Tumors, Common Symptoms, Causes of Cancer: Carcinogenesis-Chemical and Irradiation; Oxygen Free Radicals, Aging and Cancer; Genetic Susceptibility and Cancer; Viral Carcinogenesis.  Molecular Mechanism of cancer: protooncogenes, oncogene, tumour suppressor genes involved in cancer, errors in cell cycle (Cyclins and CDKs). Apoptosis in cancer – mechanism of apoptosis, intrinsic and extrinsic pathways. | | | | | | | | | |
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| **Unit:4** | **DNA replication  and Transcription** | | | | **11 Hours** | | | | |
| Chromosome-structure and function, Prokaryotic and Eukaryotic DNA replication mechanisms - Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extra chromosomal replicons, DNA damage and repair mechanisms. Transcription- RNA polymerases, Regulatory sequences in protein-coding genes, Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, regulation of transcription factor activity, capping, elongation and termination, Processing of Pre- mRNA, splicing, polyadenylation; RNA transport, Cytoplasmic mechanisms of Post- transcriptional control, Processing of rRNA and tRNA. Gene regulation –lac and trp operon. | | | | | | | | | |
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| **Unit:5** | **Translation** | | | | **11 Hours** | | | | |
| Genetic code, aminoacylation of tRNA, tRNA-identity. Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, translational proof-reading, translational inhibitors, post- translational modification of proteins. | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | **2 hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | |
|  | **Total Lecture hours** | | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | | |
| 1 | Cell Biology – 2013 by Gerald Karp; Publisher: Wiley; Seventh edition. | | | | | | | | |
| 2 | Advances in Cell Biology: Volume 2, 2013 by David M. Prescott; Publisher: Springer;Softcover reprint of the original 1st ed. 1971 edition. | | | | | | | | |
| 3 | Lehninger Principles of Biochemistry: International Edition – 2017 by David L. Nelson and Michael Cox; Publisher: WH Freeman; 7th ed. 2017 edition. | | | | | | | | |
| 4 | The Molecular Basis of Human Cancer – 2018 by William B. Coleman (Editor), Gregory J. Tsongalis; ublisher: Humana Press Inc.; Softcover reprint of the original 2nd ed. 2017 edition. | | | | | | | | |
| 5 | Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics– 2012 by Pecorino;Oxford University Press; 3rd edition. | | | | | | | | |
| **Reference Books** | | | | | | | | | |
| 1 | Molecular Cell Biology– 2016 by Arnold Berk, Chris A. Kaiser, Harvey Lodish, Angelika Amon, Hidde Ploegh, Anthony Bretscher, Monty Krieger and Kelsey C. Martin; Publisher: WH Freeman; 8 edition. | | | | | | | | |
| 2 | Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition. | | | | | | | | |
| 3 | Molecular Biology of the Gene – 2017 by James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard; Publisher: Pearson Education; Seventh edition. | | | | | | | | |
| 4 | Biochemistry – 2015 by Jeremy M. Berg, Lubert Stryer, John L. Tymoczko and Gregory J. Gatto; Publisher: WH Freeman; 8th ed. edition. | | | | | | | | |
| 5 | Lewin's GENES XII – 2017 by Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick; Publisher: Jones and Bartlett Publishers, Inc; 12th Revised edition edition. | | | | | | | | |
| 6 | The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman; Publisher: Sinauer Associates Inc; 6 edition | | | | | | | | |

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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |
| 1 | [https://bio.libretexts.org/Bookshelves/Cell\_and\_Molecular\_Biology/Book%3A\_Cells\_-](https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Book%3A_Cells_-Molecules_and_Mechanisms_(Wong))  [Molecules\_and\_Mechanisms\_(Wong)](https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology/Book%3A_Cells_-Molecules_and_Mechanisms_(Wong)) |
| 2 | [https://nptel.ac.in/courses/102/106/102106025/#](https://nptel.ac.in/courses/102/106/102106025/) |
| 3 | <https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/> |
| 4 | <https://www.mooc-list.com/tags/molecularbiology?title=MOLECULAR+PHYSIOLOGY> |
| Course Designed By: **Dr. S. Selvakumar** | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | L | M | M | S | L | M | S | M | S |
| **CO3** | S | S | M | L | L | L | M | S | S | S |
| **CO3** | S | S | M | L | S | M | L | L | M | M |
| **CO4** | S | L | M | L | L | L | M | S | M | M |
| **CO5** | S | M | M | M | L | M | M | S | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **13C** | **ANALYTICAL  BIOCHEMISTRY** | **L** | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - III** | **4** | | | | √ | **-** | **4** |
| **Pre-requisite** | | **Prior knowledge on modern methods and**  **technologies used in biochemical analysis** | **Syllabus**  **Version** | | | | | **2025 – 26** |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. The main objective of the course is qualitative and quantitative analysis of different molecules taking place in a biochemical reaction. 2. It includes the development of different tools and methods for identification, analysis and examination of physical properties of different biochemical compositions to provide better chemical information. 3. It helps the biochemistry students in understanding the basic science in a variety of applications. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | To obtain the knowledge about the microscope handling and the basic difference between the ordinary microscope and electron microscope. | | | K2 | | | | |
| 2 | To learn the chromatographic techniques for the separation of the individual compound from the mixture of compound. | | | K3  & K5 | | | | |
| 3 | To study the interaction between matter and electromagnetic radiation and visible light dispersed according to its wavelength, by a prism. | | | K4  & K5 | | | | |
| 4 | To understand the characterization of surfaces using radioisotopes generally involves observing the manner in which the radioactive species interact with the surface | | | K1, K2  &  K3 | | | | |
| 5 | To obtain knowledge about the separation and analysis of macromolecules and their fragments, based on their size and charge. | | | K2  & K3 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
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| **Unit:1** | **Microscopy, Centrifugation and Electrochemical Techniques** | | | | **15 Hours** | | | |
| Principles of microscopic techniques: Light microscope, Fluorescence microscope, Phase contrast microscope, Electron microscope (SEM,TEM), Confocal microscopy, Flow Cytometry. Centrifugation: Small bench top centrifuges, large capacity refrigerated centrifuges, High speed refrigerated centrifuges, preparative and analytical ultra-centrifuge. Electrochemical techniques: Principles of electrochemical techniques, redox reactions, the pH electrode, ion sensitive and gas-sensitive electrodes, The clark oxygen electrode, | | | | | | | | |
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| **Unit:2** | **Spectroscopic Techniques** | | | | **10 Hours** | | | |
| Spectroscopic techniques: Properties of electromagnetic radiation, interaction with matter. Gamma ray spectroscopy, X-ray spectroscopy, UV and Visible spectroscopy, Infrared and Raman spectroscopy, Electron spin resonance spectroscopy, Nuclear magnetic resonance spectroscopy, Circular dichroism spectroscopy, Atomic absorption spectroscopy. Lasers, Spectro fluorimetry, turbidometry and nephelometry, Mass spectrometry, MALDI-TOF, Fluorescent spectroscopy. | | | | | | | | |
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| **Unit:3** | **Chromatography** | | | | | **15 Hours** | | |
| Principles of chromatography, Thin layer chromatography (TLC), size exclusion, Ion-exchange and affinity chromatography. High performance liquid Chromatography (HPLC), High performance Thin Layer chromatography (HPTLC), Gas liquid chromatography (GLC), Paper chromatography, GC-MS, LC-MS/MS, ICPMS and Surface Plasma Resonance methods. | | | | | | | | |
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| **Unit:4** | **Electrophoresis** | | | | | **11 Hours** | | |
| Electrophoresis: General principles, Detection, estimation and recovery of proteins. Electrophoresis of proteins: SDS-PAGE, Native gels, Gradient gel, Isoelectric focusing, 2-D gel electrophoresis (2-D PAGE), Immunoblotting. Electrophoresis of nucleic acids: agarose gel electrophoresis of DNA, Pulse field gel electrophoresis, Capillary electrophoresis. | | | | | | | | |
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| **Unit:5** | **Radio Isotope Techniques** | | | | | **11 Hours** | | |
| Radio isotope techniques: The nature of radioactivity, detection and measurement of radioactivity: detection based on gas ionization- Geiger Muller counter- principles and applications. Detection based on excitation- Liquid Scintillation counter-principle and applications. Radio-labelled compounds, specific activity, inherent advantages and restrictions of radiotracer experiments, safety aspects, applications of radio isotopes in biological sciences. Flowcytometry. | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | |
| Expert lectures, online seminars - webinars | | | | | | | | |
|  | **Total Lecture hours** | | | | | **64 Hours** | | |
| **Text Book(s)** | | | | | | | | |
| 1 | Instrumental methods of chemical analysis – P.K. Sharma | | | | | | | |
| 2 | Biophysical chemistry – Upadhyay., Upadhyay and Nath | | | | | | | |
| 3 | Basha M. Analytical Techniques in Biochemistry. Humana Press; 2020. | | | | | | | |
| 4 | Wilson, K. and Walker, J. (2018) Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 8th Edition, Cambridge  University Press, India | | | | | | | |
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| **Reference Books** | | | | | | | | |
| 1 | A Biologist‟s guide to principle and techniques of practical biochemistry – Brigan L. Williams. | | | | | | | |
| 2 | Experimental methods in Biophysical chemistry- Nicolau, C. | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | <http://epgp.inflibnet.ac.in/> | | | | | | | |
| 2 | <http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=944> | | | | | | | |
| Course Designed By: **Dr. K. M. Saradhadevi** | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | S | S | M | L | S | M | M |
| **CO3** | S | S | S | S | S | M | L | S | M | S |
| **CO3** | S | S | M | S | S | M | L | M | M | S |
| **CO4** | S | M | M | S | S | M | L | M | M | S |
| **CO5** | S | S | S | S | S | M | L | S | M | S |

S-Strong; M-Medium; L-Low

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| **Course code** | | **13D** | | | **MICROBIOLOGY** | | | | | | **L** | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | **Core - IV** | | | | | | **4** | | √ | | | **-** | **4** |
| **Pre-requisite** | | | | | **Basic knowledge in cell and molecular**  **biology** | | | | | | **Syllabus**  **Version** | | | **2025 - 26** | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. Provide knowledge about microbial culture techniques. 2. Learn the concepts of Microbial Fermentation and its industrial applications. 3. Understand the basic concepts of diagnosing infectious and Food borne diseases 4. Understand the concepts of assessment of antimicrobial activity in textiles. 5. Provide knowledge about industrial applications of microbes | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, students will be able to: | | | | | | | | | | | | | | | | | |
| 1 | | Apply culture techniques for isolation of microbes from various sources and preserve the isolates. | | | | | | | | | K3 | | | | | | |
| 2 | | Students will gain knowledge about  Microbial Fermentation process and its industrial applications | | | | | | | | | K2 | | | | | | |
| 3 | | Students will learn about fermentation in the food industry. | | | | | | | | | K2 | | | | | | |
| 4 | | Students will be able to diagnose infectious and Food borne diseases | | | | | | | | | K3 | | | | | | |
| 5 | | Students will know the concepts of production, harvest, recovery and uses of industrially beneficial microbial products. | | | | | | | | | K3 | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | |
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| **Unit:1** | | **Culture Techniques** | | | | | | | | | **15 Hours** | | | | | | |
| Isolation of microbes from various sources, serial dilution techniques, pure culture techniques, anaerobic culture methods – chemical and physical methods. Gut microbes. Culture preservation techniques. Microbial nutrition-Nutritional requirements. Culture media- types of media, composition of media-carbon sources, nitrogen sources, vitamin and growth factors, minerals, inducers, precursors and inhibitors. Sterilization methods. | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | **Fermentation Techniques** | | | | | | | | | **15 Hours** | | | | | | |
| Introduction to Fermentation process: Media for industrial fermentation: Essential criteria for media, Media components, Media formulation, Media optimization. Introduction to bioreactors - Instrumentation. Aerobic and anaerobic fermentation; solid state and submerged fermentation. | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | **Clinical Microbiology** | | | | | | | | | **10 Hours** | | | | | | |
| Infectious Diseases – Diagnosis – Process of sample collection, transport and examinations of the specimens (Bacteria, Fungi and Virus). Antibiogram. Bacteriology: Morphology, cultural characteristics, pathogenicity and laboratory diagnosis of Gram- positive organisms - *Staphylococcus aureus*, Mycoplasma; Gram negative organisms:  E. coli. Hospital acquired infections: Antimicrobial agents for textiles, International standards for the assessment of antimicrobial activity of textiles. Applications of     Artificial intelligence in clinical microbiology testing. | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | **Microbiology of Food** | | | | | | | | | | | | **11 Hours** | | | |
| Microbiology of Fermented Foods – yoghurt, cheese, bread, sauerkraut. Mushroom farming – Use of enzymes in food industry. Food borne diseases- Bacterial and Non- Bacterial. Microbial quality and safety – Determining microorganisms in food culture, Microscopy and sampling methods – Chemical and immunological methods. | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | **Industrial Microbiology** | | | | | | | | | | | | **11 Hours** | | | |
| Microbial fermentation and production of small and macro molecules. Major Products of Industrial Microbiology:Microbial products in pharmaceutical and agriculture industry: Production, harvest, recovery and uses Enzymes, Antibiotics (Penicillins, Tetracycline), vitamins (B2, B12),Aminoacids (lysine, glutamic acid, Organic solvents (acetone, ethanol); Organic acids  (acetic  acid,  citric  acid).  Formulation  of  Biofertilizer  (*Rhizobium*)  and Biopesticides (*Bacillus thruingiensis).* | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | | | | | | | | | | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | | |
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|  | | **Total Lecture hours** | | | | | | | | | | | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | |
| 1 | | Prescott, Harley and Klein”s Microbiology 7th edition Joanne M. Wwilley, Linda M. Sherwood, Christopher j.Woolverton Mcgraw Hill Education 2017 ISBN -10: 981315 1269. | | | | | | | | | | | | | | | |
| 2 | | Principles of Fermentation technology by P.F. Stanbury and A.Whitaker, Pergamon press.Second edition. 2005. | | | | | | | | | | | | | | | |
| 3 | | Gerard J. Tortora, Berdell R. Funke, Christine L. Case. (2013) Microbiology: An  Introduction, 11th edition, Pearson Education, Inc. Company Ltd, New Delhi. | | | | | | | | | | | | | | | |
| 4 | | Pelczar, M.J., Chan, E.C. and Krieg, N.R. (2006) Microbiology, 5th Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi. | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | |
| 1 | | Kathleen Park Talaro. (2008) Foundations in Microbiology, Tata McGraw Hill Publishing Company Ltd, New Delhi. | | | | | | | | | | | | | | | |
| 2 | | Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. (2017) Prescott's  Microbiology, 10th edition, Tata McGraw Hill Publishing Company Ltd, New Delhi. | | | | | | | | | | | | | | | |
| 3 | | Fermentation microbiology and Biotechnology. Second edition, edited by   El-.Mansi, C.F.A.Bryce, A.L. Demain, A.R. Allman. Taylor and Francis, 2007. | | | | | | | | | | | | | | | |
| 4 | | Casida., J.R. (2006) Industrial Microbiology, 4th Edition, Wiley Eastern Ltd, New Delhi. | | | | | | | | | | | | | | | |
| 5 | | Gupta, P.K (2006) Biotechnology and Genomics, 1st Edition, Rastogi Publications, Meerut. | | | | | | | | | | | | | | | |
| 6 | | Yuan Gao and Robin Cranston. Recent Advances in Antimicrobial Treatments of Textiles,Textile Research Journal, 2008 78: 60. SAGE publications. | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | |
| 1 | | Bioenergy - an overview | ScienceDirect Topics  [www.sciencedirect.com](http://www.sciencedirect.com/) › earth-and-planetary-sciences › b.. | | | | | | | | | | | | | | | |
| 2 | | Sciencedirect.com/topics/agricultural-and-biological-sciences/industrial-microbiology | | | | | | | | | | | | | | | |
| 3 | | Hospital-Acquired Infections: Practice Essentials, Background ...   emedicine.medscape.com › article › 967022-overview | | | | | | | | | | | | | | | |
| Course Designed By: **Dr. R. Kavitha** | | | | | | | | | | | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | |
| **COs** | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | | **PO9** | | | **PO10** | | |
| **CO1** | S | | S | S | | S | S | S | S | M | | S | | | S | | |
| **CO3** | S | | S | S | | S | S | S | S | M | | S | | | S | | |
| **CO3** | S | | S | S | | S | S | S | S | M | | S | | | S | | |
| **CO4** | S | | S | S | | S | S | S | S | M | | S | | | S | | |
| **CO5** | S | | S | S | | S | S | S | S | M | | S | | | S | | |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **1EA** | **GENETICS AND DEVELOPMENT BIOLOGY** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective -1** | **4** | | | | √ | | **-** | **4** |
| **Pre-requisite** | | **To acquire knowledge in Mendelian and Non mendelian genetics and developmental concepts** | **Syllabus**  **Version** | | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. The main objective of this course is to introduce about concepts in Genetics and Developmental Biology. This course emphasizes to learn about principles involved in mendelian genetics and Non-mendelian inheritance and techniques used to diagnose genetic diseases and mutation concepts. 2. The course aims to give exposure to learn the basic concepts involved in developmental biology such as Potency, commitment, specification, induction, competence, determination and differentiations and morphogenetic gradients 3. This course also provides knowledge about Cell division in cleavage, Rudimental organs, Gametogenesis and Fertilization approaches. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | To learn Mendelian genetics, history, Monohybrid, Dihybrid and Trihybrid cross, Mendelian ratio of segregation, interaction of genes, alleles, Extrachromosomal inheritance, Extensions of mendelian principles | | | | | K1,  K2 & K4 | | | | |
| 2 | To understand the types, causes and detection, mutant types and techniques involved in Prenatal diagnosis of genetic diseases, DNA/RNA probes in the diagnosis of genetic diseases | | | | | K2 & K3 | | | | |
| 3 | To learn the concept of determination and differentiation; morphogenetic gradients; cell fate and cell lineages and imprinting. | | | | | K1,  K2 & K4 | | | | |
| 4 | To understand the process of cell division in cleavage, patterns in embryonic cleavage after fertilization. To know about the development of primary organs and Rudimental organs | | | | | K1, K2 | | | | |
| 5 | To learn the process involved in spermatogenesis, gametogenesis and fertilization | | | | | K1 &  K2 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit:1** | **Mendelian Inheritance and Its Extensions** | | | | **15 Hours** | | | | | |
| Principles of Mendelian inheritance; Mendel‟s experiments-monohybrid, dihybrid trihybrid and multi hybrid crosses. Concept of gene: Allele, multiple alleles, pseudo allele, complementation tests. Extensions of mendelian principles: Codominance, Incomplete dominance, Gene interactions, Pleiotropy, Genomic imprinting, Penetrance and expressivity, Phenocopy, Linkage and crossing over. Sex linkage, Sex limited and sex influenced characters. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. | | | | | | | | | | |
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| **Unit:2** | **Mutations & Genetic Diseases** | | | **15 Hours** | | | | | | |
| Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis, HIV mutation. Prenatal diagnosis of genetic diseases- amniocentesis, karyotyping. DNA probes in diagnosis of genetic diseases: Cystic fibrosis, Sickle cell anemia, Leukaemia, Burkets lymphoma. | | | | | | | | | | |
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| **Unit:3** | **Basic Concepts of Development** | | | **10 Hours** | | | | | | |
| Potency, commitment, specification, induction, competence, determination and differentiation; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. ABC model of flower development in Arabidopsis thaliana | | | | | | | | | | |
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| **Unit:4** | **Cell Differentiation** | | | **11 Hours** | | | | | | |
| Cell division in cleavage–Chemical changes–Patterns of embryonic cleavage – Morula and Blastula – Role of egg cortex – Morphogenetic gradients – Fate map – Gastrulation – Primary organ, Rudimental organs, Organizer – Morphogenetic movements. Anterior and posterior axis differentiation in drosophila | | | | | | | | | | |
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| **Unit:5** | **Gametogenesis** | | | **11 Hours** | | | | | | |
| Gametogenesis–Origin of germ cells–Significance of gametogenesis. Oogenesis – Types of eggs– growth, development and maturation of oocyte, Egg envelopes, Polarity and symmetry, Spermatogenesis–Sperm Structure, Types of sperm, Fertilization – Approach of spermatozoon– Reaction of egg, essence of activation – Changes in egg cytoplasm caused by fertilization | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | **2 Hours** | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
|  | | | | | | | | | | |
|  | **Total Lecture hours** | | | **64 Hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Snustad D. P, Simmons M. J. (2015) Principles of Genetics, 7 th Edition, ISBN: 978-1-119-14228-7 JohnWiley & Sons. | | | | | | | | | |
| 2 | Scott F Gilbert, , Michael J.F. Barresi, (2016) Developmental biology, Sinauer Associates Inc; 11th edition | | | | | | | | | |
| 3 | Pierce,B.A (2020) Genetics: A conceptual approach, Seventh edition, W.H Freeman and company publishing, New york | | | | | | | | | |
| 4 | Klug,W., Cummings, M., Spencer, C., Palladino, M and killian D (2020) Concepts of Genetics, 12 Edition, Pearson Higher education and professional Group | | | | | | | | | |
| 5 | Wolpert L,  Tickle C, and  Martinez Arias A (2019) Principles of development 5th edition, Oxford University Press, Oxford, United Kingdom ISBN: 9780198800569 | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Genes VII, Benjamin Lewin, 2000, Oxford University Press. | | | | | | | | | |
| 2 | Genetics, 3rd edition, 2002, Strick berger, Prentice Hall of India. | | | | | | | | | |
| 3 | Genetics, Gupta PK., 5th edition, 2018, Rastogi Publications, Meerut, India. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | https://nptel.ac.in/courses/121/106/121106008/ | | | | | | | | | |
| 2 | https://nptel.ac.in/courses/102/104/102104052/ | | | | | | | | | |
| 3 | https:/[/www.toppr.com/guides/biology/human-reproduction/gametogenesis-in-humans/](http://www.toppr.com/guides/biology/human-reproduction/gametogenesis-in-humans/) | | | | | | | | | |
| 4 | https:/[/www.ndsu.edu/pubweb/~mcclean/plsc431/mutation/mutation4.htm](http://www.ndsu.edu/pubweb/~mcclean/plsc431/mutation/mutation4.htm) | | | | | | | | | |
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| Course Designed By: **Dr. S. Suja** | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | L | S | S | S | S | M | S |
| **CO3** | S | S | S | L | S | S | S | M | S | S |
| **CO3** | M | M | S | M | S | S | M | S | S | S |
| **CO4** | S | S | S | M | S | S | S | S | S | S |
| CO5 | M | S | S | M | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **13P** | | **BIOCHEMISTRY, CELL BIOLOGY**  **MICROBIOLOGY** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Core Practical - I** | **-** | **-** | | **6** | **4** |
| **Pre-requisite** | | | | **Basic knowledge in**  **Biochemistry, cell biology and microbiology** | **Syllabus**  **Version** | | | **2025 - 26** | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. The course enables the students to learn the basic biochemical tests 2. Give basic knowledge about the cell biology techniques 3. Learn the microbial culture techniques | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | | | Helps to understand the basic biochemical techniques | | | | K1 &  K2 | | |
| 2 | | | Gives a clear understanding about the estimation and separation of biomolecules | | | | K1 &  K2 | | |
| 3 | | | Perform the basic cell biology techniques and evaluate the biological samples | | | | K3 &  K5 | | |
| 4 | | | Apply basic microbiological culture techniques and to analyze the microbes present in the biological samples | | | | K3 &  K4 | | |
| 5 | | | Apply bacterial Isolation and Identification techniques and evaluate the bacterial sample | | | | K3 &  K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
| **Biochemistry** | | | | | | | | | |
| 1. | | Estimation of Glucose by Anthrone method. | | | | | | | |
| 2. | | Estimation of Total Cholesterol by ZAK‟s method. | | | | | | | |
| 3. | | Separation of amino acids using paper chromatography. | | | | | | | |
| 4. | | Separation of amino acids and plant pigments using thin layer chromatography (TLC). | | | | | | | |
| 5. | | Separation of two proteins using column chromatography. | | | | | | | |
| 6. | | Estimation of protein using Bradford and Lowry's methods. | | | | | | | |
| 7. | | Estimation of DNA using Diphenylamine. | | | | | | | |
| 8. | | Estimation of RNA using Orcinol reagent. | | | | | | | |
| 9. | | Separation of protein by Gel filtration, HPLC, flow cytometry | | | | | | | |
| 10. | | Estimation of Methionine | | | | | | | |
| **Cell biology** | | | | | | | | | |
| 1. | | Microtome and histochemical techniques | | | | | | | |
| 2. | | Squash preparation of onion root tip and anther lobes. | | | | | | | |
| 3. | | Cell counting methods – use of hemocytometer – calibration of the ocular micrometer and measurement of average cell size and chromosome length. | | | | | | | |
| **Microbiology** | | | | | | | | | |
| 1. | Preparation of culture media- Nutrient Broth, Nutrient Agar, Blood Agar, Macconkey Agar, Potato Dextrose Agar. | | | | | | | | |
| 2. | Isolation of bacteria from soil and air. | | | | | | | | |
| 3. | Staining techniques – simple, differential and special staining, streaking method. | | | | | | | | |
| 4. | Plotting of bacterial growth curve. | | | | | | | | |
| 5. | Identification of unknown bacteria by biochemical tests, IMVIC test. | | | | | | | | |
| 6. | Motility of bacteria by hanging drop method. | | | | | | | | |
| 7. | Assay of antibiotics by disc diffusion method | | | | | | | | |
| 8. | MIC assay | | | | | | | | |
| 9. | Bacteriological examination of water / Industrial effluents. | | | | | | | | |
| **Reference Books** | | | | | | | | | |
| 1. | Rao, B. S., & Deshpande, V. (2006). *Experimental biochemistry: a student companion*.Anshan. | | | | | | | | |
| 2. | Experiments and Techniques in Biochemistry: by Sheel Sharma, Galgotia publications. 2007. | | | | | | | | |
| 3. | Vasanthakumari.R, (2009) Practical Microbiology, BI Publishers Pvt Ltd, India. | | | | | | | | |
| 4. | Watson, J.D., Baker,T. A., Bell, S.P., Gan, A., Levine, M. and Losick, R. (2009) MolecularBiology of the Gene, 5th Edition, Pearson Education Inc. | | | | | | | | |
| Course Designed By: **Dr. S. Suja** and **Dr. R. Kavitha** | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | M | S | S | M | S | S |
| **CO3** | S | S | S | S | M | S | S | M | S | S |
| **CO3** | S | S | S | S | M | S | S | M | S | S |
| **CO4** | S | S | S | S | M | S | S | M | S | S |
| **CO5** | S | S | S | S | M | S | S | M | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **1EA** | **GENETICS AND DEVELOPMENT BIOLOGY** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective -1** | **4** | | | | √ | | **-** | **4** |
| **Pre-requisite** | | **To acquire knowledge in Mendelian and Non mendelian genetics and developmental concepts** | **Syllabus**  **Version** | | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. The main objective of this course is to introduce about concepts in Genetics and Developmental Biology. This course emphasizes to learn about principles involved in mendelian genetics and Non-mendelian inheritance and techniques used to diagnose genetic diseases and mutation concepts. 2. The course aims to give exposure to learn the basic concepts involved in developmental biology such as Potency, commitment, specification, induction, competence, determination and differentiations and morphogenetic gradients 3. This course also provides knowledge about Cell division in cleavage, Rudimental organs, Gametogenesis and Fertilization approaches. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | To learn Mendelian genetics, history, Monohybrid, Dihybrid and Trihybrid cross, Mendelian ratio of segregation, interaction of genes, alleles, Extrachromosomal inheritance, Extensions of mendelian principles | | | | | K1,  K2 & K4 | | | | |
| 2 | To understand the types, causes and detection, mutant types and techniques involved in Prenatal diagnosis of genetic diseases, DNA/RNA probes in the diagnosis of genetic diseases | | | | | K2 & K3 | | | | |
| 3 | To learn the concept of determination and differentiation; morphogenetic gradients; cell fate and cell lineages and imprinting. | | | | | K1,  K2 & K4 | | | | |
| 4 | To understand the process of cell division in cleavage, patterns in embryonic cleavage after fertilization. To know about the development of primary organs and Rudimental organs | | | | | K1, K2 | | | | |
| 5 | To learn the process involved in spermatogenesis, gametogenesis and fertilization | | | | | K1 &  K2 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit:1** | **Mendelian Inheritance and Its Extensions** | | | | **15 Hours** | | | | | |
| Principles of Mendelian inheritance; Mendel‟s experiments-monohybrid, dihybrid trihybrid and multi hybrid crosses. Concept of gene: Allele, multiple alleles, pseudo allele, complementation tests. Extensions of mendelian principles: Codominance, Incomplete dominance, Gene interactions, Pleiotropy, Genomic imprinting, Penetrance and expressivity, Phenocopy, Linkage and crossing over. Sex linkage, Sex limited and sex influenced characters. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. | | | | | | | | | | |
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| **Unit:2** | **Mutations & Genetic Diseases** | | | **15 Hours** | | | | | | |
| Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis, HIV mutation. Prenatal diagnosis of genetic diseases- amniocentesis, karyotyping. DNA probes in diagnosis of genetic diseases: Cystic fibrosis, Sickle cell anemia, Leukaemia, Burkets lymphoma. | | | | | | | | | | |
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| **Unit:3** | **Basic Concepts of Development** | | | **10 Hours** | | | | | | |
| Potency, commitment, specification, induction, competence, determination and differentiation; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. ABC model of flower development in Arabidopsis thaliana | | | | | | | | | | |
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| **Unit:4** | **Cell Differentiation** | | | **11 Hours** | | | | | | |
| Cell division in cleavage–Chemical changes–Patterns of embryonic cleavage – Morula and Blastula – Role of egg cortex – Morphogenetic gradients – Fate map – Gastrulation – Primary organ, Rudimental organs, Organizer – Morphogenetic movements. Anterior and posterior axis differentiation in drosophila | | | | | | | | | | |
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| **Unit:5** | **Gametogenesis** | | | **11 Hours** | | | | | | |
| Gametogenesis–Origin of germ cells–Significance of gametogenesis. Oogenesis – Types of eggs– growth, development and maturation of oocyte, Egg envelopes, Polarity and symmetry, Spermatogenesis–Sperm Structure, Types of sperm, Fertilization – Approach of spermatozoon– Reaction of egg, essence of activation – Changes in egg cytoplasm caused by fertilization | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | **2 Hours** | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
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|  | **Total Lecture hours** | | | **64 Hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Snustad D. P, Simmons M. J. (2015) Principles of Genetics, 7 th Edition, ISBN: 978-1-119-14228-7 JohnWiley & Sons. | | | | | | | | | |
| 2 | Scott F Gilbert, , Michael J.F. Barresi, (2016) Developmental biology, Sinauer Associates Inc; 11th edition | | | | | | | | | |
| 3 | Pierce,B.A (2020) Genetics: A conceptual approach, Seventh edition, W.H Freeman and company publishing, New york | | | | | | | | | |
| 4 | Klug,W., Cummings, M., Spencer, C., Palladino, M and killian D (2020) Concepts of Genetics, 12 Edition, Pearson Higher education and professional Group | | | | | | | | | |
| 5 | Wolpert L,  Tickle C, and  Martinez Arias A (2019) Principles of development 5th edition, Oxford University Press, Oxford, United Kingdom ISBN: 9780198800569 | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Genes VII, Benjamin Lewin, 2000, Oxford University Press. | | | | | | | | | |
| 2 | Genetics, 3rd edition, 2002, Strick berger, Prentice Hall of India. | | | | | | | | | |
| 3 | Genetics, Gupta PK., 5th edition, 2018, Rastogi Publications, Meerut, India. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | https://nptel.ac.in/courses/121/106/121106008/ | | | | | | | | | |
| 2 | https://nptel.ac.in/courses/102/104/102104052/ | | | | | | | | | |
| 3 | https:/[/www.toppr.com/guides/biology/human-reproduction/gametogenesis-in-humans/](http://www.toppr.com/guides/biology/human-reproduction/gametogenesis-in-humans/) | | | | | | | | | |
| 4 | https:/[/www.ndsu.edu/pubweb/~mcclean/plsc431/mutation/mutation4.htm](http://www.ndsu.edu/pubweb/~mcclean/plsc431/mutation/mutation4.htm) | | | | | | | | | |
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| Course Designed By: **Dr. S. Suja** | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | L | S | S | S | S | M | S |
| **CO3** | S | S | S | L | S | S | S | M | S | S |
| **CO3** | M | M | S | M | S | S | M | S | S | S |
| **CO4** | S | S | S | M | S | S | S | S | S | S |
| CO5 | M | S | S | M | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **1EB** | **NUTRITIONAL BIOCHEMISTRY** | | | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective - I** | | | **4** | √ | | **-** | **4** |
| **Pre-requisite** | | **Basic Knowledge in energy content in foods, nutritional requirements and its associated diseases** | | | **Syllabus**  **Version** | | | **2025 - 26** | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. The main objective of this course is to introduce about Dietary requirements and energy content in foods needed for human body 2. The course aims to give exposure to learn about malnutrition, starvation, protein metabolism in prolonged fasting and diseases that occur due to malnutrition. 3. This course teaches about inherited metabolic disorders and naturally borne food toxicants   and allergy causing foods. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To learn energy content in foods. techniques involved in the measurement of energy expenditure, Dietary requirements of carbohydrates, dietary fibre and dietary lipids | | | | | | | K1  & K2 | |
| 2 | To learn essential and non-essential aminoacids, protein reserves in human body, Protein malnutrition, techniques for the study of starvation, concepts for weight reduction diets. | | | | | | | K1, K2  & K4 | |
| 3 | To know about nutritional requirement during pregnancy, lactation, infants and childs, Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper. | | | | | | | K1, K2  & K4 | |
| 4 | To learn about role of diet and nutrition in the prevention and treatment of diseases, learn about inherited metabolic disorders | | | | | | | K1, K2  &K4 | |
| 5 | To learn naturally occurring food borne toxicants, Allergy causing foods and management. | | | | | | | K1,  K2 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | **Dietary Sources and Energy content of Foods** | | | | | | **15 Hours** | | |
| Composition of human body. Energy content of foods. Measurement of energy expenditure: direct and indirect colorimetry. Definition of BMR and SDA and factors affecting these. Carbohydrates – Dietary requirements and sources of available and unavailable carbohydrates. Physico-chemical properties and physiological actions of unavailable carbohydrates (dietary fibre). Lipids – Major classes of dietary lipids. Properties and composition of plasma lipoproteins. Dietary needs of lipids. Essential fattyacids and their physiological functions. | | | | | | | | | |
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| **Unit:2** | **Protein Nutrition and Malnutrition** | | **15 Hours** | | | | | | |
| Protein reserves of human body. Nitrogen balance studies and factors influencing nitrogen balance. Essential aminoacids for men and concept of protein quality. Cereals proteins and their limiting aminoacids. Nutritional requirements at different stages of life**.** Protein energy malnutrition, clinical features, metabolic disorders and management of marasmus and Kwashiorkar diseases: starvation – Techniques for the study of starvation. Protein metabolism in prolonged fasting. Proteins bearing treatments during fasting. Basic concepts of high protein and low calorific weight reduction diets. | | | | | | | | | |
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| **Unit:3** | **Nutrition Requirements During Different Stages** | | | **11 Hours** | | | | | |
| Dietary sources, biochemical functions and specific deficiency diseases associated with fat and water soluble vitamins. Hyper vitaminosis and their symptoms. Nutrition requirements during pregnancy, lactation and of infants and children. Nutritional significance of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper. | | | | | | | | | |
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| **Unit:4** | **Inherited Metabolic Disorders** | | | **11 Hours** | | | | | |
| Role of diet and nutrition in the prevention and treatment of diseases: Dental carries, Fluorosis, Renal failure, Hyperlipidemia, Atherosclerosis, Inherited metabolic disorders: Phenylketonuria, Maple syrup diseases, Hemocystinuria, Galactosemia, Gout, Diabetes Insipidus and Diabetes Mellitus. | | | | | | | | | |
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| **Unit:5** | **Allergy** | | | **10 Hours** | | | | | |
| Types of diagnosis and management of allergy. Naturally occurring food borne toxicants: protease inhibitors, Antinutritional factors, Hepatotoxins, Allergens, Oxalates, Toxins from mushrooms, animal food stuffs and sea foods. | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | **2 Hours** | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | |
|  | | | | | | | | | |
|  | **Total Lecture hours** | | | **64 Hours** | | | | | |
| **Text Book(s)** | | | | | | | | | |
| 1 | Krause,M.V and Hunsher,M.A, Food, Nutrition   and Diet Therapy, 11th edition,  W.B.Saunders company, Philadelphia, London, 2004. | | | | | | | | |
| 2 | Bamji M.S, Prahlad Rao N, Reddy V, Textbook of Human Nutrition II Edition, Oxford andPBH Publishing Co. Pvt. Ltd, New Delhi,2004 | | | | | | | | |
| 3 | Srilakshmi. E.(2016) Nutrition Science, New Age International Publishers. | | | | | | | | |
| 4 | Gopalani, S. (2008) Diet and Nutrition, Cyber Tech. Publication. | | | | | | | | |
| 5 | Swaminathan, M. (2009) Advanced Textbook on Food Science and Nutrition, Vol: 2, 2ndEdition, Reprinted, Bangalore Printed and Publishing Co Inc, Banglore | | | | | | | | |
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| **Reference Books** | | | | | | | | | |
| 1 | Gopalan, C., Ramasastry, B.V and Balasubramanian, S. (2007) Nutritive Value of Indian Foods, | | | | | | | | |
| 2 | National Institute of Nutrition, Hyderabad. | | | | | | | | |
| 3 | Swaminathan, M. (2010) Essentials of Food and Nutrition, Volume I and II Ganesh and Co., Madras. | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | |
| 1 | [https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-5\_03-](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-5_03-Balanced%20diet%20and%20food%20groups.pdf)  [Balanced%20diet%20and%20food%20groups.pdf](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-5_03-Balanced%20diet%20and%20food%20groups.pdf) | | | | | | | | |
| 2 | [https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1\_01-](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food%2C%20Nutrition%20and%20Health%201-A.pdf)  [Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food%2C%20Nutrition%20and%20Health%201-A.pdf) | | | | | | | | |
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| Course Designed By: **Dr. R. Kavitha** | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | S | S | S | S | M | S |
| **CO3** | S | S | S | L | S | S | S | S | M | S |
| **CO3** | S | M | S | M | S | S | S | S | S | S |
| **CO4** | S | M | S | M | S | S | S | S | S | S |
| **CO5** | M | M | S | L | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

Second Semester

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| **Course code** | **23A** | **ENZYMOLOGY** | **L** | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - V** | **4** | | √ | | | **-** | **4** |
| **Pre-requisite** | | **Background ideas on enzyme catalyzed**  **reactions** | **Syllabus**  **Version** | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the classification of enzymes and fundamentals of enzyme assay. Also, understanding of kinetics of enzyme catalyzed reactions and derivation of Michaelis Menten equation. 2. To advance the knowledge on mechanism of enzyme action as well as regulation of enzyme action with relevant examples. 3. To study about the techniques of immobilization and application in enzymes in food and   pharmaceutical industries. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Course material will help in understanding of nomenclature and classification ofenzymes and also the fundamentals of enzyme assay. | | | K2 | | | | | |
| 2 | Students will thoroughly understand the Kinetics of enzyme essay and derivationof velocity equations. | | | K2 & K4 | | | | | |
| 3 | Course will advance the knowledge of students on mechanism of enzyme action. | | | K2 &  K3 | | | | | |
| 4 | Understanding of detailed mechanism in enzyme regulation with relevant examples. | | | K1,  K2 & K3 | | | | | |
| 5 | Students will gain knowledge in various immobilization techniques and industrial application of enzymes | | | K2,  K3 & K5 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | **Introduction to Enzymes** | | | | | **15 Hours** | | | |
| Concept of convergent and divergent evolution of enzymes. Nomenclature and classification of enzymes. Specificity and active site- Lock & key model, Induced fit model. Co-enzymes. Fundamentals of enzyme assay – enzyme Units, coupled kinetic assay, immobilized enzymes. Enzyme localization. Criteria of purity of enzymes. Monomeric and oligomeric enzymes- Monomeric enzymes; serine proteases, zymogen activation, multifunctional enzymes, oligomeric enzymes and multi- enzyme complexes, Coenzymes. | | | | | | | | | |
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| **Unit:2** | **Kinetics of Enzyme-catalyzed Reactions** | | | | | **15 Hours** | | | |
| Methods used in the investigation of the kinetics of enzyme-catalyzed reactions, initial velocity studies, rapid reaction techniques and relaxation technique. Enzyme kinetics of single substrate reactions – Michaelis Menten and Briggs and Haldane theory (rapid equilibrium and steady state theory). Kinetic data evaluation-linear transformation of Michaelis-Menten equation. Pre-steady state kinetics. Kinetic analysis of Bisubstrate enzymes. Integrated velocity equation. Haldane equation. King-Altman procedure for deriving the rate equation. Mechanism of enzyme inhibition-Competitive, Non-competitive and Un-competitive. Effect of pH & temperature on enzymatic reactions, Arrhenius plot, determination of activation energy. | | | | | | | | | |
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| **Unit:3** | **Mechanism of Enzyme Action** | | | | | **11 Hours** | | | |
| Acid-base catalysis, covalent catalysis, proximity, orientation effect. Strain & distortion theory. Chemical modification of active site groups. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin, lysozyme, glyceraldehyde 3- phosphate dehydrogenase, aldolase, carboxypeptidase. | | | | | | | | | |
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| **Unit:4** | **Enzyme Regulation** | | | | | **11 Hours** | | | |
| General mechanisms of enzyme regulation, product inhibition. Reversible (glutamine synthase & phosphorylase) and irreversible (proteases) covalent modifications of enzymes. Mono cyclic and multicyclic cascade systems with specific examples. Feedback inhibition and feed forward stimulation. Allosteric enzymes, qualitative description of “concerted” & “sequential” models for allosteric enzymes. Half site reactivity, Flipflop mechanism, positive and negative co-operativity with special reference to aspartate trans carbamoylase& phosphofructokinase. Protein ligand  binding measurement, analysis of binding isotherms, Hill and Scatchard plots. | | | | | | | | | |
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| **Unit:5** | **Applications of Enzymes** | | | | | **10 Hours** | | | |
| Application of enzymes in food, Pharmaceutical, pulp, textile and other industries; diagnostic & therapeutic applications. Enzyme data repositories and their types and classification. Datamining– software types and its usage. Immobilized enzymes-Techniques of enzyme immobilization; applications of immobilized enzymes. | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | | | | |
| 1 | Fundamentals of Enzymology, 3rd Edition – 2009 by Nicholas C. Price; Oxford University Press. | | | | | | | | |
| 2 | Molecular Enzymology (Tertiary Level Biology)- 2013 by Christopher W. Wharton; Springer | | | | | | | | |
| 3 | ENZYMES– 2008 by Trevor Palmer and Philip Bonner; East West, New Delhi. | | | | | | | | |
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| **Reference Books** | | | | | | | | | |
| 1 | Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis – 2008 byRobert A. Copeland; Wiley India Pvt Ltd. | | | | | | | | |
| 2 | Enzyme Kinetics and Mechanism – 2007 by Paul F. Cook and W. W. Cleland; Publisher:Garland Science. | | | | | | | | |
| 3 | Fundamentals and Application of New Bioproduction Systems (Advances in BiochemicalEngineering/Biotechnology) – 2016 by An-Ping Zeng; Publisher: Springer | | | | | | | | |
| 4 | Enzyme Kinetics: Rapid–Equilibrium Applications of Mathematica: 53 (Methods of Biochemical Analysis) – 2011 by Robert A. Alberty; Publisher: Wiley-Blackwell. | | | | | | | | |
| 5 | Fundamentals of Enzyme Kinetics – 2004 by Athel Cornish-Bowden; Publisher: PortlandPress. | | | | | | | | |
| 6 | Fundamentals of Enzyme Engineering 2017 by Young Je Yoo, Yan Feng, Yong- Hwan Kim and Camila Flor J. Yagonia; Publisher: Springer. | | | | | | | | |
| 7 | Enzyme Kinetics: Behavior and Analysis of Rapid Equilibrium and Steady–State Enzyme Systems (Wiley Classics Library)-1993 by Irwin H. Segel; Publisher: Wiley | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | |
| 1 | <https://www.classcentral.com/course/swayam-enzymology-19860> | | | | | | | | |
| 2 | <https://www.udemy.com/course/enzymology/> | | | | | | | | |
| 3 | <https://www.mooc-list.com/course/biochemistry-biomolecules-methods-and-mechanisms-edx> | | | | | | | | |
| 4 | Introduction to Data Mining, Pang-NingTan (2018) Pearson Education India <https://books.google.co.in/books?id=64GVEjpTWIAC> | | | | | | | | |
| Course Designed By: **Dr. S. Selvakumar** | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | M | L | S | M | M | S | M |
| **CO3** | S | S | M | M | S | L | S | M | M | S |
| **CO3** | S | M | L | M | S | M | M | M | M | M |
| **CO4** | S | S | S | S | M | M | L | M | S | S |
| **CO5** | S | S | M | L | M | L | M | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **23B** | | | **INTERMEDIARY METABOLISM** | **L** | **T** | | | **P** | | | **C** |
| **Core/Elective/Supportive** | | | | **Core - VI** | **4** | √ | | | **-** | | | **4** |
| **Pre-requisite** | | | | **Basic knowledge in Chemistry Biomolecules** | **Syllabus** **Version** | | | | | | | **2025 - 26** |
| **Course Objectives:** | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the metabolism of carbohydrates, lipids, proteins and nucleic acids. 2. To impart knowledge of the concepts of regulation of metabolism. 3. To offer basic knowledge of Porphyrin Metabolism. | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | Understand the concepts of carbohydrate metabolism and its regulation | | | | | | | | K2 | | | |
| 2 | Understand the concepts of lipids metabolism and its regulation | | | | | | | | K2 | | | |
| 3 | Understand the concepts of metabolism of amino acids and urea cycle | | | | | | | | K2 | | | |
| 4 | Understand the concepts of nucleotide metabolism and regulation  mechanism | | | | | | | | K2 | | | |
| 5 | Apply the knowledge of  metabolic concepts in pathway analysis | | | | | | | | K3 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | |
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| **Unit:1** | **Metabolism of Carbohydrates** | | | | | | | **15 Hours** | | | | |
| Metabolism of carbohydrates - Reactions, energetics and regulation of glycolysis; Feeder pathways for glycolysis; Fate of pyruvate under aerobic and anaerobic conditions; Pyruvate dehydrogenase complex and its regulation; Reactions, regulation and amphibolic nature of TCA cycle; Anaplerotic reactions; Glyoxylate cycle; Polyol pathways; ED pathway: Pentose phosphate pathway; Gluconeogenesis; Cori cycle; Biosynthesis of lactose, sucrose and starch; Glycogenesis and Glycogenolysis; Control of glycogen metabolism. | | | | | | | | | | | | |
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| **Unit:2** | **Metabolism of Lipids** | | | | | | | **15 Hours** | | | | |
| Fatty acid oxidation - Franz Knoop‟s experiment; β oxidation of saturated, unsaturated and odd carbon fatty acids; Peroxisomal β oxidation; α- and ω- oxidations of fatty acids; Ketone bodies – Formation and utilization; Biosynthesis of saturated fatty acids; Elongation and desaturation of fatty acids; Triacylglycerols – Biosynthesis, and mobilization from adipose tissue; Regulation of fatty acid metabolism; Cholesterol biosynthesis and its regulation; Biosynthesis of phosphoglycerides and sphingolipids. Biosynthesis of Eicosanoids. Lipoprotein metabolism. | | | | | | | | | | | | |
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| **Unit:3** | **Amino Acid Metabolism** | | | | | | **11 Hours** | | | | | |
| Amino acid metabolism - Degradation of amino acids, oxidative and nonoxidative deamination, transamination, decarboxylation, detoxification of ammonia - Urea cycle catabolism of carbon skeletons of amino acids - ketogenic and glucogenic amino acids. | | | | | | | | | | | | |
| **Unit:4** | **Nucleic Acid Metabolism** | | | | | | | | | **11 Hours** | | |
| Biosynthesis of purines and pyrimidines- De novo and salvage pathways and their regulation. Catabolism of purine and pyrimidines. Structure and regulation of ribonucleotide reductase. Biosynthesis of ribonucleotides and deoxyribonucleotides. | | | | | | | | | | | | |
| **Unit:5** | | **Integration of Metabolism** | | | | | | | | | **10 Hours** | |
| Overview of metabolism of Porphyrins, Biosynthesis and degradation of heme. Nitrogen balance-Factors affecting nitrogen balance-conversion of amino acids to specialized products. | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | | | | | | | **2 Hours** | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | |
| **Total Lecture hours-64 Hours** | | | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | |
| Lehninger: Principles of Biochemistry (2021) 8th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York). | | | | | | | | | | | | |
| Textbook of Biochemistry with Clinical Correlations (2022) 7th ed., Devlin, -T.M., JohnWiley & Sons, Inc. (New York). | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| Biochemistry (2015) 8th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. FreemanandCompany (New York). | | | | | | | | | | | | |
| Harper‟s Biochemistry (2018) 31st ed., Murray, R.K., Granner, D.K., Mayes and  P.A.,Rodwell, V.W., Lange Medical Books/McGraw Hill. | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| https://www.researchgate.net/publication/322407168\_Machine\_Learning\_Methods\_for\_Analysis\_of\_Metabolic\_Data\_and\_Metabolic\_Pathway\_Modeling | | | | | | | | | | | | |
| <https://www.nature.com/articles/s41540-018-0054-3> | | | | | | | | | | | | |
| https://www.researchgate.net/publication/263474674\_A\_Comprehensive\_View\_on\_Metabolic\_Pathway\_Analysis\_Methodologies | | | | | | | | | | | | |
| Course Designed By: **Dr. R. Kavitha** | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | S | M | S | S | S | S |
| **CO3** | S | S | S | S | S | M | S | S | S | S |
| **CO3** | S | S | S | S | S | M | S | S | S | S |
| **CO4** | S | S | S | S | S | M | S | S | S | S |
| **CO5** | S | S | S | S | S | M | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **23C** | **HUMAN PHYSIOLOGY AND MOLECULAR PHYSIOLOGY** | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | **Core – VII** | **4** | | | √ | **-** | **4** |
| **Pre-requisite** | | **Understand function of each organ** | **Syllabus**  **Version** | | | | **2025 - 26** | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. This course presents an Introduction and provides a comprehensive, balanced introduction to this exciting, evolving and multi-disciplinary field. 2. To enable the students to learn or to know the biological, physiological activities along with   the mechanism of action of various organs. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Obtain a deep knowledge regarding blood. | | | | K1 & K2 | | | |
| 2 | Gives an idea about the heart and its regulation. | | | | K1 & K2 | | | |
| 3 | Provides Knowledge about digestive secretion and urine formation. | | | | K2 & K3 | | | |
| 4 | Obtain an insight about respiration and Neurons. | | | | K2 & K3 | | | |
| 5 | Provides knowledge about Hormone and its regulation. | | | | K2, K3 & K4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
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| **Unit:1** | **Cardiovascular system and Digestive system** | | | | **15 Hours** | | | |
| Composition, types and functions of blood and plasma. Blood coagulation -  mechanism, fibrinolysis, anticoagulants. Hemoglobin - structure, abnormal types,anemia.Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG - its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.  Digestions and absorption of carbohydrates, lipids, proteins and nucleic acids. Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, electrolyte balance. | | | | | | | | |
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| **Unit:2** | **Respiratory, Nervous System and Endocrinology** | | | | **15 Hours** | | | |
| Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration. Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Functions and applications of Extracorporeal membrane oxygenation (ECMO) machines.  Exo and Endocrine glands, basic mechanism of hormone action, Types of hormones and diseases; reproductive processes, neuroendocrine regulation. | | | | | | | | |
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| **Unit:3** | **Signaling components** | | | **11 Hours** | | | | |
| Endocrine, Paracrine and Autocrine signaling; Signaling molecules - Hormones (agonists and antagonists) NO; Receptor Classification: Receptor linked to Trimeric G proteins (G proteins linked Receptors), Receptors with intrinsic or associated enzymatic activity (TGF - , cytokine, Receptor Tyrosine kinase, Receptor guanylyl cyclase, Receptor Phosphotyrosine phosphatase, T - Cell Receptor), Ion Channels as receptors, receptors involving proteolysis (Wnt, Hedgehog Hh, Notch/ Delta, NF –k ), intracellular receptor (NO. Pathway, Nuclear receptor). Membrane anchoring process - myristoylation, palmitoylation, Farnesylation, Geranylation, GPI anchor. | | | | | | | | |
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| **Unit:4** | **Signal Transmission and its Regulations** | | | **11 Hours** | | | | |
| G Protein Coupled Signal Transmission: GPCR Structure and classification, ligand binding domain; Signaling pathways via cAMP, ion Channel regulation, Phospholipase C; Trimeric and monomeric G proteins and their effectors; Regulation – GTPase superfamily and GTP hydrolysis; Regulation of GPCR signaling – GDP/GTP cycling, GTPase activity, phosphodiesterase activity, feedback inhibition, heterologous desensitization, phosphorylation of receptors, β-arrestin in regulation of GPCR. | | | | | | | | |
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| **Unit:5** | **Integration of Signals and Gene Controls** | | | **10 Hours** | | | | |
| TGF Receptors and Smad activation; cytokine receptors and JAK - STAT pathway; RTK and Ras activation; MAP Kinase pathways; phosphoinositides as signal transducers; Signal induced protein cleavage (NF-kB, Notch /Delta, Wnt, Hedgehog). Inflammatory signaling. Classifications of Bio Database (Primary and Secondary). Types of the database - Nucleotide and Protein Database. | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | **2 Hours** | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | |
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|  | **Total Lecture hours** | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | |
| 1 | Human Physiology by C. C. Chatterjee, CBS Publishers & Distributors; 13th revised edition, volume 2 (2020). | | | | | | | |
| 2 | Textbook of Medical Physiology, Guyton and Hall 15th Edition, *Publisher*: Saunders (2015) | | | | | | | |
| 3 | Biochemistry of Signal Transduction and Regulation – 2014 by Gerhard Krauss; Publisher:Wiley VCH; 5th edition. | | | | | | | |
| 4 | The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman;Publisher: Sinauer Associates Inc; 6 edition. | | | | | | | |
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| **Reference Books** | | | | | | | | |
| 1 | Review of Medical Physiology by William. F. Ganong. McGraw-Hill Medical; 26th edition (2022). | | | | | | | |
| 2 | Physiology and Mechanisms of Disease by Arthur C. Guyton, John E. Hall. Saunders, 6TH Edition (1997). | | | | | | | |
| 3 | V. Bhuvaneswari, T. Devi, Big Data Analytics, Scitech Publisher, 2018 | | | | | | | |
| 4 | Han Hu, Yonggang Wen, Tat- Seng, Chua, Xuelong Li „Toward Scalable Systems for Big Data Analytics: A Technology Tutorial‟, IEEE, 2014. | | | | | | | |
| 5 | Molecular Cell Biology– 2016 by Arnold Berk, Chris A. Kaiser, Harvey Lodish, Angelika Amon, Hidde Ploegh, Anthony Bretscher, Monty Krieger and Kelsey C. Martin; Publisher:WH Freeman; 8 edition. | | | | | | | |
| 6 | Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition. | | | | | | | |
| 7 | Arthur M Lesk (2014). Introduction to bioinformatics. Oxford University Press. Oxford, United Kingdom | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | NOC: Animal Physiology  <https://nptel.ac.in/courses/102/104/102104058/> | | | | | | | |
| 2 | Animal Physiology  [https://nptel.ac.in/courses/102/104/102104042/#](https://nptel.ac.in/courses/102/104/102104042/) | | | | | | | |
| 3 | Introductory Human Physiology  <https://www.coursera.org/learn/physiology> | | | | | | | |
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| Course Designed By: **Dr. S. Suja** | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | S | S | M | S | M | S |
| **CO3** | S | S | S | M | M | M | S | M | M | S |
| **CO3** | S | S | S | M | M | M | S | S | M | S |
| **CO4** | S | M | M | M | S | S | M | S | M | S |
| **CO5** | S | S | S | M | M | M | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **23D** | **IMMUNOLOGY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - VIII** | **4** | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Prior knowledge on the components of immune system** | **Syllabus**  **Version** | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. The study of immunology helps the students in understanding the immune system in all organism especially the physiological functioning of the immune system in states of both health and disease. 2. To understand the malfunctions of the immune system in immunological disorders such as autoimmune disease, hypersensitive, immune deficiency and transplant rejection. 3. 3. To understand the physical, chemical and physiological characteristics of the components of immune system in in vitro, in situ and in vivo. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | To obtain the knowledge about the immune system, as a host defense system comprising many biological structures and processes within an organism that protects against disease. | | | K1 & K2 | | | | | |
| 2 | To concentrate on the antigen and antibody reactions and immunological techniques | | | K1 & K2 | | | | | |
| 3 | Understanding about the two branches of immune system such as humoral immunity and cellular immunity, cytokines and complement system. | | | K1 & K2 | | | | | |
| 4 | Clear about the hypersensitivity reaction or intolerance with undesirable reactions produced by the normal immune system, including allergies and autoimmunity. | | | K1 & K2 | | | | | |
| 5 | To obtain the knowledge about the hybridoma technology is to produce large numbers of identical antibodies (monoclonal antibodies) and a recombinant DNA technology that involves inserting the DNA encoding an antigen that stimulates  an immune response | | | K1, K3  & K4 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | **Cells of The Immune System** | | | | **15 Hours** | | | | |
| Cells of the immune System - Macrophages, B and T lymphocytes, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. Organs of the immune system: Thymus, Bone marrow, Spleen, lymph nodes, MALT, GALT. Haemopoiesis and differentiation, lymphocyte trafficking. Structure and functions of different classes of Immunoglobulin. Biology of antigen and Superantigens. | | | | | | | | | |
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| **Unit:2** | **Antigen-Antibody Reactions** | | | | **15 Hours** | | | | |
| Antigen antibody reactions, Applications of Immunological techniques- ELISA, RIA, Immunofluorescence, immunoblotting and immunoelectrophoresis, immunocytochemistry, genetic control of immune response, effector mechanisms, MHC, antigen recognition and presentation, activation of B and T lymphocytes. | | | | | | | | | |

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| **Unit:3** | **Humoral and Cell Mediated Immunity** | **11 Hours** |
| Humoral and cell mediated immunity. Cell mediated Cytotoxicity: Mechanism of T cell and NK Cell mediated lysis, Antibody dependent cell mediated Cytotoxicity and macrophage mediated Cytotoxicity. Interleukins and Cytokines - their role in immune regulation, Biology of Complement system, and Complement fixation test. Immune suppression and immune tolerance. | | |
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| **Unit:4** | **Immunity Versus Diseases** | **11 Hours** |
| Hyper sensitivity reactions, Autoimmune disorders, Transplantation immunology- MLR, HLA Typing, Bone marrow transplantation, Organ transplants. Immunity to Infectious agents - Bacteria, Viruses, Malaria, and Helminthes. Tumor immunology and immunotherapy. AIDS and other immune deficiencies, Structure of HIV, envelope glycoproteins, destruction of T cells: immunologic symptoms of AIDS, AIDS vaccine. | | |
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| **Unit:5** | **Applications of Antibodies** | **10 Hours** |
| Vaccine technology and recombinant vaccines, Identification of B and T epitopes for vaccine development. In situ characterization of cells from tissues, Immunoscreening of Recombinant library, Hybridoma – Monoclonal Antibody production and applications; MAbs in diagnosis and therapy. | | |
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| **Unit:6** | **Contemporary Issues** | **2 Hours** |
| Expert lectures, online seminars - webinars | | |
| ***Total Lecture hours* 64 Hours** | | |
| **Text Book(s)** | | |
| 1 | J.Kuby, 2018, Immunology 8th edition , W.H. Freeman and Company, Newyork. | |
| 2 | C.V.Rao. 2005, An Introduction to Immunology, Narosa Publishing House, Chennai. | |
| 3 | Barker, Taylor. Applied immunology and biochemistry. Scientific e-Resources, 2019. | |
| 4 | I.R.Tizard, 1995, Immunology: An Introduction , 4 edition , Saunders College Publishers,New York. | |
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| **Reference Books** | | |
| 1 | I.Roitt, 2017, Essential Immunology, 13th edition, Blackwell Science, Singapore. | |
| 2 | Abul Abbas Andrew H. Lichtman Shiv Pillai, 2017, Cellular and Molecular immunology 9th  Edition | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | |
| 1 | <https://www.hindawi.com/journals/bmri/2014/437987/> | |
| 2 | <https://www.tandfonline.com/doi/full/10.1080/1744666X.2019.1623670> | |
| 3 | [https://www.technologynetworks.com/immunology/articles/using-the-internet-of-things-to-](https://www.technologynetworks.com/immunology/articles/using-the-internet-of-things-to-fight-virus-outbreaks-331992)  [fight-virus-outbreaks-331992](https://www.technologynetworks.com/immunology/articles/using-the-internet-of-things-to-fight-virus-outbreaks-331992) | |
| Course Designed By: **Dr. K. M. Saradhadevi** | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | M | M | S | S | S | M | S | W |
| **CO3** | S | S | M | L | S | M | S | M | W | W |
| **CO3** | S | S | S | L | S | M | S | M | M | M |
| **CO4** | S | S | S | L | S | M | M | L | M | M |
| **CO5** | S | S | S | M | S | M | M | L | S | W |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **23P** | **IMMUNOLOGY AND ENZYMOLOGY**  **LAB** | **L** | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | **Core Practical - II** | **-** | **-** | **6** | **4** |
| **Pre-requisite** | | **Basic knowledge in Biochemical Analysis** | **Syllabus**  **Version** | | **2025 - 26** | |
| **Course Objectives:** | | | | | | |
| The main objectives of this course are:   1. To familiarize students with the various immunological techniques that includes antigen- antibody interactions, quantitation of antigens or antibody, ELISA, agglutination reactions etc. 2. To gain knowledge on enzymology in the aspects of isolation and purification, kinetics as   well as native PAGE analysis. | | | | | | |
| **Expected Course Outcomes:** | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | |
| 1 | Understood the principles of immunology and the methods of studying immune reactions | | | K2 | | |
| 2 | Apply basic techniques for identifying antigen antibody interactions. | | | K2, K3 | | |
| 3 | Analyse the kinetics of enzyme catalysis and learn the basics of  isolation and purification of enzymes. | | | K2, K3,  K4 | | |
| 4 | Understand the concepts of isoenzyme   analysisand inhibitory mechanisms of enzyme activity | | | K2, K3,  K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | |
| **Immunology** | | | | | | |
| 1 | Immuno diffusion – single radial and double diffusion | | | 3 Hours | | |
| 2 | Immunoelectrophoresis | | | 3 Hours | | |
| 3 | Rocket immunoelectrophoresis | | | 3 Hours | | |
| 4 | Haemagglutination and passive hemagglutination | | | 3 Hours | | |
| 5 | Identifying blood group and Rh typing | | | 3 Hours | | |
| 6 | ELISA-Direct and Indirect | | | 3 Hours | | |
| 7 | Isolation and purification of IgG from serum | | | 3 Hours | | |
| 8 | Dissection and identification of Thymus, Spleen, Lymph node from rat | | | 3 Hours | | |
| **Enzymology** | | | | | | |
| 1 | Isolation and Purification of Salivary Amylase enzyme. | | | 3 Hours | | |
| 2 | Determination of total and specific activity of salivary amylase. | | | 3 Hours | | |
| 3 | Effect of pH on enzyme activity (Acid phosphatase/Alkaline phosphatase). | | | 3 Hours | | |
| 4 | Effect of temperature on enzyme activity (ACP/ALP) and determination of activation energy. | | | 3 Hours | | |
| 5 | Effect of substrate concentration on enzyme activity (Salivary Amylase) and determination of Km value. | | | 3 Hours | | |
| 6 | Effect of inhibitor on activity of Salivary Amylase. | | | 3 Hours | | |
| 7 | Assay of lactate dehydrogenase (LDH). | | | 3 Hours | | |
| 8 | Isoenzyme analysis (LDH) from serum sample- Native PAGE. | | | 3 Hours | | |
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|  | **Total practical hours** | | | **48  hours** | | |
| **Text Book(s)** | | | | | | |
| 1 | K. Wilson and J. Walker, Practical Biochemistry, Principles and Techniques,  Cambridge University Press, eighth edition 2018. | | | | | |
| 2 | J. Jayaraman, Laboratory Manual in Biochemistry - New age international pvt. ltd,2011 | | | | | |
| 3 | D.T. Plummer, Practical Biochemistry - TATA McGraw-Hill education; 3rd edition,2006 | | | | | |
| 4 | R.C.Gupta & S. Bhargava Practical Biochemistry - CBS publishers and distributors,5th revised edition, 2013 | | | | | |
| 5 | Experimental Biochemistry – A Student Companion - B.S. Rao & V. Deshpande, I.K.Interational Pvt. Ltd. (N. Delhi, Mumbai, Bangalore) 2005. | | | | | |
| **Reference Books** | | | | | | |
| 1 | R. Boyer, Modern Experimental Biochemistry, 3rd., Pearson Education  (Singapore) Pvt. Ltd.,2001. | | | | | |
| 2 | R. L. Switzer and L. F. Garrity, Experimental Biochemistry, 3rd edition., W. H.  Freeman,1999. | | | | | |
| Course Designed By: **Dr. S. Selvakumar** and **Dr. K. M. Saradhadevi** | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | L | M | M | S | S | M | S |
| **CO2** | S | S | S | L | M | M | S | S | M | S |
| **CO3** | S | S | M | S | S | M | L | S | M | S |
| **CO4** | S | S | M | M | M | M | M | S | L | S |
| **CO5** | S | S | S | M | S | M | M | L | S | W |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **2EB** | **ANIMAL BIOTECHNOLOGY** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective - II** | **4** | | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Knowledge about basic concepts of Animal cell culture and its applications** | **Syllabus**  **Version** | | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the basics of animal cell culture and importance of stem cells and regenerative medicine 2. To acquire knowledge about animal transgenesis 3. To learn about the applications of Animal biotechnology | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Course will advance the understanding of basics of Animal cell culture | | | | K1 | | | | | |
| 2 | Students will understand about the cell lines, cytotoxicity and viability assays | | | | K1 & K2 | | | | | |
| 3 | Advancement in knowledge in stem cell culture and its applications | | | | K2 & K3 | | | | | |
| 4 | Students will acquire knowledge in Genetic engineering of animal cells | | | | K1, K2 & K4 | | | | | |
| 5 | Understanding about the applications of animal biotechnology | | | | K2, K3 & K5 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
|  | | | | | | | | | | |
| **Unit:1** | **Animal Cell and tissue culture** | | | | **15 Hours** | | | | | |
| Introduction-History and scope; Qualitative and Quantitative requirements of Animal tissue culture. Role and importance of growth factors, types of culture media—natural and artificial media..Initiation of cell cultures-types-primary culture, cell lines, maintenance of cultures-monolayer and suspension cultures- preservation and authentication.Layout of animal tissue culture laboratory and sterilization methods | | | | | | | | | | |
|  | | | | | | | | | | |
| **Unit:2** | **Modification and applications of cultured cells** | | | | **15 Hours** | | | | | |
| Large-scale culture of cell lines — Scaling up of animal cell cultures, genetic modification — transfection of animal cells and markers to select transformants. Cellular senescence-measurement of cell death, cytotoxicity and viability assays.Growth kinetics of cell culture; embryo and organ culture. | | | | | | | | | | |
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| **Unit:3** | **Stem cell culture** | | | **10 Hours** | | | | | | |
| Stem cell culture - Origin, types — adult, embryonic culture and applications, Adult stem cells in clinical trials — reprogramming somatic cells into induced pluripotent stem cells - direct reprogramming of cells.  Stem cells in livestock, Three dimensional culture; tissue engineering — stages, support materials, cell sources, applications in regenerative medicine; cell fusion and its applications. Ethical aspects in stem cell research. | | | | | | | | | | |
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| **Unit:4** | **Cloning and its applications** | | | | | **11 Hours** | | | | |
| Somatic cell nuclear transfer — Genetic engineering of animal cells — embryo technology, gene knockout technologies and mice model for human genetic disorder. CIoning of animaIs-principles.Human therapeutic cloning— the relationship between stem cells and cloning - xenotransplantation, Model organisms in Biotechnology and Biomedical sciences, developments in molecular markers in livestock — developments in livestock genomics and applications of molecular markers.The Dolly story — cloning of pets and endangered species; Ethical aspects of cloning; IVF and artificial insemination. | | | | | | | | | | |
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| **Unit:5** | **Animal Transgenesis** | | | | | **11 Hours** | | | | |
| Animal transgenesis — principles and methods - biopharming in animal transgenesis, disease resistant transgenic animals and transgenesis in aquaculture. Pest management using juvenile hormone analogs, biocontrol agent, Pheromones, Biotechnology of silkworms, insect cell culture and its products. Marine Biotechnology — therapeutics from marine organism resources. Nutrigenomics, metabolomics and its role in animal production. | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Freshney, R.I. (2005) Culture of Animal Cells - A Manual of Basic Techniques, 5thEdition, John Wiley and Sons, New York. | | | | | | | | | |
| 2 | Purohit, S.S. (2006) Biotechnology: Fundamentals and Applications, Agriobios, India | | | | | | | | | |
| 3 | Cheria Ranjit, (2021), Animal Physiology and Biochemistry, Academic Aspirations. | | | | | | | | | |
| 4 | Sathyanarayana, U. (2005), Biotechnology, 2nd Edition, Books and Allied Ltd., Calcutta. | | | | | | | | | |
| 5 | Davis, J.M. (Ed.) (2005) Basic Cell Culture, 2ndEdition, a Practical Approach, Oxford University, New York. | | | | | | | | | |
| 6 | Butler, M. (2004) Animal Cell Cukure Technology — Basics, 1st Edition, Academic Press, New York. | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Ranga, M.M. (2007) Animal Biotechnology, 3rd Edition, Agrobios, India. | | | | | | | | | |
| 2 | Potten, C.S. (2006) Stem cells - Academic Press, UK. | | | | | | | | | |
| 3 | Arthur M Lesk (2014). Introduction to bioinformatics. Oxford University Press.  Oxford, United Kingdom | | | | | | | | | |
| 4 | Srivastava, A.K., Singh, R.K., Yadav, M.P. (2009) Animal Biotechnology, Oxford and IBH Publishing and company | | | | | | | | | |
| 5 | Singh. B, Gautam, S.K and Chauhan M.S. (2015) Textbook of animal Biotechnology, The Energy Resource Institute, TERI press, New Delhi, India | | | | | | | | | |
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| Course Designed By: **Dr. S. Selvakumar** | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | L | M | M | S | L | S | S |
| **CO3** | S | S | M | L | S | M | L | M | M | M |
| **CO3** | M | S | L | L | L | M | S | S | M | M |
| **CO4** | S | M | S | M | S | L | S | S | L | S |
| **CO5** | S | L | S | M | M | L | L | M | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **2EC** | **NANOSCIENCE AND** **TECHNOLOGY** | **L** | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | **ELECTIVE – II** | **4** | √ | **-** | **4** |
| **Pre-requisite** | | **To acquire knowledge about synthesis, characterization of nanoparticles and its**  **applications** | **Syllabus Version** | | **2025 – 26** | |
| **Course Objectives:** | | | | | | |
| The main objectives of this course are to:   1. The main objective of this course is to introduce about concepts in Nanoscience and technology and the internet of nano-things and applications 2. This course emphasizes to learn about nanoparticles and its types, synthesis, characterization of nanoparticles and microscopy techniques 3. Nanocarriers and drug delivery system in nanomedicine provides the learner to know about the treatment of diseases using nanoparticles and to know about Big data in Nanomedicine. | | | | | | |
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| **Expected Course Outcomes:** | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | |
| 1 | Learn history of nanotechnology, Properties of nanoparticles, types and internet of nano-things and applications | | K1&K 2 | | | |
| 2 | know the bottom up and top down approaches and synthesis of nanoparticlesusing physical, chemical and biological method | | K1& K2, K3 | | | |
| 3 | Understand the characterization of nanoparticles using Microscopy techniques such as SEM, TEM, AFM, STM | | K2,  K3 & K4 | | | |
| 4 | Learn about surface modification of biomolecules and conjugation to nanomaterials and to know about Nano-biomimetics | | K2&K3 | | | |
| 5 | Learn about treatment of diseases using nanoparticles in nanomedicine and to know about nanotechnology in Big data analysis | | K2,K3&K 4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | |
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| **Unit:1** | **Introduction to Nanoscience and Nanotechnology** | | **15 Hours** | | | |
| Milestones in Nanotechnology; Overview of Nanobiotechnology and Nanoscale processes; Physicochemical properties of materials in Nanoscales. Types of Nanomaterials (Quantum dots- 0D,1D,2D, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes). The internet of Nano-things and its applications | | | | | | |
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| **Unit:2** | **Nanomaterials** | | **15 Hours** | | | |
| Top down and bottom up synthesis -Physical, Chemical and Biological synthesis of Nanoparticles; Polymers in nano material synthesis- natural and synthetic polymers. Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.-Green synthesis. | | | | | | |
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| **Unit:3** | **Characterization techniques** | | **10 Hours** | | | |
| Characterization of Nano material**;** UV-visible spectroscopy, FTIR, SEM, TEM, AFM, STM, XRD.Confocal and TIRF imaging. | | | | | | |
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| **Unit:4** | **Biomolecules and Biomimetics** | | **11 Hours** | | | |
| Reactive groups on biomolecules (DNA & Proteins); Surface modification and conjugation to nanomaterials. Fabrication and application of DNA nanowires; Nanofluidics to solve biological problems. Nano-biomimetics. | | | | | | |
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| **Unit:5** | **Nanocarriers** | | **11 Hours** | | | |
| Properties of nanocarriers; drug delivery systems used in nanomedicine; Types of Nanocarriers- Liposomes, Polymeric Nanoparticles, Dendrimers, Carbon nanotubes,Gold Nanoparticles ; Enhanced Permeability and Retention effect; Blood-brain barrier; Active and passive targeting of diseased cells; Health and environmental impacts of nanotechnology. Big data at Nanoscale; Use of data mining and machine learning in Nanomedicine | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | |
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|  | **Total Lecture hours** | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | |
| 1 | Bio-nanotechnology Concepts and applications. Madhuri Sharon, Maheshwar Sharon, Sunil Pandey and Goldie Oza, Ane Books Pvt Ltd, 1 edition 2012. | | | | | |
| 2 | Nanobiotechnology: Bioinspired Devices and Materials of the Future by Oded Shoseyovand Ilan Levy, Humana Press; 1 edition 2007. | | | | | |
| 3 | Microscopy Techniques for Material Science. A. R. Clarke and C. N. Eberhardt (Editors) CRC Press. 1st Edition, 2002. | | | | | |
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| **Reference Books** | | | | | | |
| 1 | Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer(Editor), Chad A. Mirkin (Editor), Wiley-VCH; 1 edition, 2004. | | | | | |
| 2 | Nanobiotechnology Protocols (Methods in Molecular Biology) by Sandra J Rosenthal and David W. Wright, Humana Press; 1 edition, 2005. | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | |
| 1 | Nanotechnology and Big data analysis for computer aided diagnosis  <https://pubmed.ncbi.nlm.nih.gov/26979668/> | | | | | |
| 2 | The use of data mining and machine learning in Nanomedicine  [https://www.oatext.com/the-use-of-data-mining-and-machine-learning-in-nanomedicine-a-](https://www.oatext.com/the-use-of-data-mining-and-machine-learning-in-nanomedicine-a-survey.php#gsc.tab%3D0) [survey.php#gsc.tab=0](https://www.oatext.com/the-use-of-data-mining-and-machine-learning-in-nanomedicine-a-survey.php#gsc.tab%3D0) | | | | | |
| 3 | Kethineni P.Applications of internet of nano things: A survey  Proc. of the IEEE International Conference for Convergence in Technology (I2CT) | | | | | |
|  | Mumbai, India (2017), pp. 371-375 | | | | | |
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| Course Designed By**: Dr. S. Selvakumar** | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO**  **10** |
| **CO1** | L | M | S | M | L | S | M | S | S | S |
| **CO2** | M | S | S | M | M | S | M | S | S | S |
| **CO3** | M | S | S | M | L | S | M | S | S | S |
| **CO4** | L | M | S | M | M | S | S | S | S | S |
| CO5 | L | L | S | M | M | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

Third Semester

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| **Course code** | **33A** | **CLINICAL BIOCHEMISTRY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - IX** | **4** | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Basic knowledge in Metabolism of Biomolecules and Analytical Techniques** | **Syllabus**  **Version** | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. Provide knowledge about carbohydrate, lipid and nucleic acid metabolic disorders 2. Offer knowledge about hemoglobin metabolism and associated diseases 3. Give knowledge about functional tests of organs and clinical diagnosis of diseases by enzymatic assays 4. Give basic knowledge about free radicals and diseases. 5. Provide awareness and concepts about Disease diagnosis with automated analyzers | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | Students will acquire insight into disorders of carbohydrates, lipids and nucleic acid | | | K2 | | | | | |
| 2 | Students will be able to do functional tests and enzymatic assays to diagnose the function of liver, kidney, thyroid, gastrointestinal and pancreas. | | | K4 | | | | | |
| 3 | Students will gain knowledge about disorders of nitrogen metabolism | | | K3 | | | | | |
| 4 | Students will learn about the disorders of hemoglobin metabolism | | | K3 | | | | | |
| 5 | Students will learn about the applications of Automated and semi automated analyzers | | | K3 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
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| **Unit:1** | **Disorders of Carbohydrate and Lipid Metabolism** | | | | **15 Hours** | | | | |
| Clinical investigation of sugar levels in blood and urine; factors influencing blood glucose level, Glycosylated hemoglobin; carbohydrate tolerance tests-procedures and interpretation. Biochemical basis of Diabetes, glycogen storage diseases; carbohydrate metabolic disorders. Disorders associated with lipid metabolism and its therapeutic intervention, ketone bodies and ketosis; Fatty liver, Atherosclerosis. | | | | | | | | | |
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| **Unit:2** | **Disorders of Nitrogen Metabolism** | | | | **15 Hours** | | | | |
| Abnormalities of nitrogen metabolism - uremia, aminoaciduria- phenylketonuria, Alkaptonuria, Albinism. Excretion of nitrogenous waste products-ammonia, urea, uric acid, creatine, creatinine. Disorders of acid base balance. | | | | | | | | | |
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| **Unit:3** | **Disorders of Nucleotide and Heme Metabolism** | | | | | **11 Hours** | | | |
| Gout, Xanthinuria, orotic aciduria. Lesch- Nyhan syndrome. : Heme metabolism associated diseases- porphyrias, porphyrinurias, sickle cell anemia, thalassemia. Hemorrhagic disorders, disseminated intravascular coagulation, acquired prothrombin complex disorders. Biochemical basis of Jaundice. | | | | | | | | | |
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| **Unit:4** | **Biochemical Diagnosis of Diseases** | | | | | **11 Hours** | | | |
| Functional tests of liver, kidney, thyroid, gastrointestinal and pancreas, biochemical diagnosis of diseases by enzymatic assays- ALP, SGOT, SGPT, creatinine, cholinesterase, creatine kinase and LDH. Clinical research guidelines.Disease diagnosis -Types of analyzers - Automated and semi automated analyzers - Semi-auto analyzer - Batch analyzer – Random Access autoanalyzers. Steps in the automated systems - Responsibilities of a technician in the maintenance of the analyzers.) | | | | | | | | | |
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| **Unit:5** | **Free Radical and Diseases** | | | | | **10 Hours** | | | |
| Free radicals - reactive oxygen species and reactive nitrogen species. Formation of free radicals- Oxidative stress and diseases. Metabolism of iron, calcium and phosphorus, Trace elements and their deficiency. | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | | | | |
| 1 | Chatterjee and Shindae (: 2012). Text book of medical biochemistry, Eighth Edition | | | | | | | | |
| 2 | Textbook of Biochemistry with Clinical Correlations, 7th Edition ISBN: 978-0-470-60976-7 June 2010 | | | | | | | | |
|  | | | | | | | | | |
| **Reference Books** | | | | | | | | | |
| 1 | Clinical Biochemistry 5th Edition (2013) Allan Gaw Michael Murphy Rajeev Srivastava Robert Cowan Denis O'Reilly | | | | | | | | |
| 2 | Sembulingam, K and Sembulingam, P 6th Edition (2010). Essentials of Medical Physiology,fifth edition. Jaypae Brothers (p) ltd, New Delhi. | | | | | | | | |
| 3 | Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds): Tietz Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition) Elsevier, St. Louis, USA, 2012, 2238 pp, 909 illustrations. ISBN: 978-1-4160-6164-9 | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | |
| 1 | Big Data Analytics and Its Applications [https://www.researchgate.net/publication/320345031\_Big\_Data\_Analytics\_and\_Its\_Applicati](https://www.researchgate.net/publication/320345031_Big_Data_Analytics_and_Its_Applications) [ons](https://www.researchgate.net/publication/320345031_Big_Data_Analytics_and_Its_Applications) | | | | | | | | |
| 2 | Big Data Analytics in Medicine and Healthcare  <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6340124/> | | | | | | | | |
| 3 | Implications of big data analytics in developing healthcare  <https://www.sciencedirect.com/science/article/pii/S1319157817302938> | | | | | | | | |
| 4 | Critical analysis of Big Data challenges and analytical methods  [www.sciencedirect.com](http://www.sciencedirect.com/) › science › article › | | | | | | | | |
| 5 | Artificial Intelligence in Medicine  <https://www.datarevenue.com/en-blog/artificial-intelligence-in-medicine> https:/[/www.frontiersin.org/articles/10.3389/fmed.2020.00027/full](http://www.frontiersin.org/articles/10.3389/fmed.2020.00027/full) | | | | | | | | |
| Course Designed By: **Dr. R. Kavitha** | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | M | S | L | S | S | S | S |
| **CO3** | S | S | S | L | S | M | S | S | S | S |
| **CO3** | S | S | S | M | S | M | S | S | S | S |
| **CO4** | S | S | S | M | S | M | S | S | S | S |
| **CO5** | S | S | S | M | S | M | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **33B** | **RECOMBINANT DNA TECHNOLOGY** | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core – X** | **4** | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Knowledge on basic concepts of recombinant**  **DNA technology and DNA sequencing** | **Syllabus**  **Version** | | | | **2025 – 26** | | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To study about the DNA modifying enzymes and Vectors used in recombinant DNA technology 2. Understanding the cloning strategies and preparation of probes. In addition, acquiring thorough knowledge about confirmation of rDNA expression by various techniques, including blotting and immunological screening. 3. Upon completion of the course, students might also be thorough about various types of   sequencing techniques as well as on biotechnological applications of rDNA technology. | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | |
| 1 | The course material will provide clear understanding about DNA modifying enzymes and their uses in rDNA technology | | | | K1 &  K2 | | | | |
| 2 | Students will advance their knowledge on host cells and vectors that are highly suitable for rDNA-based expression of desirable genes. | | | | K1 &  K2 | | | | |
| 3 | The course will provide detailed understanding of cloning strategies andvarious methods adapted for confirmation of rDNA expression. | | | | K1 &  K2 | | | | |
| 4 | Students will learn about advances in sequencing techniques and theiradvantages. | | | | K1 &  K2 | | | | |
| 5 | Course material provides detailed understanding of Biotechnological applications of rDNA technology. | | | | K1, K3  & K4 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
|  | | | | | | | | | |
| **Unit:1** | **DNA modifying enzymes** | | | **15 Hours** | | | | | |
| DNA modifying enzymes and their uses in Molecular Biology a) Restriction enzymes b) DNA Polymerase i) Klenow ii) DNA polymerase I iii) T4/T7 DNA Polymerase c) Reverse Transcriptase d) Terminal Transferases e) T4 Polynucleotide kinases & Alkaline phosphatase f) DNA dependent RNA polymerases. g) DNA ligases h) Nucleases: - Bal 31, S1 nucleases, DNase I, Mungbean nucleases, Ribonucleases, EXO III. Thermostable DNA polymerases used in PCR. | | | | | | | | | |
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| **Unit:2** | **Vectors** | | | **15 Hours** | | | | | |
| Host cells and Vectors - Host Cell Types (Prokaryotic and eukaryotic). Plasmid vectors for use in E. coli and Gram-positive bacteria. Bacteriophage - Lambda and M13 vectors c) Cosmids d) Phagemids. Artificial chromosomes (YACs, PACs, BACs, MACs and HACs). Specialized vectors & their uses a) Expression vectors for Prokaryotes & Eukaryotes - Inducible vectors; vectors with tags (Histidine tags, signalling peptides for exportation), b) Gene fusion vectors. | | | | | | | | | |
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| **Unit:3** | **Cloning and Screening strategies** | | | | **11 Hours** | | | | |
| Cloning strategies: DNA cloning a) Sticky ends b) Blunt ends c) Homopolymeric tailing d) Use of adapters & linkers. Methods of gene transfer into plant and animal cells: chemical, biological and mechanical methods. Construction of genomic DNA libraries (shotgun cloning) and cDNA libraries. Screening of recombinants - Antibiotic resistance, lacZ complementation (Blue-white selection), fluorescent markers (e.g. GFP). Preparation of radiolabelled/non-radiolabelled DNA & RNA probes. Southern/Northern/Western blot, dot blot and Zoo blot. Screening of genomic  libraries with oligo-probe. Immunological screening for expressed genes. | | | | | | | | | |
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| **Unit:4** | **Gene sequencing** | | | | **11 Hours** | | | | |
| PCR and RT-PCR– basic process and applications. DNA sequencing- Maxam-Gilbert (chemical degradation) and Sanger (chain termination) methods, Microchip based Sanger Sequencing of DNA. Next generation (second generation) sequencing - high throughput Pyrosequencing,  Lynx Therapeutics' Massively Parallel Signature Sequencing (MPSS), Polony sequencing, Ligation based sequencing (SOLiD sequencing), Ion semiconductor sequencing, DNA nanoball sequencing, sequencing based on reversible dye-terminators (Illumina or Solexa sequencing), RNA sequencing (RNA-Seq) Third-generation sequencing- Single molecule Real-Time DNA sequencing (SMRT), Optical sequencing, Oxford nanopore sequencing. Biological sequence retrieval and data accession | | | | | | | | | |
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| **Unit:5** | **Applications of rDNA technology** | | | | **10 Hours** | | | | |
| Biotechnological applications of rDNA technology: CRISPR-Cas9 gene editing, Synthesis and purification of proteins from cloned genes- Native and fusion proteins. Yeast expression system-production of enzymes. Therapeutic products for use in human health care- insulin, growth hormones, TPA, alpha interferon, Hepatitis B vaccine and Factor VIII. Medical and forensic applications of rDNA technology- DNA Profiling, Multiplex PCR, Diagnosis of inherited disorders and infectious diseases, RFLP. Treatment using rDNA technology- Gene therapy for ADA and cystic fibrosis. Big data analytics for genomic medicine and its application. | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | **2 Hours** | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | |
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|  | **Total Lecture hours** | | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | | |
| 1. | Principles of Gene Manipulation and Genomics – 2013 by Sandy B. Primrose, Richard Twyman; Publisher: Wiley-Blackwell; 7 edition. | | | | | | | | |
| 2. | Molecular Cloning: A Laboratory Manual (3 Volume Set): 4th Edition – 2013 by Michael R Green, Joseph Sambrook; Publisher: Viva Books Private Limited | | | | | | | | |
| 3. | Gene Cloning and DNA Analysis: An Introduction – 2016 by T. A. Brown; Publisher: Wiley-Blackwell; 7th edition | | | | | | | | |
| 4. | Gene cloning and DNA analysis: an introduction (Dr. Hansie peterson) – 2015 by Dr. Hansie Peterson; Publisher: Koros | | | | | | | | |
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| **Reference Books** | | | | | | | | | |
| 1. | Gene Cloning -2006 by Julia Lodge, Peter Lund, Steve Minchin; Publisher: Taylor & Francis; 1 edition | | | | | | | | |
| 2. | An Introduction to Genetic Engineering – 2008 by Desmond S. T. Nicholl; Publisher: Cambridge University Press; 3 edition. | | | | | | | | |
| 3. | Next-Generation Genome Sequencing: Towards Personalized Medicine 1st Edition-2011 by Michal Janitz; Publisher: Wiley-Blackwell. | | | | | | | | |
| 4. | Recombinant DNA: Genes and Genomes – 2007 by James D. Watson, Amy A. Caudy, Richard M. Myers and Jan A. Witkowski; Publisher: WH Freeman; 3rd ed. | | | | | | | | |
| 5. | Gupta SK, Bencurova E, Srivastava M, Pahlavan P. Improving re-annotation of annotated eukaryotic genomes. In: Big data analytics in genomics. Cham: Springer; 2016. p. 171–95. | | | | | | | | |
| 6. | Big Data Analytics: Systems, Algorithms, Applications (2019) Authors: Prabhu, C.S.R., Sreevallabh Chivukula, A., Mogadala, A., Ghosh, R., Livingston, L.M.J. Springer Book Archives – ISBN 978-981-15-0093-0 | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | |
| 1 | <https://onlinecourses.nptel.ac.in/noc19_bt15/preview> | | | | | | | | |
| 2 | <https://www.classcentral.com/course/swayam-genetic-engineering-theory-and-application-14090> | | | | | | | | |
| 3 | <http://biology.kenyon.edu/courses/biol114/Chap08/Chapter_08a.html> | | | | | | | | |
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| Course Designed By: **Dr. S. Selvakumar** | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | L | M | M | S | L | L | S |
| **CO2** | S | S | L | M | L | M | M | L | M | S |
| **CO3** | S | S | M | M | S | M | M | L | S | M |
| **CO4** | S | S | M | L | S | M | M | M | M | M |
| **CO5** | S | M | L | M | S | M | S | M | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **33C** | **DRUG BIOCHEMISTRY** | **L** | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - XI** | **4** | √ | **-** | **4** |
| **Pre-requisite** | | **Basic knowledge in Pharmacodynamics, Pharmacokinetics and toxicology** | **Syllabus**  **Version** | | **2025 - 26** | |
| **Course Objectives:** | | | | | | |
| The main objectives of this course are to:   1. To study about the basic principles about pharmacokinetics, routes of drug administration 2. Understanding the mechanism of drug action, drug receptor interactions, factors affecting the drug receptor interaction 3. This course also provides knowledge about drug discovery process, AI in drug discovery process ethical issues and preclinical toxicological studies. | | | | | | |
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| **Expected Course Outcomes:** | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | |
| 1 | To understand about basic principles involved in pharmacokinetics and routes of drug administration processes. | | K1& K2 | | | |
| 2 | To gain knowledge on metabolism and excretion of drugs | | K1, K2 | | | |
| 3 | To understand mechanism of drug action, drug receptor interactions,  Factors affecting the drug receptor interaction | | K2, K3&  K4 | | | |
| 4 | To obtain knowledge on drug discovery process, ethical issues and able to understand the scope and applications of AI in drug discovery | | K2& K4 | | | |
| 5 | To gain knowledge in preclinical toxicological studies | | K2& K4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | |
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| **Unit:1** | **Basic Principles of Pharmacokinetics** | | **11 Hours** | | | |
| General Principles: Basic principles of drug action-Pharmacokinetics: Absorption, distribution and elimination of drugs, routes of drug administration. Pharmacogenetics. origin of drug from plants and animals. Computer aided drug design : Introduction to docking: Docking software -Protein - ligand . | | | | | | |
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| **Unit:2** | **Drug Metabolism** | | **15 Hours** | | | |
| Drug metabolism – general pathways of drug metabolism (different types of reaction in phase I and phase II with examples), metabolism and excretion of drugs. Mechanism of drug action, combined effect of drugs. Factors modifying drug action, tolerance and dependence. Molecular simulation : Introduction to molecular dynamic simulations – MD simulation software. | | | | | | |
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| **Unit:3** | **Pharmacodynamics** | | **15 Hours** | | | |
| Pharmacodynamics - receptor concepts, theory, drug receptor interaction (DRI), Factors affecting DRI, Drug Synergism and antagonism, Cholinergic and anticholinergic drugs, Adrenergic and adrenergic blockers, General anesthetics, Local anesthetics. Adverse reactions to drugs and common drug receptor interactions. | | | | | | |
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| **Unit:4** | **Application for New Drug Discovery** | | **11 Hours** | | | |
| Application for New Drug Discovery (NDD) according to Indian Control Authority and USFDA guidelines. Ethical considerations in utilizing human subjects for drug discovery process. Helsinki‟s declaration. Regulatory requirements for conducting clinical trials. Overview of drugs and cosmetics act. Regulatory process for export of pharmaceutical products and medicines from India. Docking tools and databases in ADME , Toxicity prediction: ADMETlab 2.0 and SwissADME. | | | | | | |
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| **Unit:5** | **Toxicology** | | **10 Hours** | | | |
| Toxicology: Principles of toxicology and treatment of poisoning. Heavy metals and antagonists. Non metallic environmental toxicants. Methods involved in the development of new drugs.Preclinical toxicological studies: Calculation of LD50 and ED50.Acute, subacute and chronic toxicity studies; Basics of OECD guidelines. Irwin profile test, Pre-clinical pharmacokinetic and dynamic studies. Lipinski‟s rule for drug like molecule. | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | **2 Hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | |
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|  | **Total Lecture hours** | | **64 Hours** | | | |
| **Text Book(s)** | | | | | | |
| 1 | Satoskar, R.S and Bhandarkar, S.D. (2000) Pharmacology and Pharmacotherapeutics,  13th edition, Vol. I and II, Popular Prakeshan PVT Ltd, Mumbai. | | | | | |
| 2 | Tripathi, K.D. (2013) Essentials of Medical Pharmacology, 7th edition, Jaypee brothers medical publishers, New Delhi. | | | | | |
| 3 | Rang, H.P., Dale, M.M., Ritter, J. and Flower, R.J. (2007) Pharmacology, 6th edition,  Churchill Living Stone Elsevier | | | | | |
| 4 | Brenner, G.M. and Stevens, C.W. (2010) Pharmacology, Reed Elsevier India Pvt. Ltd. | | | | | |
| 5 | Sharma, P.D. (2003) Toxicology, 2nd edition, Rastogi Publications, Meerut. | | | | | |
| 6 | Patrick Bultinck , Hans De Winter , Wilfried Langenaeker, Jan P. Tollenare, Computational Medicinal Chemistry for Drug Discovery 1st Edition Marcel Dekker Inc.2004. | | | | | |
| **Reference Books** | | | | | | |
| 1 | Barar, F.S.K. (2013) Text Book of Pharmacology, 1st edition, S.Chand and Company Pvt. Ltd. | | | | | |
| 2 | Shargel,L. et al., 2012. Applied Biopharmaceutics and Pharmacokinetics, 6th Edition, McGraw-Hill Medical | | | | | |
| 3 | Cohen, N.C. “Guide Book on Molecular Modeling on Drug Design”, Academic Press /Elsevier, 2006 | | | | | |
| 4 | Andrew R. Leach Molecular Modeling Principles and Applications (2nd Ed.). Prentice Hall ,2009. | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | |
| 1 | <https://dth.ac.in/medical/courses/pharmacology/1/8/index.php> | | | | | |
| 2 | Mak, K.-K. & Pichika, M. R. (2019) Artificial intelligence in drug development: present status and future prospects. *Drug Discov.*  *Today*. <https://doi.org/10.1016/j.drudis.2018.11.014> | | | | | |
| 3 | <https://www.nature.com/articles/d41586-018-05267-x> | | | | | |
| 4 | <https://nptel.ac.in/courses/127/106/127106137/> | | | | | |
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| Course Designed By: **Dr. R. Kavitha** | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | S | M | S | M | S | S | S |
| **CO3** | S | S | S | M | M | S | S | S | S | S |
| **CO3** | S | M | M | M | S | S | S | S | S | S |
| **CO4** | M | S | S | L | S | S | S | S | S | S |
| **CO5** | S | L | S | M | S | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **33D** | **BIOSTATISTICS AND RESEARCH  METHODOLOGY** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core - XII** | **4** | | | | √ | | **-** | **4** |
| **Pre-requisite** | | **Basic knowledge in Biostatistics and Research** **Methodology** | **Syllabus**  **Version** | | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the statistical tools commonly used in biological research 2. To assimilate the concepts of hypothesis testing and its importance in research 3. To know the aspects fundamental to research and to understand the methods of research 4. To know the nuances of technical writing of scientific documents like thesis and journal articles. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Helps to collect data and organize the data | | | | | | K1 & K2 | | | |
| 2 | Gives a clear understanding about the basic statistical analysis | | | | | | K1 & K2 | | | |
| 3 | A Clear Knowledge on probability and its application | | | | | | K2 & K3 | | | |
| 4 | Provides the sampling distribution techniques and its analysis | | | | | | K2 & K3 | | | |
| 5 | Gives an idea about thesis writing, funding agencies and patenting | | | | | | K3 & K4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit:1** | **Statistical Survey** | | | | **15 Hours** | | | | | |
| Organising a statistical survey - Planning and executing the survey. Source of data - Primary and secondary data, Collection - observation; interview; enquiry forms, questionnaire schedule and checklist. Classification and tabulation of data. Diagrammatic & graphic presentation of data. | | | | | | | | | | |
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| **Unit:2** | **Measures of central tendency and Measures of Variation** | | | | **15 Hours** | | | | | |
| Measures of central tendency; arithmetic mean, median, mode, quartiles, deciles and percentiles. Measures of variation: range, quartile, deviation, mean deviation, standard deviation. Correlation analysis: Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank method. Regression analysis. | | | | | | | | | | |
| **Unit:3** | **Probability** | | | **11 Hours** | | | | | | |
| Probability - definition, concepts, theorems (proof of the theorems not necessary) and calculations of probability. Theoretical, distributions. Binomial - Poisson and normal distribution. Normal - importance, properties, conditions and constants of the distribution (proof not necessary). Simple problems. | | | | | | | | | | |
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| **Unit:4** | **Sampling Distribution and Experimental Design** | | | **11 Hours** | | | | | | |
| Sampling distribution and test of significance: Testing of hypothesis errors in hypothesis testing, standard error and sampling distribution. sampling of variables (large samples and small samples). Student's 't' distribution and its applications. Chi - square test & goodness of fit. Analysis of variance one-way and two-way classification, Duncan's Multiple Range Test. Design of experiment - completely randomized block design. Introduction to SPSS and R programming. | | | | | | | | | | |
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| **Unit:5** | **Research Methodology** | | | | | **10 Hours** | | | | |
| Thesis writing, Publication in a scientific journal, Preparation of Abstract and manuscript. Contents-Preamble, the problem, objectives, hypothesis to be tested, study, design, setup, measurement procedures, analysis of data, organization of report; Displaying data tables, graphs and charts – preparation of project proposal: Thrust area - funding agencies (National and International) – kinds of research program in India and abroad – career development in laboratory research – principle and method of patenting. | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 Hours** | | | | |
| Expert lectures, online seminars - webinars  Case study -Medical Statistics, collection of data - startup companies | | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Statistical Methods, S.P.Gupta 45th Edition; Sultan Chand & Sons, 2017 | | | | | | | | | |
| 2 | Research methodology: Methods and Techniques, [C. R. Kothari.](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor%3A%22C.%2BR.%2BKothari%22) New Age International,2004 | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Biostatistics: A Foundation for Analysis in the Health Sciences, 11th Edition, Wayne W.Daniel, Chad L. Cross, Wiley, 2018. | | | | | | | | | |
| 2 | Biostatistical analysis - Jerrold H.Zar. Pearson Education, 5th Edition Pearson Education,2010. | | | | | | | | | |
| 3 | Arshdeep Bahga, Vijay Madisetti, „Internet of Things: A Hands-on Approach, 2014. ISBN:978-0996025515. | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | Data handling and Analytics– Lecture 55  <http://nptel.ac.in/courses/106/105/106105166> | | | | | | | | | |
| 2 | Introduction to IoTs Part I & Part II - Lectures 1 & 2  <http://nptel.ac.in/courses/108108098/> | | | | | | | | | |
| 3 | Introduction to IoT – Lecture I –  <https://ocw.cs.pub.ro/course/iot/courses/01> | | | | | | | | | |
| 4 | Mathematical Biostatistics Boot Camp 1  <https://www.coursera.org/learn/biostatistics> | | | | | | | | | |
| 5 | Mathematical Biostatistics Boot Camp 1  <https://www.coursera.org/learn/biostatistics-2> | | | | | | | | | |
| 6 | Application of big data  <https://journalofbigdata.springeropen.com/articles/10.1186/s40537-019-0217-0> | | | | | | | | | |
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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | M | S | M | S | L | S | S | M | M | S |
| **CO3** | M | S | S | S | M | M | M | S | M | S |
| **CO3** | M | S | M | S | M | M | S | S | M | S |
| **CO4** | M | S | S | S | M | S | S | S | M | S |
| **CO5** | M | M | S | M | M | S | S | S | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **33P** | **CLINICAL BIOCHEMISTRY AND MOLECULAR BIOLOGY** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Core Practical-III** | **-** | **-** | | **6** | **4** |
| **Pre-requisite** | | **Familiarity in Principles of Clinical and Molecular Biological Techniques** | **Syllabus**  **Version** | | | **2025 - 26** | |
| **Course Objectives:** | | | | | | | |
| The main objectives of this course are to:   1. Familiarize the students with specific characteristics of a laboratory of clinical biochemistry, know the analytical methods commonly used in the clinical laboratory and know how can the clinical laboratory contribute to assess the health status of individuals. 2. Obtain hands on experience in some of the important molecular biology techniques and to   learn the basic principles of recombinant DNA technology | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | It trains the students to gain concepts of assessing the human physiology using  Biological fluid. | | | | K2 | | |
| 2 | Helps the students to understand, evaluate and analysis the abnormal  constitutes in various serum biological profile | | | | K2, K3,  K5 | | |
| 3 | Aids in the technical understanding of the bacterial transformation and  isolation of genetic components | | | | K2, K3,  K5 | | |
| 4 | Understand and familiarize in the modern molecular biological technics and its  applications | | | | K2, K3,  K4, K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | |
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| **Clinical Biochemistry** | | | | | | | |
| 1. | Differential, cell count | | | | | 3 hours | |
| 2. | Blood sugar determination by glucose oxidase method | | | | | 3 hours | |
| 3. | Estimation of bilirubin | | | | | 3 hours | |
| 4. | Estimation of blood urea | | | | | 3 hours | |
| 5. | Estimation of serum enzymes - Creatine phosphokinase (CPK), ALP, AST, SGPT and SGOT | | | | | 3 hours | |
| 6. | Normal and abnormal constituents of urine | | | | | 3 hours | |
| 7. | Determination of Lipid Profile | | | | | 3 hours | |
| 8. | Estimation of glycosylated haemoglobin | | | | | 3 hours | |
| 9. | Estimation of total protein and albumin from serum | | | | | 3 hours | |
| **Molecular Biology** | | | | | | | |
| 1. | Subcellular fractionation of organelle | | | | | 3 hours | |
| 2. | Bacterial Transformation | | | | | 3 hours | |
| 3. | Isolation of DNA from E. coli/ liver/ plant | | | | | 3 hours | |
| 4. | Agarose gel electrophoresis of DNA | | | | | 3 hours | |
| 5. | Restriction digests of DNA. | | | | | 3 hours | |
| 6. | Isolation of plasmid | | | | | 3 hours | |
| 7. | Separation of serum protein by SDS -PAGE | | | | | 3 hours | |
| 8. | Western blotting | | | | | 3 hours | |
| 9. | PCR amplification | | | | | 3 hours | |
|  | | | | | | | |
|  | **Total practical hours** | | | | | **50 Hours** | |
| **Text Book(s)** | | | | | | | |
| 1. | Experiments in Molecular Biology-R. J. Slater, Humana Press, 1986. | | | | | | |
| 2. | Molecular cloning -Sambrook and Russell, Cold Spring Harbor Laboratory Press, 2001 | | | | | | |
| 3. | Practical Biochemistry- David T Plummer, Tata McGraw-Hill, 1988. | | | | | | |
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| **Reference Books** | | | | | | | |
| 1 | Experimental Biochemistry- B. S. Rao and V. Deshpande, I.K. International Pvt.Ltd. | | | | | | |
| 2 | Practical Biochemistry- Keith Wilson and John Walker, Cambridge University Press, 1997. | | | | | | |
| 3 | Experiments in Molecular Biology-R. J. Slater, Humana Press, 1986. | | | | | | |
| Course Designed By: **Dr. S. Selvakumar and Dr. K. M. Saradhadevi** | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | L | S | L | M | M | S | S | M | S |
| **CO2** | S | S | S | L | M | S | M | M | M | S |
| **CO3** | S | M | M | S | L | S | M | L | M | S |
| **CO4** | S | S | S | S | L | S | L | M | M | M |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | **3EC** | **PLANT BIOCHEMISTRY AND ENVIRONMENTAL BIOTECHNOLOGY** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective - III** | **4** | | | | √ | | **-** | **4** |
| **Pre-requisite** | | | Basic concepts in plant biochemistry, plant  biotechnology and environmental biotechnology | **Syllabus**  **Version** | | | | | **2025 - 26** | | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. This course emphasizes to learn about principles involved in photosynthesis process, types and nitrogen fixation. 2. The course aims to give exposure to learn the concepts involved in plant tissue culture, secondary metabolite production, Machine learning for big data analytics in plants and genetic transformation techniques for the generation of transgenic plants. 3. This course provides basic concepts about environmental pollution 4. This course also provides knowledge about Disaster management and role of Big data in Disaster management. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Learn the organization of photosynthesis process and types | | | | K1 & K2 | | | | | |
| 2 | | Understand about nitrogen fixation in plants and enzymology of nitrogen fixation. | | | | K1 & K2 | | | | | |
| 3 | | Understand about plant tissue culture, plant secondary metabolites, elicitation and methods involved in gene transfer of plants and machine learning in analysis of plant | | | | K2, K3 & K4 | | | | | |
| 4 | | Learn about types of environmental pollution | | | | K1 & K2 | | | | | |
| 5 | | Students will learn about Disaster management and role of Big data in disaster management | | | | K2, K3 &  K4 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:1** | | **Photosynthesis and Its Types** | | | **15 Hours** | | | | | | |
| Photosynthesis –organization of thylakoid; role of photosynthetic pigments; light absorption and energy conservation. Light absorption by pigment molecules; the reaction center complex. The photo systems I and II; cyclic and noncyclic photophosphorylation. Carbon reactions in C3, C4 and CAM plants - Calvin cycle; Hatch- Slack pathway. pathways of glucose oxidation in plants;  starch biosynthesis and degradation. Photorespiration: role of photorespiration in plants | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:2** | | **Nitrogen Fixation and Enzymology of Nitrogen Fixation** | | | **15 Hours** | | | | | | |
| Nitrogen fixation – symbiotic and non-symbiotic. Symbiotic nitrogen fixation in legumes by Rhizobia– enzymology of nitrogen fixation; regulation of nif and nod genes of nitrogen fixation. Interaction between nitrate assimilation and carbon metabolism. Sulphur chemistry and functions; reductive sulfate assimilation pathway. Synthesis and function of glutathione and its derivatives. Metabolic transport between organelles. | | | | | | | | | | | |
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| **Unit:3** | **Plant Tissue Culture and Genetic Transformation** | | | | | | **10 Hours** | | | | |
| Plant cell and tissue culture. Tissue culture media-composition and preparation. Micropropagation; somoclonal variation. Callus induction, somatic embryogenesis. Protoplast culture-isolation and purification of protoplast. Alkaloids, Flavanoids, terpenoids, phenol- Nature, distribution and functions. Production of secondary metabolites in plants, elicitation, Machine learning for big data analytics in plants. Gene transfer to plant; *Agrobacterium* mediated transformation-Ti plasmids, Ri plasmids, Direct DNA transfer to plants- Protoplast transformation, Plant viruses as vectors- CAMV, Gemini viruses, RNA viruses (TMV, Potato virus X) as vectors. Advantages and uses of transgenic plants. | | | | | | | | | | | |
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| **Unit:4** | **Concept of Ecology and Ecosystem** | | | | | | **11 Hours** | | | | |
| Concept of Ecology and Ecosystem: Environmental pollution-water, soil, air, noise and thermal. Global environmental problems – Green house effect, reforestration through micropropagation, biodiversity, species conservation. Treatment of Waste water from distillery, dairy and tannery industries –parameters – BOD, COD, TSS, TDS - physical, chemical and biological wastewater treatment - primary, secondary and tertiary treatment - Solid waste management. | | | | | | | | | | | |
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| **Unit:5** | **Disaster Management** | | | | | | **11 Hours** | | | | |
| Climate change and Disaster management: Types of environmental hazards and Disasters; Natural - volcanic eruption, earthquakes, landslides, cyclones, lightning, hailstorms; Man Induced Hazards - Soil erosion, chemical hazards, sedimentation problems, biological hazards. Disaster management - pre- disaster stage (preparedness), emergency stage, post disaster stage (rehabilitation); Integrated approach- role of Institutions and Media. | | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | | **2 Hours** | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | |
|  | **Total Lecture hours** | | | | | | **64 Hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Buchanan, B.B., Gruissem,W. and Jones, R.L., (2002); Biochemistry and Molecular Biology of Plants; ISBN: 978-0-943088-39-6; American Society of Plant Physiologists, 2 nd Indian Reprint (2007), I.K. International Pvt. Ltd. N. Delhi. | | | | | | | | | | |
| 2 | Srivastava, H.S. (2006), Plant Physiology, Biochemistry and Biotechnology,Rastogi  Publications, Meerut. | | | | | | | | | | |
| 3 | Khurana, SM Paul, and Rajarshi Kumar Gaur, eds. Plant biotechnology: Progress in Genomic era. Springer, 2019. | | | | | | | | | | |
| 4 | Razdan, M.K. (2007), Introduction to Plant Tissue culture, II edition, Oxford and IBA Publications Co Pvt Ltd. | | | | | | | | | | |
| 5 | Russell Jones, Helen Ougham, Howard Thomas, Susan Waaland, (2012), The Molecular life of Plants, ISBN 978-0-470-87011-2; Wiley-Blackwell Publishers | | | | | | | | | | |
| 6 | Taiz, L. Zeiger, E., Moller, I.M. and Murphy, A. (2015) Plant Physiology and Development.  6th Edition, Sinauer Associates, Sunderland, CT. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Saikia,R., Bezbarrah,R.L.,Bora,T., (2008) Microbial Biotechnology, New India Publishing agency, New Delhi | | | | | | | | | | |
| 2 | Dubey,R.C. (2010) A textbook of Biotechnology, S.Chand and Company Ltd, New Delhi | | | | | | | | | | |
| 3 | Wang, L.K. (2010), Environmental Biotechnology, 1st edition, A Product of Humana Press. | | | | | | | | | | |
| 4 | Ghosh, G.K.(2007), Disaster Management, 1st edition, Delhi | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | Yu, M., Yang, C., & Li, Y. (2018). Big data in natural disaster management: A  review. *Geosciences*, 8(5), 165. | | | | | | | | | | |
| 2 | Akter, S., & Wamba, S. F. (2017). Big data and disaster management: A systematic review and agenda for future research.*Annals of Operations Research*. <https://doi.org/10.1007/s10479-017-2584-2.> | | | | | | | | | | |
| 3 | Ma C, Zhang HH, Wang X. (2014) Machine learning for big data analytics in plants.TrendsPlant Sci. Dec;19(12):798-808. | | | | | | | | | | |
| Course Designed By: **Dr. K. M. Saradhadevi** | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | M | S | M | L | S | M | M | S | S |
| **CO3** | S | L | S | L | M | S | S | S | M | S |
| **CO3** | M | S | S | M | M | S | M | M | M | S |
| **CO4** | L | M | S | M | M | S | S | S | S | S |
| CO5 | L | L | S | M | M | S | S | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | **3ED** | **BIOLOGY OF CANCER AND STEM CELL** | **L** | | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective - III** | **4** | | | √ | | | **-** | 4 |
| **Pre-requisite** | | **Preliminary knowledge on cell Signaling and Characteristics of Stem Cells** | **Syllabus**  **Version** | | | | **2025 - 26** | | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:   1. To update knowledge on types of cancer, causes of cancer as well as on molecular mechanism of carcinogenesis. 2. To be familiar with various methods used for cancer diagnosis and on therapeutic strategies used to control tumor cell proliferation. 3. To become updated on types of stem cell, its characterization, pluripotency and niche specification. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | The course will introduce the biology of cancer metabolism and its impact on life expectancy | | | K2, K3 &  K4 | | | | | | |
| 2 | Students will become updated on types of cancer, causes of cancer as well as on molecular mechanism of carcinogenesis. | | | K1 & K2 | | | | | | |
| 3 | The course will help in detailed understanding of cancer, its diagnosis & therapy. | | | K2 & K4 | | | | | | |
| 4 | Course material provides understanding on types of stem cell, its  characterization, pluripotency and niche specification. | | | K1, K2 &  K4 | | | | | | |
| 5 | Students will understand the types and differentiations of stem cell and its biological applications | | | K2, K3 &  K5 | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit:1** | **Cancer development and progression** | | | | | | | **15 Hours** | | |
| Metabolic Alterations in Cancer: Aerobic glycolysis,Glutaminolysis, Lipid metabolism,  Serine and glycine metabolism. Angiogenesis: Role of endothelial cells, Regulation, Physiological and pathological significance, Angiogenesis inhibitors. | | | | | | | | | | |
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| **Unit:2** | **Metastasis and Invasion** | | | | | | | **15 Hours** | | |
| Molecular principles of invasion and metastasis, Secondary tumors, Tumor microenvironment (TME), Key components of the TME, Role of TME in invasion and metastasis, Immunosuppression and therapeutic response, TME in immune evasion. | | | | | | | | | | |
| **Unit:3** | **Cancer Diagnosis & Therapy** | | | | | | **10 Hours** | | | |
| Cancer, Diagnosis & Therapy: Tumor Markers; Gene Expression Microarrays; Proteomic Methods; Circulating Epithelial Cells; Circulating Endothelial Cells and Endothelial Progenitor Cells; Molecular Imaging; Application of cancer database in health care and industries. Haplotype Mapping. Cancer therapy: Surgery, Radiotherapy, Chemotherapy, Hormone therapy, Immune, Prodrug and Targeted therapies, Bone marrow transplantation, CAR T-cell therapy. | | | | | | | | | | |
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| **Unit:4** | **Stem Cell Biology** | | | | | | **11 Hours** | | | |
| Introduction to Stem Cell: Definition, Types of Stem cell, characterization, pluripotency, niche specification – Drosophila germ line stem cells, self-renewal and differentiation, tooth primordia, gut specifications. Occurrence of stem cell in mammals: In Mesenchymal cells - Hemangioblasts, skeletal muscle cells, adipose cells, bladder cells; In Epidermal cells – skin, mammary gland, dental and neural cells; In Endodermal cells – liver, GI tract, pancreatic cells | | | | | | | | | | |
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| **Unit:5** | **Stem Cell Types and Applications** | | | | | | **11 Hours** | | | |
| Embryonic Stem Cells: Blastocyst and inner cell mass cells, Organogenesis, Adult versus embryonic stem cells, post genomic adult stem cells, stemness, characteristics, hierarchy, stem cell niche; Adult stem cell from amniotic fluid and cord blood; induced pluripotency stem cells (ips cells).- Stem cell characterization techniques and cryopreservation, Shelf life of stored stem cells. | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | **2 Hours** | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
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|  | **Total Lecture hours** | | | | **64 Hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Principles of Cancer Biology – 2016 by Kleinsmith; Publisher: Pearson Education India; First edition | | | | | | | | | |
| 2 | Molecular biology of cancer, 3rd edition – 2014 by Pecorino; Publisher: Oxford University Press | | | | | | | | | |
| 3 | The Biology of Cancer – 2013 by Robert Weinberg; Publisher: W. W. Norton & Company; 2nd edition | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | The Molecular Basis of Human Cancer – 2018 by William B. Coleman (Editor), Gregory J. Tsongalis; ublisher: Humana Press Inc.; Softcover reprint of the original 2nd ed. 2017 edition. | | | | | | | | | |
| 2 | Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics– 2012 by Pecorino;Oxford University Press; 3rd edition. | | | | | | | | | |
| 3 | Stem Cells: Current Challenges and New Directions (Stem Cell Biology and Regenerative Medicine) – 2013 by Kursad Turksen; Publisher: Humana Press; 2013 edition. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | <https://swayam.gov.in/nd2_aic20_ge02/preview> | | | | | | | | | |
| 2 | <https://nptel.ac.in/content/storage2/courses/104103068/module1/lec1/2.html> | | | | | | | | | |
| 3 | <https://www.coursera.org/learn/cancer> | | | | | | | | | |
| 4 | <https://www.classcentral.com/course/stem-cells-10745> | | | | | | | | | |
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| Course Designed By: **Dr. S. Selvakumar and Dr. K. M. Saradhadevi** | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | M | S | M | S | M | S | M |
| **CO3** | S | S | L | M | S | S | S | S | M | S |
| **CO3** | M | S | S | S | L | S | M | S | M | S |
| **CO4** | S | M | M | M | S | M | S | M | S | L |
| **CO5** | M | S | S | M | M | L | M | M | S | M |

\*S-Strong; M-Medium; L-Low

     Supportive

     Course

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| **Course code** | **GS108** | **TOOLS AND TECHNIQUES IN**  **BIOSCIENCE** | **L** | | | | | | | | | | | | **T** | | | | | **P** | | | **C** |
| **Core/Elective/Supportive** | | **Supportive - I** | **2** | | | | | | | | | | | | √ | | | | | **-** | | | **2** |
| **Pre-requisite** | | **Prior knowledge on modern methods and technologies used in biochemical analysis** | **Syllabus**  **Version** | | | | | | | | | | | | | | | | | **2025 - 26** | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. Methods and tools in biosciences represent a new standard of comprehensive paper for all students in various fields of biology and medicine. 2. The series emphasizes important developments in methodology and research tools and their potential for application to human and other biologic systems | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | To obtain the knowledge on the cell fractionation techniques to separate cellular components and to demonstrate the cellular location of various biochemical processes. Understood about radionuclide as an unstable atom and are used in biology and nuclear medicine | | | | | | | | | | | | | K2& K3 | | | | | | | | | |
| 2 | Understood about the centrifugation technique to separate particles from a solution according to their size, shape, density, viscosity of the medium and rotor speed. | | | | | | | | | | | | | K2,K3& K4 | | | | | | | | | |
| 3 | To learn the chromatographic techniques for the separation of the individual compound from the mixture of compound and measuring the relative proportions of analytes in a mixture. | | | | | | | | | | | | | K3& K4 | | | | | | | | | |
| 4 | To obtain knowledge about the separation and analysis of  macromolecules and their fragments, based on their size and charge | | | | | | | | | | | | | K2& K4 | | | | | | | | | |
| 5 | To study the interaction between matter and electromagnetic radiation and visible light dispersed according to its wavelength, by a prism | | | | | | | | | | | | | K2 | | | | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | **Fractionation Techniques** | | | | | | | | | **7 Hours** | | | | | | | | | | | | | |
| Cell fractionation techniques: Cell lysis, homogenization, extraction, salting in, salting out, dialysis and ultra-filtration. Radioisotopes in Biology: Concept of half-life, decay constant, detection and quantitation - GM counter and solid and liquid scintillation counter. Specific activity, autoradiography and Applications of radioactivity. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | **Centrifugation and Microscopy** | | | | | | | | | **7 Hours** | | | | | | | | | | | | | |
| Centrifugation: Svedberg's constant, sedimentation velocity and sedimentation equilibrium. Differential and density gradient centrifugation, centrifugal elutriation, construction of preparative and analytical ultra-centrifuge. Microscopy: Principles and application of light phase contrast, fluorescence, scanning and transmission electron microscopy. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | **Chromatographic Techniques** | | | | | **6 Hours** | | | | | | | | | | | | | | | | | |
| Chromatographic techniques: Principles and applications of paper, TLC, HPTLC, adsorption, ion exchange, gel filtration, affinity, GC - MS, chromate focusing and HPLC. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | **Electrophoretic Techniques** | | | | | | | | **5 Hours** | | | | | | | | | | | | | | |
| Electrophoretic techniques: Polyacrylamide gel electrophoresis, SDS PAGE, 2D electrophoresis, Native PAGE, agarose gel electrophoresis, isoelectric focusing, and pulse field electrophoresis | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | **Spectroscopic Techniques** | | | | | | | | **5 Hours** | | | | | | | | | | | | | | |
| Spectroscopic techniques: Principles of colorimeter, spectrophotometer, fluorimeter. Beer Lambert's Law and its limitations. Extinction coefficient, Atomic absorption spectroscopy, UV- Visible, Spectro fluorimetry, Flame Photometry. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | | | | **2 Hours** | | | | | | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | | | | **32 Hours** | | | | | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Wilson, K. and Walker, J. (2012) Practical Biochemistry – Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, India | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Upadhyay,A.Upadhyay,K. and Nath,N. 2009. Biophysical Chemistry: Principles andTechniques, Third Edition, Himalaya Publishing. 11thEdition | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Sharma, B. K. 2004. Instrumental Methods of Chemical analysis, 23rd Edition Goel  Publications. | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Basha M. Analytical Techniques in Biochemistry. Humana Press; 2020. | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | <http://epgp.inflibnet.ac.in/> | | | | | | | | | | | | | | | | | | | | | | |
| 2 | <http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=944> | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: **Dr. K. M. Saradhadevi** | | | | | | | | | | | | | | | | | | | | | | | |
| **Course code** | **GS102** | **MEDICAL LAB TECHNOLOGY** | **L** | | | | **T** | | | | | | | | | | | **P** | | | **C** | | |
| **Core/Elective/Supportive** | | **Supportive - II** | **2** | | | | √ | | | | | | | | | | | **-** | | | **2** | | |
| **Pre-requisite** | | **Basic laboratory principles, laboratory functions and solution preparations** | **Syllabus**  **Version** | | | | | | | | | | | | | **2025 - 26** | | | | | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. The main objective of this course is to introduce basic concepts in Medical laboratories. 2. This course emphasizes to understand about the functioning of medical laboratories and laboratory personnel with good clinical practices 3. Automation in clinical biochemistry provides the learner to know about the instrumental concept and quality control. solution preparation provides exposure to prepare normality, molarity and percent solutions. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Learn basic laboratory concepts and principles, Know about the role of medical laboratory personnel, safety measures in laboratory, know about clinical born infections and personnel hygiene | | | | | | | | | | | | K1 & K2 | | | | | | | | | | |
| 2 | Acquire knowledge on sterilization methods and staining techniques. | | | | | | | | | | | | K1 &  K2 | | | | | | | | | | |
| 3 | Know about Quality control, Quality assurance and Instrumentation. | | | | | | | | | | | | K2 &  K3 | | | | | | | | | | |
| 4 | Get wide knowledge on Clinical samples, common laboratory infections and Anticoagulants | | | | | | | | | | | | K1 &  K2 | | | | | | | | | | |
| 5 | Calculate Normality, Molar and percent solutions. know about pH and methods to measure liquids | | | | | | | | | | | | K4,  K5 | | | | | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | **Basic Laboratory Principles** | | | | **7 Hours** | | | | | | | | | | | | | | | | | | |
| Basic laboratory principles - Code of conduct of medical laboratory personnel - Organization of clinical laboratory - Role of medical laboratory technician - Safety measures - Good clinical practices. Hospital and clinic borne infections and personnel hygiene. Overview of laboratory accreditation. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | **Sterilization Methods and Staining Techniques** | | | | **6 Hours** | | | | | | | | | | | | | | | | | | |
| Common glass wares in clinical laboratory - care and maintenance - Calibration of pipettes and volumetric apparatus - Cleaning and sterilization methods - antiseptics and disinfectants - staining techniques – vital stains | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | **Automation in Clinical Biochemistry** | | **6 Hours** | | | | | | | | | | | | | | | | | | | | |
| Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument, Quality assurance, Control of pre-analytical and analytical variables, External and internal quality control measurements. Clinical laboratory records- Modern laboratory set up - Quality control: Accuracy, Precision, and Reference values. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | **Clinical Samples and Specimens** | | | | | | | | | | **6 Hours** | | | | | | | | | | | | |
| Clinical samples and specimens - Specimen collection, transport, storage and disposal –common laboratory infections - Anticoagulants: EDTA, Di-potassium salts of EDTA, double oxalate, single oxalate, sodium citrate and sodium fluoride. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | **Buffers and Solutions Preparation** | | | | | | | | | | **5 Hours** | | | | | | | | | | | | |
| Acid - Base balance – Electrolytes - Buffer and pH- Preparation of solution: Normal, per cent, Mole and Molar solution - normal saline -Methods of measuring liquids. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | | | | | | **2 Hours** | | | | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | | | | | | | | |
|  | **Total Lecture hours** | | | | | | | | | | **32 Hours** | | | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Mukerjee, K. L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I, McGraw Hill, New Delhi | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Sood.R., 2006. Textbook of Medical Laboratory Technology, Jaypee, New Delhi. | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York. | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Sonnenwirth, A.C. and L. Jarret, 2000 Gradwohls‟ Clinical laboratory methods and  diagnosis. M.D.B.I., New Delhi. | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice,  McGraw Hill, New Delhi. | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | <https://nptel.ac.in/courses/102/103/102103015/> | | | | | | | | | | | | | | | | | | | | | | |
| 2 | <https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod1.pdf> | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: **Dr. K. M. Saradhadevi** | | | | | | | | | | | | | | | | | | | | | | | |
| **Course code** | **GS109** | **CLINICAL DIAGNOSIS IN HEALTH AND** **DISEASES** | **L** | | | | | **T** | | | | | | | | | | | **P** | | | **C** | |
| **Core/Elective/Supportive** | | **Supportive - III** | **2** | | | | | √ | | | | | | | | | | |  | | | **2** | |
| **Pre-requisite** | | **Knowledge about diseases and diagnosis** | **SyllabusVersion** | | | | | | | | | | | | | | **2025 - 26** | | | | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To introduce basic concepts in Clinical diagnosis in health and diseases. 2. This course emphasizes to understand about analysis of body fluids, detection of body metabolites, organ functions and communicable and Non-Communicable diseases | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Learn about general health and common diseases, To learn how to analyse the samples (Blood, urine, pleural fluid, synovial fluid, cerebro spinal fluid and tissues and histology) | | | K1, K2 & K4 | | | | | | | | | | | | | | | | | | | |
| 2 | Acquire knowledge on detection of body metabolites and its importance,liver function and kidney function | | | K2 & K4 | | | | | | | | | | | | | | | | | | | |
| 3 | Know about heart function, lung function test | | | K2, K3 &  K4 | | | | | | | | | | | | | | | | | | | |
| 4 | Get wide knowledge on Bacterial viral and fungal infections | | | K1 & K2 | | | | | | | | | | | | | | | | | | | |
| 5 | Know about Non-communicable diseases and cancer markers | | | K1, K2 | | | | | | | | | | | | | | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | **Introduction to Diagnosis** | | **7 Hours** | | | | | | | | | | | | | | | | | | | | |
| General health, syndrome and common diseases – communicable and noncommunicable diseases. Samples for analysis: Blood, urine, pleural fluid, synovial fluid, cerebro spinal fluid and tissues and histology. General check up: Blood group, Hb, height and weight, waist to hip ratio, electro cardio gram, X-ray, abdomen scan and appearance of scars, urine analysis – routine analysis (protein, sugar, pigments and cells). | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | **Detection of Metabolites and Its Importance** | | **6 Hours** | | | | | | | | | | | | | | | | | | | | |
| Tests for liver function: Enzyme assay (SGOT, SGPT, Alkaline phosphatase, GGT), Total protein, albumin /globulin ratio and their significance. Test for kidney function: Urea and creatinine estimation and their significance. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | **Diagnosis for Organ Function** | | **6 Hours** | | | | | | | | | | | | | | | | | | | | |
| Test for heart function: Blood pressure (cystolic and diastolic), lipid profile (cholesterol, triglycerides, HDL, LDL estimation) and their importance. Test for lung function: Chest X-ray, Spirometry. Test for Brain function: EEG, MRI, CT. Test for Surgery: Bleeding time, clotting time. Special test: X-ray, CT, MRI, Doppler, TMT, angioplasty. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | **Diagnosis of Infections** | | | | | | | | | | | **5 Hours** | | | | | | | | | | | |
| Infection: Bacterial, viral, fungal and protozoans. Blood: Total cell count, differential count, erythrocyte sedimentation rate. Infectious diseases: Tuberculosis, Leprosy, Malaria, Hepatitis, Cholera, Dengue, HIV, Chikun gunya and H1N1. TORCH – Panel (infertility profile), Infection in pregnancy, Koch postulations – Microscopic examination of body fluids, ELISA and PCR tests. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | **Non-communicable Diseases** | | | | | | | | | | | **6 Hours** | | | | | | | | | | | |
| Diabetes: Blood sugar, urine sugar, glucose tolerance test, HbA1c. Hyper tension: Lipid profile, electrolyte (sodium, potassium, chloride and biocarbonate) investigation. Cancer markers: ELISA and DNA Probes. | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | | | | | | | **2 Hours** | | | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | | | | | | | | |
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|  | **Total Lecture hours** | | | | | | | | | | | **32 Hours** | | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Burtis,C. and Bruns,D. 2007.Teitz Fundamentals of Clinical Chemistry, 3rd Edition, W.B. Saunders Company. | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Devlin,T.M. 1998. Text book of Biochemistry with Clinical Correlation,4th Edition, John Wiley and Sons. | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Mayne,P.D. 1994. Clinical Chemistry in Diagnosis and Treatment, 6th Edition, Hodder Arnold Publication | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Marshall,W.J. and Bangeit, S.K. 1995. Clinical Biochemistry - Metabolic concepts and Clinical aspects, Churchill Livingstone. | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Guyton, A.C. and Hall,J.E. 2010. Text Book of Medical Physiology, 12 Edition, Saunders. | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | <https://www.verywellhealth.com/liver-enzyme-and-function-3157004> | | | | | | | | | | | | | | | | | | | | | | |
| 2 | <https://nptel.ac.in/content/storage2/courses/109104029/pdf_lecture/Lecture10.pdf> | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: **Dr. S. Selvakumar** | | | | | | | | | | | | | | | | | | | | | | | |

**CERTIFICATE COURSE IN BIOINFORMATICS**

**Unit-1:**

Principles of computing: Operating systems, Basic word processing and database management soft wares. Programming in PERL-introduction, variables and data types, Basic operators and control structures, scalars, arrays, lists, hashes, file manipulation, regular expression, patterns, input and output, HTML: basic codes for a web-page. Basic knowledge of computer systems software and programming languages. Application and advantages of Unix/Linux in bioinformatics.

**Unit-II:**

Databases: Biological databases (Eg. Genbank, SWISSPROT, PDB, etc) searching and retrieving data form databases- FASTA-BLAST: parameters and its types. Sequence analysis with acquired data.

**Unit-III:**

Sequence comparison with pair wise and multiple sequence alignment. Deducing phylogenetic relationships from multiple sequence alignment. Phylogenetic analysis.

**Unit-IV:**

Bioinformatics in structure analysis: Format of a protein structure data - Primary, secondary (alpha helix and Beta sheet), Tertiary, quaternary structure of protein molecules molecular visualization tools: rasmol, SWISS PDB viewer. Predicting protein structure: comparative modelling. Profiles and motifs. Phi, psi angles. Ramachandran plot. Methods for prediction of tertiary structure of proteins-knowledge based structure prediction, fold recognition Suggested.

**Unit-V:**

Drug discovery, 3D Structure prediction, Cheminformatics, Molecular docking, virtual screening, ADME Properties, Molecular dynamic simulation.

**REFERENCE BOOKS:**

1. “**Bioinformatics - A Beginner's Guide**” by Jean Michel Claverie and Cedric Notredame, Wiley- Dream Tech India Pvt. Ltd, First Edition, 2007.
2. “**Developing Bioinformatics Computer Skills**” by Cynthia Gibas and Per Jambeck, O" Reilly publications, First Edition, 2001.
3. “**Introduction to Bioinformatics**” by T.K. Attwood and D.J. Parry-smith, Pearson Education Asia, First Edition, 1999.
4. “**Bioinformatics**” by David. W. Mount, CBS publishers and distributers, Fourth Edition, 1999.
5. “**Instant Notes in Bioinformatics**” by D.R. Westhead, J. H. Parish and R. M. Twyman, Taylor & Francis Group publishers, Second Edition, 2009.

Value Added Course

**Value added course: I**

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| **ANIMAL CELL CULTURE TECHNIQUES** | |
| **Name of the Department** | **BIOCHEMISTRY** |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e- mail** | Dr. S. Selvakumar,  Assistant Professor, Department of Biochemistry, Bharathiar University  E-mail: selvakumar@buc.edu.in  Phone:8220119898 |
| **Inter / Intra Department Course** | Intra Department Course |
| **Duration of the Course** | 45 Hours |
| **Eligibility** | B.Sc., Biochemistry |
| **Number of Candidates to be Admitted** | 25 |
| **Registration Procedure** | Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage. |
| **Job Opportunities:** | |
| Build their career as Cell Culture analyst, Downstream Process development officer in various companies like Pharmaceutical Industries, Research laboratories, Stem cell laboratories,Vaccine production industries, etc., | |
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| **The objectives of the Course are:** | |
| The main objectives of this course are to: | |
|  | Learn aseptic techniques involved in handling of animal cell cultures |
|  | Focus on practical aspects of cell culture, like design and layout of the laboratory. |
|  | Provide proper procedure to make and sterilize media. |
|  | Focus on principles of cryopreservation and Nutritional requirements of cultured cells. |
| **Course Content** | **Lecture / Practical** / Project / Internship |
| Lecture / Practical | |

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| **Module 1** | **Theory:** Safety Procedures - Design of the Cell Culture  Laboratory - Maintenance of sterility - Do's & Don'ts in Tissue Culture Lab. | **3 Hours** |
| **Module 2** | **Theory:** Essential facility equipment - biological safety cabinets, inverted microscopes, table top centrifuges, pH meters, cell culture incubators, refrigerator, and vacuum pumps  – its importance and uses | **4 Hours** |
| **Module 3** | **Theory:** Types of medium,Preparation of medium and required solutions: Chemical constituents - its importance – uses. Primary Cell Culture Establishment. | **4 Hours** |
| **Module 4** | **Theory:** Cell line revival (recovery) - Maintaining Cells…Contamination and Storage- Sub-culturing (passaging) - | **4 Hours** |
|  | Counting & viability test for cells. Freezing of cells (cryopreservation) and Reviving cryopreservation cells |  |
| **Module 5** | **Practical:**  **1.** Preparation of medium and required solutions. | **6 Hours** |
| **Module 6** | **2.** Primary Cell Culture Establishment. | **6 Hours** |
| **Module 7** | **3.** Cell line revival (recovery) - Maintaining Cells. | **6 Hours** |
| **Module 8** | **4.** Sub-culturing (passaging) - Counting & viability test for  cells. | **6 Hours** |
| **Module 9** | **5.** Freezing of cells (cryopreservation). | **3 Hours** |
| **Module 10** | **6.** Reviving cryopreservation cells. | **3 Hours** |

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| **Book(s) for reference** | |
|  | Animal Cell Culture Techniques. Ed. Martin Clynes, springer, 1998. |
|  | **Cells:** a Laboratory Manual, Spector, D. L., Goldman, R.D., and Leinwand, L.A., Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 1998. |
|  | |
| **Related Online Contents** | |
|  | Verma, A. (2014). Animal tissue culture: Principles and applications. In *Animal*  *Biotechnology* (pp. 211-231). Academic Press. [https://doi.org/10.1016/B978-0-12-416002-](https://doi.org/10.1016/B978-0-12-416002-6.00012-2) [6.00012-2](https://doi.org/10.1016/B978-0-12-416002-6.00012-2) |
|  | **NPTEL :** [NOC:Cell Culture Technologies,](https://nptel.ac.in/courses/102/104/102104059/) by Prof. Mainak Das, IIT Kanpur.  <https://nptel.ac.in/courses/102/104/102104059> |
|  | **ATCC® ANIMAL CELL CULTURE GUIDE** tips and techniques for continuous celllines. <https://www.atcc.org/~/media/PDFs/Culture%20Guides/AnimCellCulture_Guide.ashx> |

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| **Book(s) for Study** | |
|  | Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, [R. IanFreshne**,**](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor%3A%22R.%2BIan%2BFreshney%22)John Wiley & Sons, 2016, Seventh edition. |
|  | Animal Cell Culture - Practical Approach, Ed. John R.W. Masters, OXFORD, Third edition, 2000. |
|  | Animal Cells: Culture and Media, D. C. Darling and S. J. Morgan, BIOS Scientific  Publishers Limited, 1994. |
|  | Methods in Cell Biology, Jennie P. Mathur and David Barnes, Animal Cell Culture Methods Academic Press, Volume 57, 1998. |
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**Value Added Course: II**

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| **PHARMACOVIGILANCE** | |
| **Name of the Department** | **BIOCHEMISTRY** |
| **Name of the Faculty Member i/c With Complete Address with Phone and e-mail** | Dr. R. Kavitha Assistant Professor  Department of Biochemistry  Bharathiar University  Email: [kavitha@buc.edu.in](mailto:kavitha@buc.edu.in) Phone: 9944353524 |
| **Inter / Intra Department Course** | Intra Department Course |
| **Duration of the Course** | 45 Hours |
| **Eligibility** | B. Sc Biochemistry |
| Number of Candidates to be Admitted | 25 |
| **Registration Procedure** | Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage. |
| **Job Opportunities:** | |
| Build a rewarding career in pharmacovigilance, progressing through roles in drug safety assessment, regulatory affairs, and clinical research within pharmaceutical companies, regulatory agencies, research organizations, and other related fields. | |
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| **The objectives of the Course are:** | |
| The main objectives of this course are to: | |
| 1 | Provide basic knowledge about pharmacovigilance |
| 2 | Develop skills in assessing and understanding the Adverse Drug reactions |
| 3 | Enhancing the problem-solving abilities |
| 4 | Give exposure to Drug safety |
| **Course Content** | Lecture / Practical / |
| Lecture / Practical | |

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| **Module 1** | **Theory:**  **Introduction to pharmacovigilance:** History and development of Pharmacovigilance. Importance of safety monitoring of medicine. WHO international drug monitoring programme. Pharmacovigilance program of India (PvPI): Services of Indian pharmacopoeia commission (IPC), Adverse drug reaction (ADR) reporting in India, Pharmacovigilance system Master File & Capacity Building, and recent developments and future perspectives. | **6 Hours** |
| **Module 2** | **Introduction to adverse drug reactions:** Definitions and   classification of ADRs. Detection and reporting,Development Safety Update Report (DSUR), Periodic Adverse Drug Experience Report (PADER), Periodic Benefit Risk Evaluation Report (PBRER),and Periodic Safety Update Report (PSUR).  **Pharmacogenomics of adverse drug reactions:** Genetics related ADR Drug safety evaluation in special population. | **3 Hours** |
| **Module 3** | **Pharmacovigilance of Herbal Drugs:** Needs of pharmacovigilance in herbals,Herbals concept of adverse effect,Pharmacovigilance of herbal medicines: current state and future directions and Challenges in Herbal Drugs Pharmacovigilance | **3 Hours** |
| **Module 4** | **Vaccine safety surveillance:** Vaccine pharmacovigilance. Vaccine failure. Communication in pharmacovigilance: Effective communication in pharmacovigilance. Communication in drug safety crisis management. Communication with regulatory agencies, business partners, healthcare facilities and media. | **3 Hours** |
| **Module 5** | **Safety data generation:** Preclinical phase. Clinical phase. Post-approval phase (PMS). ICH guidelines for pharmacovigilance: organization and objectives of ICH. Good clinical practice in pharmacovigilance studies. | **6 Hours** |
| **Module 6** | **Pharmacovigilance Regulatory effects:** CDSCO (India) and pharmacovigilance: D&C Act and Schedule Y. Differences in Indian and global pharmacovigilance requirements. | **3 Hours** |
| **Module 7** | **Benefits assessment of medicines in pharmacovigilance:** Targeted Clinical Investigations and Descriptive studies. | **3 Hours** |
| **Module 8** | **Practical:**   1. Case study analysis of Adverse Drug reaction reports 2. Form for Adverse event reporting 3. Vaccine Adverse event reporting | **6 Hours** |
| **Module 9** | 1. Adverse Drug Reaction (ADR) Reporting practice 2. Causality Assessment of ADRs | **6 Hours** |
| **Module 10** | 1. Review of Clinical Trial Safety Data 2. Applying ICH Guidelines in Pharmacovigilance | **6 Hours** |
|  |  | **45 Hours** |

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| **Book(s) for Study** | |
| 1 | Pharmacovigilance: Principles and Practice (2017) by Patrick Waller & Mira Harrison-Woolrych. |
| 2 | Detecting Adverse Drug Reactions: Pharmacovigilance in Actionby Andrew Bate. |
| 3 | FDA Pharmacovigilance: Postmarketing Drug Safety & Risk Managementby Mark P. Mathieu. |
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| **Book(s) for reference** | |
| 1 | Meyler's Side Effects of Drugs 2016, (16th Edition) – Elsevier Edited by Jeffrey K. Aronson. |
| 2 | Davies’s Textbook of Adverse Drug Reactions - 1998, (5th Edition) By D.M. Davies, R.E. Ferner, H. de Glanville. |
| 3 | Herbal-Drug Interactions and Adverse Effects: An Evidence-Based Quick Reference Guide *by Richard B. Philp*. |
| **Related Online Contents** | |
| 1 | https://gpatindia.com/pharmacovigilance-methods-classification-of-pharmacovigilance-methods/ |
| 2 | WHO Policy Perspectives on Medicines. Geneva: WHO; 2004. Geneva: World Health Organization.Looking at the Pharmacovigilance: ensuring the safe use of medicines. |
| 3 | Klepper MJ. The periodic safety updates report as a Pharmacovigilance tool. Drug Saf, 2004; 27: 569-78. |
| 4 | WHO, Safety of medicines in public health programmes:  Pharmacovigilance an essential tool, WHO, 2006. |
| 5 | Livio F, Renard D, Buclin T. Pharmacovigilance. Rev Med Suisse, 2012; 8: 116-9. |
| 6 | Skalli S, Soulaymani Bencheikh R. Safety monitoring of herb-drug interactions: acomponent ofpharmacovigilance. Drug Saf, 2012; 35: 785-91. |

Job Oriented Certificate Course

**Job-oriented Certificate courses**

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| **MEDICAL LABORATORY TECHNICIAN** | |
| **Name of the Department** | **Biochemistry** |
| **Name of the Faculty Member i/c With Complete Address with Phone and e-mail** | **Dr. S. Suja, Professor and Head,**  **Department of Biochemistry, Bharathiar University,**  **Coimbatore- 641 046.** |
| **Inter / Intra Department Course** | **Intra Department Course** |
| **Duration of the Course** | **45 hours** |
| **Eligibility** | **B.Sc** |
| **Number of Candidates to be Admitted** | **25** |
| **Mode of the Course** | **Regular** |
| **Collaboration if any with Companies** (if Yes, Full Address of the Company Address , Name of the Contact Person,  Phone, e-mail etc.) | **NG Hospital and Research Centre**  **577, Trichy Road, Near Singanallur signal, Singanallur, Coimbatore-641005** |
| **Registration Procedure** | Application will be issued by the department office. Filled in applications will be evaluated based on their Undergraduate percentage. |
| **Job Opportunities:** | |
| Students who complete medical laboratory technology program can pursue employment in settings such as hospitals, clinics, commercial laboratories, public health facilities, or diagnostic laboratories. | |
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| **The objectives of the Course are:** | |
| The main objectives of this course are to: | |
| 1 | Perform complex tests for diagnosis, treatment, and prevention of disease |
| 2 | Know what is implied by the presence of abnormal constituents in body fluid |
| 3 | Provide technical information about test results |
| 4 | Prepare and document medical tests and clinical results |
| 5 | Have sound knowledge of the functioning of lab equipment‟s and protocols for their cleaning and  Calibration |
| **Course Content** | Lecture / Practical / Project / Internship |

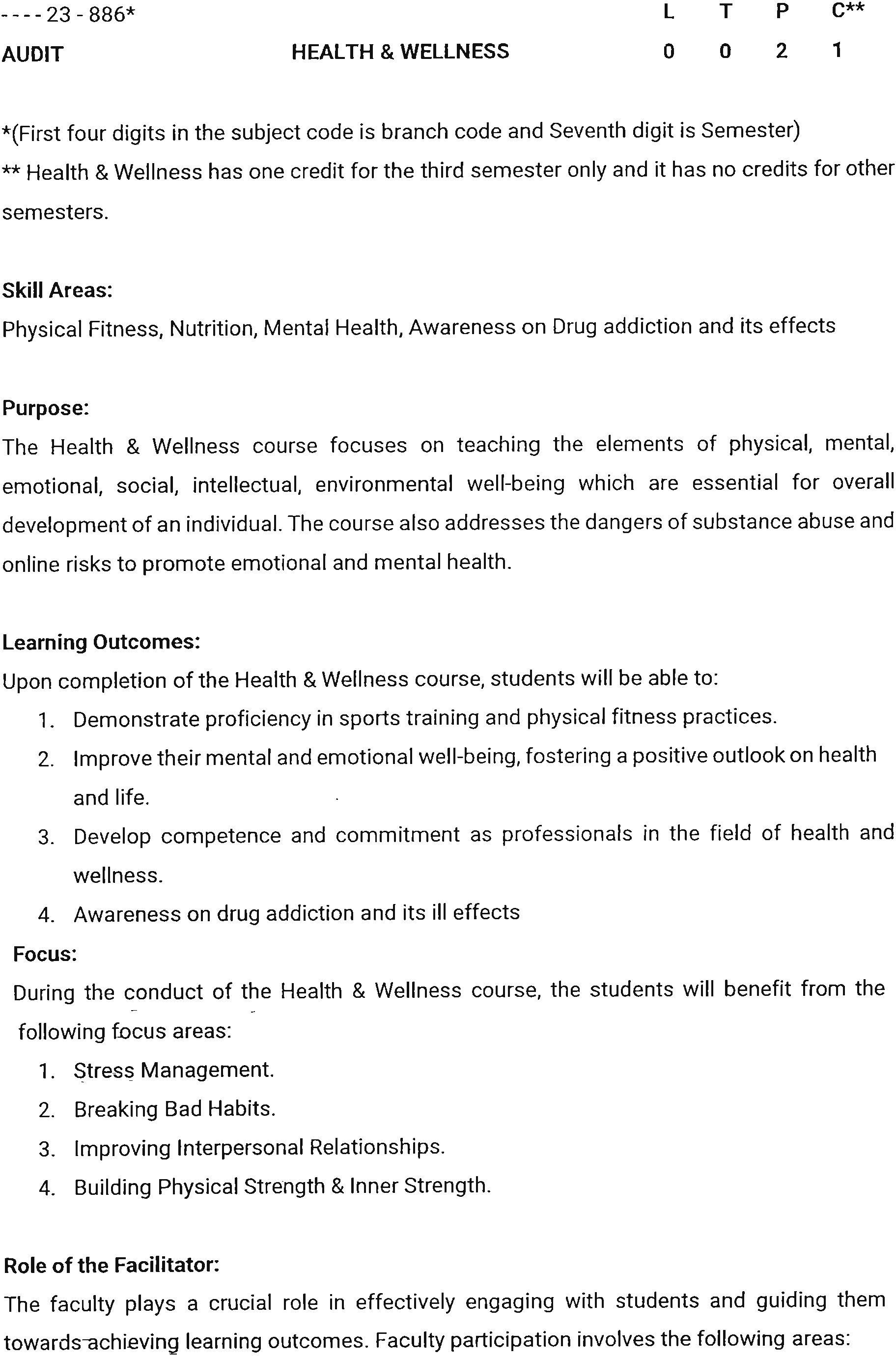
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| **Module 1** | Healthcare Systems, Laboratory and Delivery; Role of the MedicalLaboratory Technician, Introduction to Laboratory related Medical Terminology | **4 Hours** |
| **Module 2** | Introduction to Biochemistry, Haematology and Clinical Pathology | **4 Hours** |
| **Module 3** | Introduction Clinical Biochemistry | **4 Hours** |
| **Module 4** | Analytical Laboratory Testing Process and Personnel Hygiene; Safety & First Aid, Bio Medical Waste Management | **4 Hours** |
| **Module 5** | Biochemistry Practical – 1 | **4 Hours** |
| **Module 6** | Biochemistry Practical – 2 | **5 Hours** |
| **Module 7** | Haematology Practical | **5 Hours** |
| **Module 8** | Clinical Pathology Practical | **5 Hours** |
| **Module 9** | Clinical Biochemistry Practical - 1 | **5 Hours** |
| **Module 10** | Clinical Biochemistry Practical - 2 | **5 Hours** |
|  |  | **45 hours** |

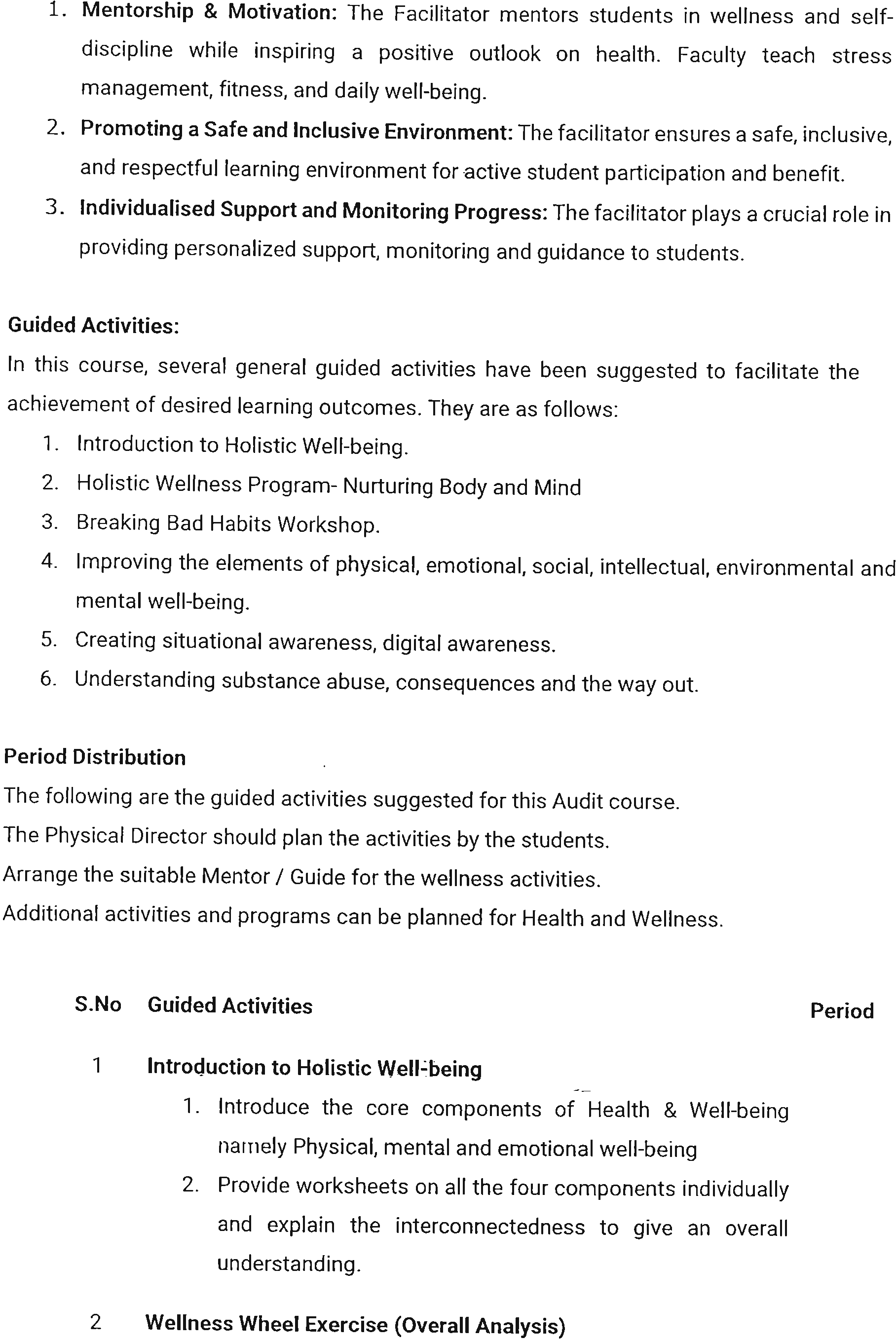
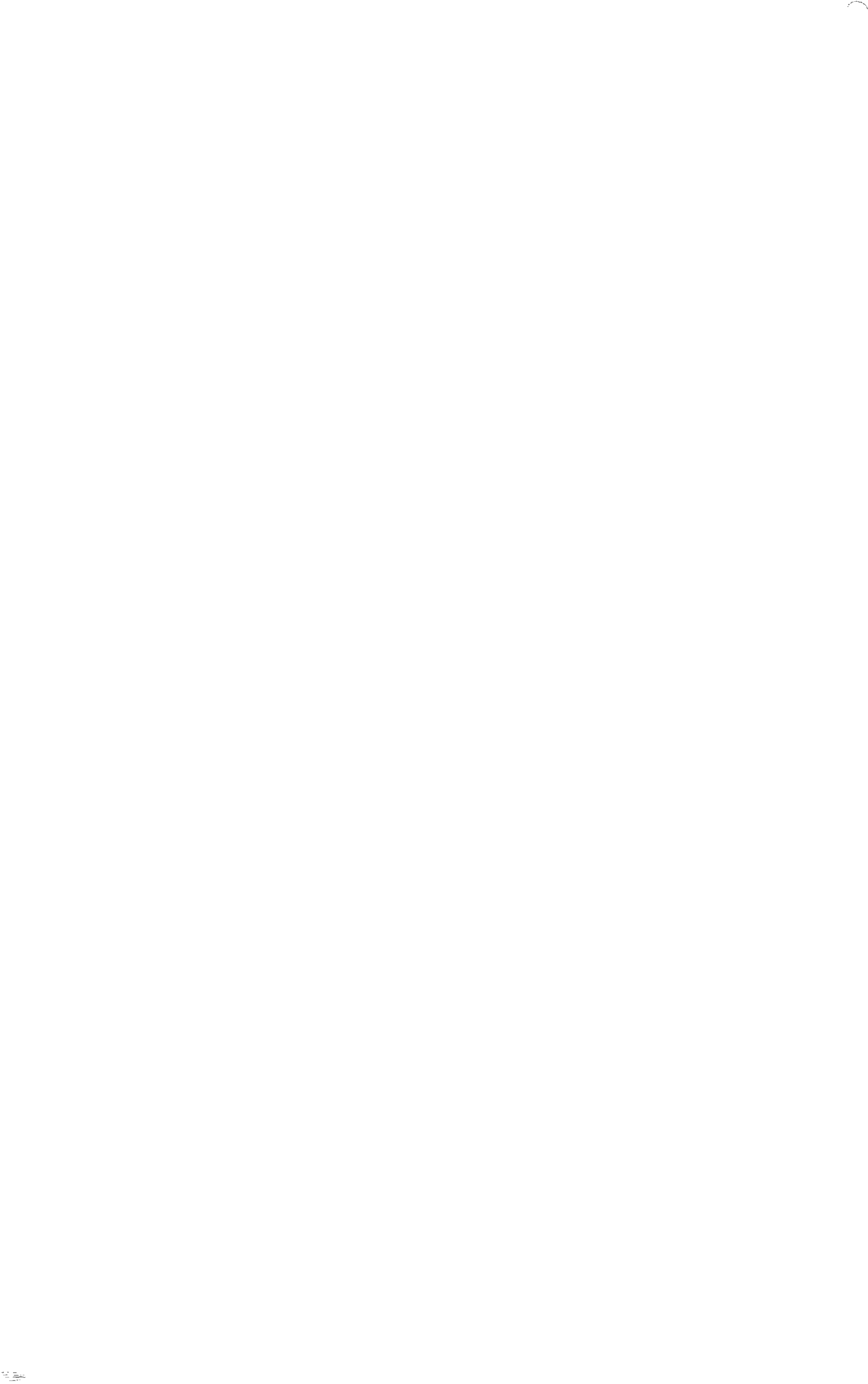
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| **Book(s) for Study** | |
| 1 | **Textbook of Medical Laboratory Technology,** Praful B. Godkar, Darshan P. Godkar, Edition 3,  Bhalani Publishing House, 2014. |
| 2 | **Textbook of Biochemistry for Medical Students,** DM Vasudevan, Sreekumari S, KannanVaidyanathan, Edition 8, Jaypee Brothers Medical Publishers (P) Ltd, 2016. |
| 3 | **Basic Pathology**, Robbins Saunders, Edition 10, An imprint of Elsevier Inc.,2017. |
| 4 | **Hematology: Basic Principles and Practice,** Ronald Hoffman**,** Edition 7, Elsevier, 2017. |
| 5 | **Clinical Biochemistry,** Maheshwari Nanda, Edition 2, Jaypee Brothers Medical Publishers, 2016. |
| **Book(s) for reference** | | |
| 1 | **Harpers Illustrated Biochemistry,** Rodwell, Edition 31, Overruns publisher, 2018 | |
| 2 | **Clinical Chemistry: Principles, Techniques, Correlations,** Michael Bishop, Edition 8, Lippincott  Williams and Wilkins publishing, 2017 | |
| 3 | **Clinical Hematology: Theory & Procedures,** [Mary Lou Turgeon,](https://www.amazon.com/s/ref%3Ddp_byline_sr_book_1?ie=UTF8&field-author=Mary%2BLou%2BTurgeon&text=Mary%2BLou%2BTurgeon&sort=relevancerank&search-alias=books) Edition 6, Jones &  Bartlett Learning, 2017. | |
| 4 | https:[//www.pdfdrive.com/medical-laboratory-technology-e34330445.html](http://www.pdfdrive.com/medical-laboratory-technology-e34330445.html) | |
| **Related Online Contents** | | |
| 1 | https:[//www.youtube.com/c/MedicalLaboratoryTechnologistVideos/featured](http://www.youtube.com/c/MedicalLaboratoryTechnologistVideos/featured) | |

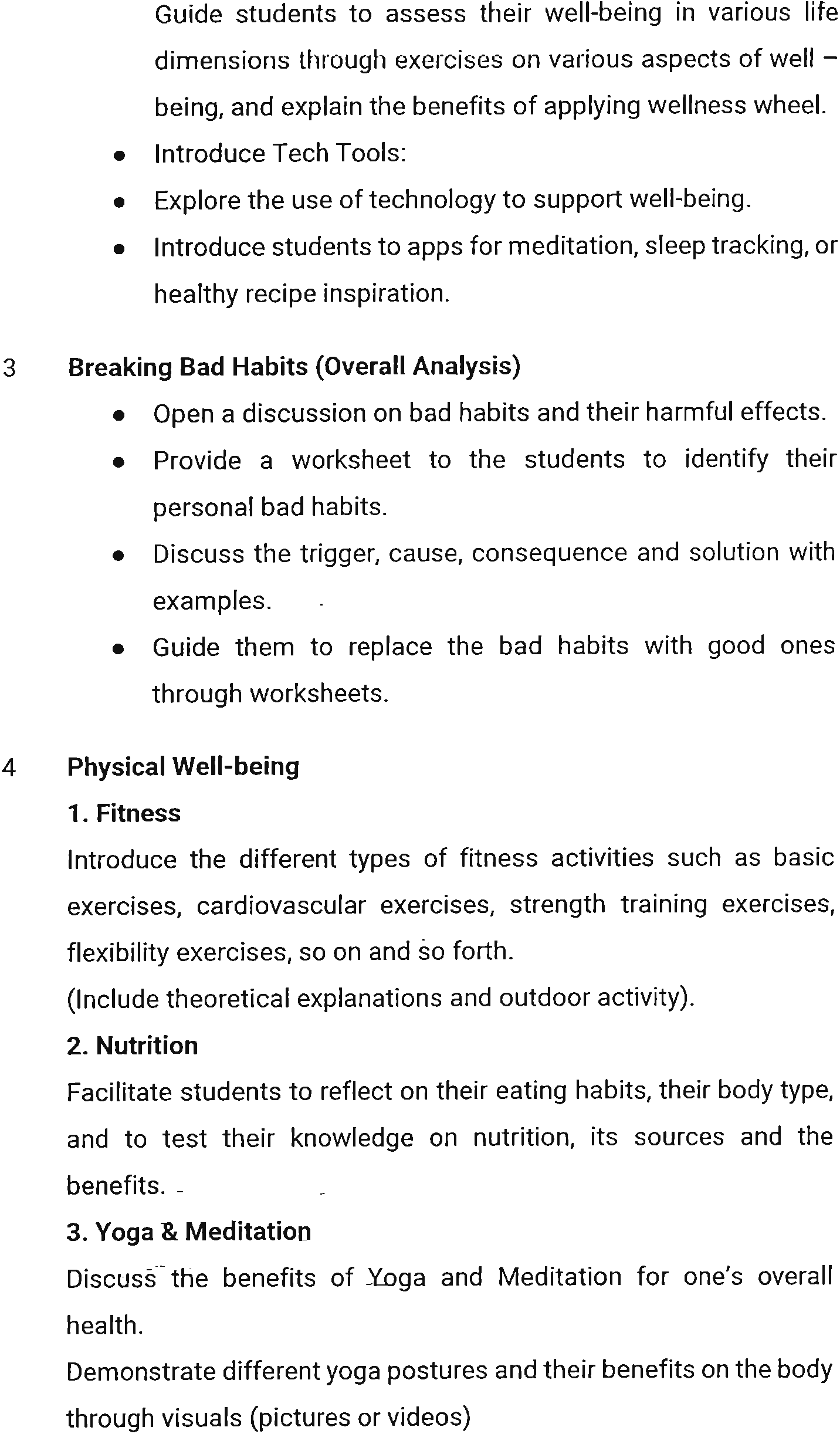
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| **Quality Control Biologist** | |
| **Name of the Department** | **BIOCHEMISTRY** |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone**  **and e-mail** | Dr. K. M. Saradhadevi  Assistant Professor  Department of Biochemistry  Bharathiar University  Email: [saradhadevi@buc.edu.in](mailto:saradhadevi@buc.edu.in) Phone: 9445285328 |
| **Inter / Intra Department Course** | Intra Department Course |
| **Duration of the Course** | 45 hours |
| **Eligibility** | B. Pharma / Graduation in Biotechnology/ B. Sc with Chemistry/  Biology/Microbiology/ Biochemistry as major subject (Preferable) |
| **Collaboration if any with Companies** (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.) | **Pasteur Institute of India, Coonoor-643103** |
| Number of Candidates to be Admitted | 25 |
| **Registration Procedure** |  |
| **Job Description:** | |
| To deliver accredited training service, mapping to the curriculum detailed above, in accordance with the Qualification Pack “LFS/Q2301, V1.0”. | |
| **The objectives of the Course are:** | |
| The main objectives of this course are to: | |
| 1 | Define life sciences industry, legal and regulatory framework and pharmacopeia to enable him/herself for establishing the industry standards in his/her performance. |
| 2 | Maintain a healthy, safe and secure working environment at the pharmaceutical manufacturing shop floor, laboratory and area around in conformance with environmental health and safety (EHS) rules. |
| 3 | Apply scientific knowledge about biological product and process in quality control analysis of bio-pharmaceutical products. |
| 4 | Prepare, preserve and ensure stability of biological samples as per good laboratory practices (GLP) and good manufacturing practices (GMP). |
| 5 | Operate analytical equipment and instruments as per standard operating procedures (SOP) and good laboratory practices (GLP). |
| 6 | Perform routine analysis of biopharmaceuticals in lab in compliance manufacturing practices (GMP) and good laboratory practices (GLP). |
| 7 | Conduct quality check for bio-pharmaceutical samples in conformance of acceptance limitsas per standard operating procedures (SOP). |
| 8 | Apply good documentation practice (GDP) and data integrity while reporting and documentation as per standard operating procedures (SOP) and good laboratory practices (GLP). |
| 9 | Work effectively in a team. |
| 10 | Respond to audit queries by citing evidence of work done. |
| 11 | Apply core communication skills and professional skills such as planning and organizing, problem solving, analytical and critical skills, decision making and customer centricity at work. |

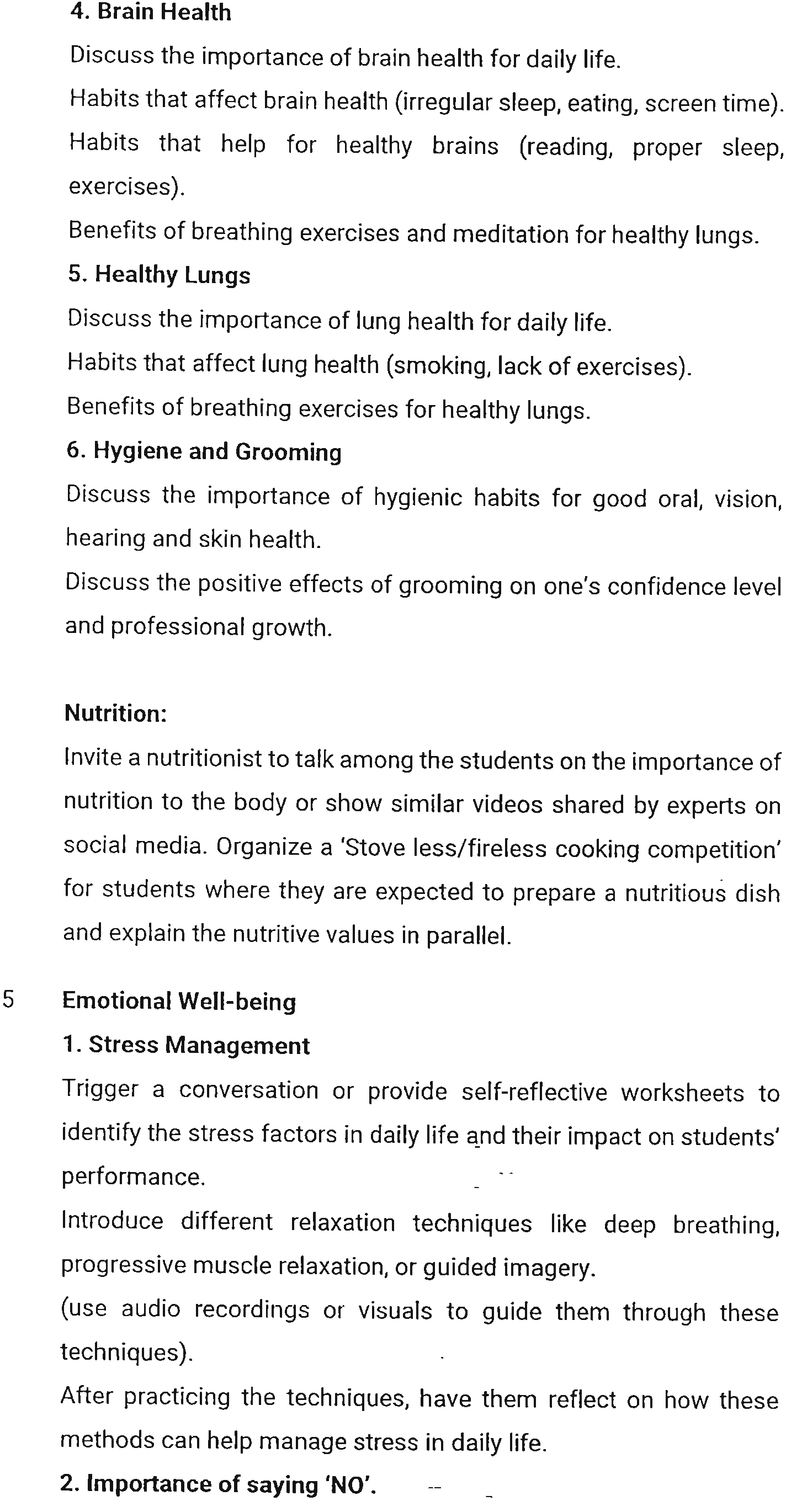
|  |  |  |  |
| --- | --- | --- | --- |
| **Course Content** | | Lecture / Practical / | |
| Lecture / Practical | | | |
| **Module 1** | **Life Sciences Industry and Quality related regulations** | | **Theory Duration** (hh:mm) 08:00  **Practical Duration** (hh:mm) 00:00 |
| **Module 2** | **GLP guidelines and production overview** | | **Theory Duration** (hh:mm) 04:00  **Practical Duration** (hh:mm) 16:00 |
| **Module 3** | **Health and safety** | | **Theory Duration** (hh:mm) 08:00  **Practical Duration** (hh:mm) 16:00 |
| **Module 4** | **Workplace cleanliness** | | **Theory Duration** (hh:mm) 08:00  **Practical Duration** (hh:mm) 16:00 |
| **Module 5** | **Sample Preparation, preservation and Storage** | | **Theory Duration** (hh:mm) 08:00  **Practical Duration** (hh:mm) 40:00 |
| **Module 6** | **Test and analysis of Biological samples for Plant/**  **Animal/Human cell culture** | | **Theory Duration** (hh:mm) 22:00  **Practical Duration** (hh:mm) 40:00 |
| **Module 7** | **Inspection of samples** | | **Theory Duration** (hh:mm) 32:00  **Practical Duration** (hh:mm) 56:00 |
| **Module 8** | **Instrumentation in Biological Analysis** | | **Theory Duration** (hh:mm) 08:00  **Practical Duration** (hh:mm) 30:00 |
| **Module 9** | **Quality Analysis** | | **Theory Duration**(hh:mm) 08:00  **Practical Duration** (hh:mm) 40:00 |
| **Module 10** | **Reporting and Documentation** | | **Theory Duration** (hh:mm) 12:00  **Practical Duration** (hh:mm) 16:00 |
| **Module 11** | **Coordinate with Supervisor, within team and cross**  **functional the teams** | | **Theory Duration** (hh:mm) 16:00  **Practical Duration** (hh:mm) 08:00 |
| **Module 12** | **Information Technology Skills at work** | | **Theory Duration** (hh:mm) 16:00  **Practical Duration** (hh:mm) 32:00 |
| **Module 13** | **On the Job Training** | | **Theory Duration** (hh:mm) 00:00  **Practical Duration** (hh:mm) 00:00 |
| **Book(s) for Study** | | | |
| 1 | **Bisen P. S. (2016) Life Science In Tools and Tecniques, CBS Publishers.** | | |
| 2 | [**R. Scott Stricoff**](https://www.amazon.com/R-Scott-Stricoff/e/B001H6KTG6/ref%3Ddp_byline_cont_book_1) **and** [**Douglas B. Walters**](https://www.amazon.com/s/ref%3Ddp_byline_sr_book_2?ie=UTF8&field-author=Douglas%2BB.%2BWalters&text=Douglas%2BB.%2BWalters&sort=relevancerank&search-alias=books) **(1995) Handbook of Laboratory Health** **and Safety 2nd Edition, Wiley-Interscience.** | | |
| 3 | [**G. Barrie Wetherill**](https://www.amazon.in/G-Barrie-Wetherill/e/B001HOHV78/ref%3Ddp_byline_cont_book_1) **(1969) Sampling Inspection and Quality Control, Methuenyoung books.** | | |
| **Book(s) for reference** | | | |
| 1 | Aashka Jain, Hina Bagada, Priya Patel (2019) Good Manufacturing Practises and Good  Laboratory Practises, Vallabh prakashan publisers. | | |
| 2 | Shubhangi Tambwekar (2015) Handbook of Quality Assurance in Laboratory Medicine,  Wolters Kluwer | Lippincott Williams and Wilkins publications. | | |
| 3 | PK Bajpai (2006) Biological Instrumentation and Methodology, S Chand & Company. | | |
| 4 | Pamposh Kumar and V.P.S. Tomar (2005) Laboratory Manual Quality Systems Standardization Quality Assurance Accreditation Quality Management, CBS publication. | | |
| **Related Online Contents** | | | |
| 1 | Hand book good laboratory practice – World Health Organization  <https://www.who.int/tdr/publications/documents/glp-handbook.pdf> | | |
| 2 | [Importance of cleanliness in laboratories](https://lab-training.com/2017/08/21/importance-cleanliness-laboratories/)  <https://lab-training.com/2017/08/21/importance-cleanliness-laboratories/> | | |
| 3 | [CELL CULTURE BASICS Handbook](https://www.vanderbilt.edu/viibre/CellCultureBasicsEU.pdf)  <https://www.vanderbilt.edu/viibre/CellCultureBasicsEU.pdf> | | |
| 4 | [Biological sample collection, processing, storage and infomtion management](https://publications.iarc.fr/_publications/media/download/1398/68b153f74693289ae66d767a8cbe1ca667df4f1b.pdf) https://publications.iarc.fr/\_publications/media/download/1398/68b153f74693289ae66d767 a8cbe1ca667df4f1b.pdf | | |
| 5 | [Lab Safety Rules and Guidelines](https://www.labmanager.com/lab-health-and-safety/science-laboratory-safety-rules-guidelines-5727)  https:/[/www.labmanager.com/lab-health-and-safety/science-laboratory-safety-rules-guidelines-5727](http://www.labmanager.com/lab-health-and-safety/science-laboratory-safety-rules-guidelines-5727) | | |

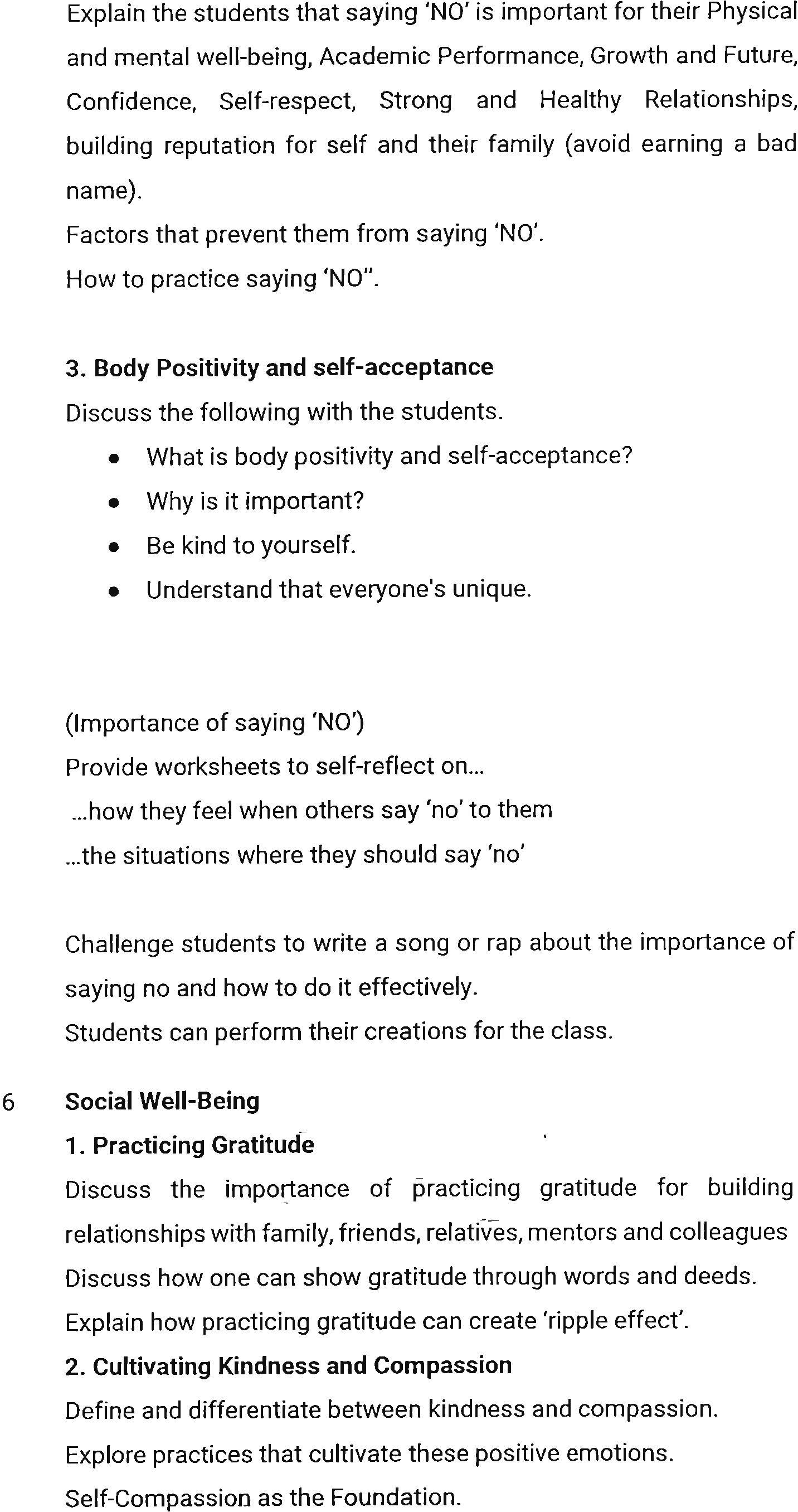
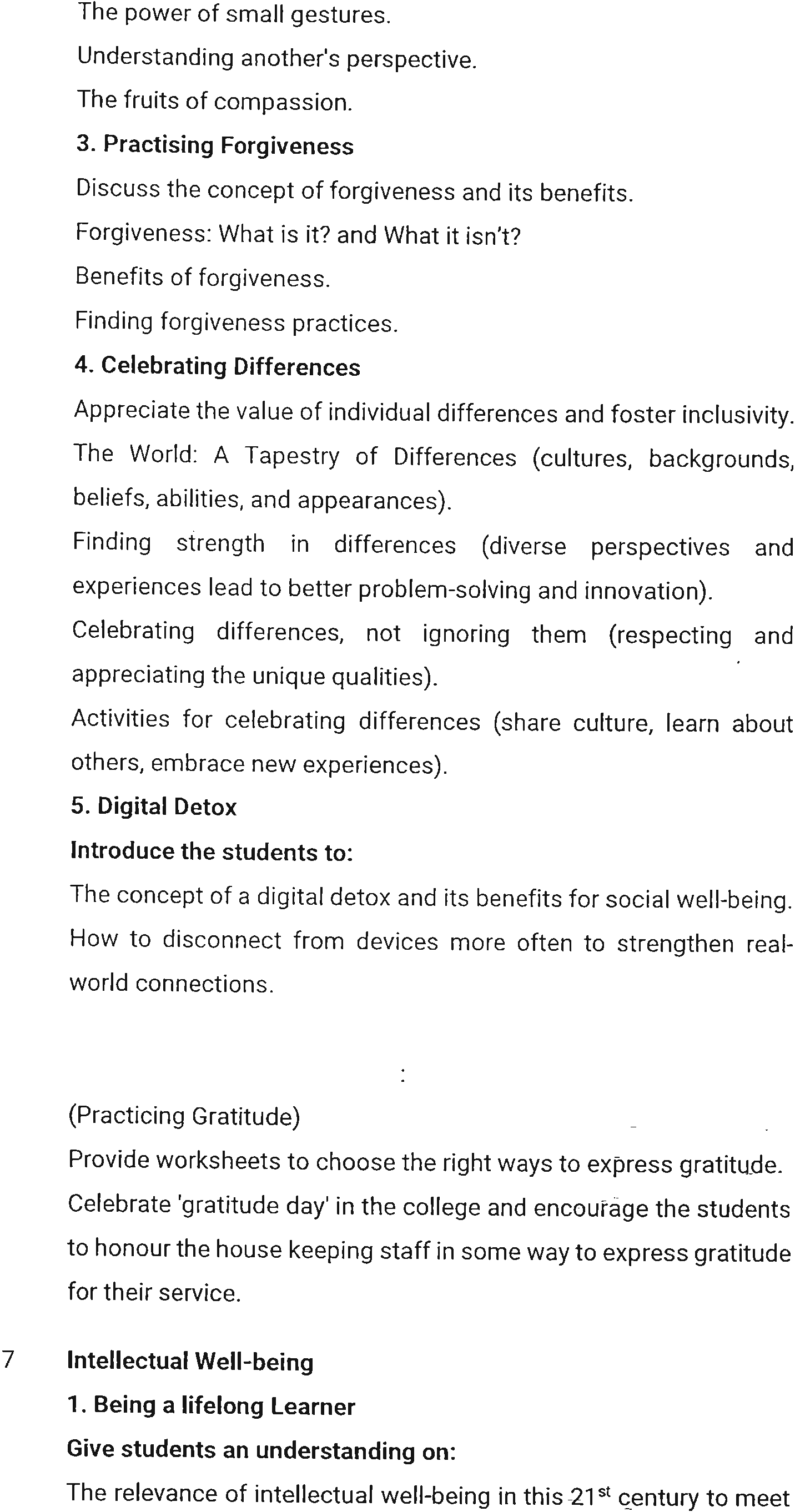
Health and Wellness

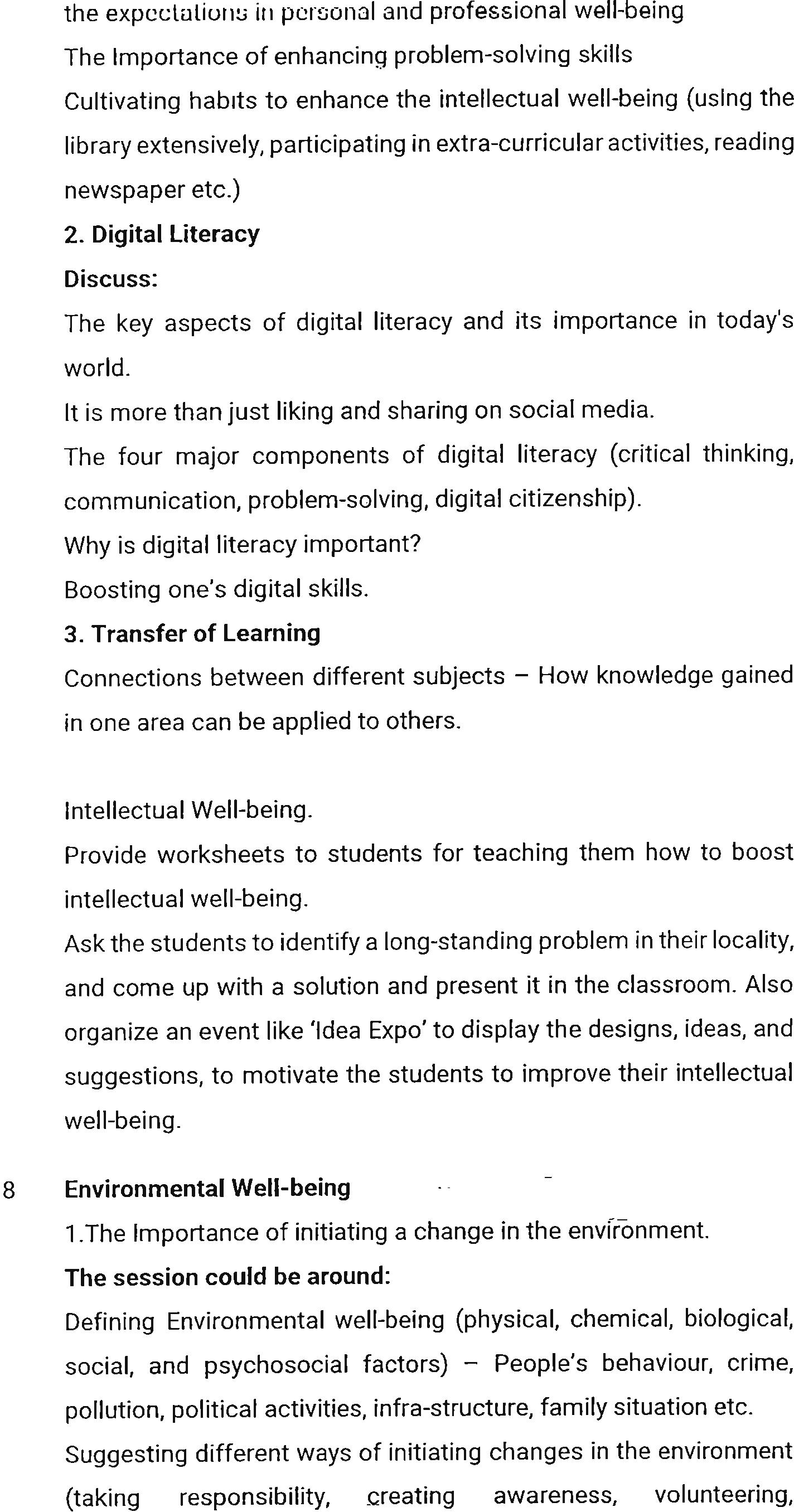


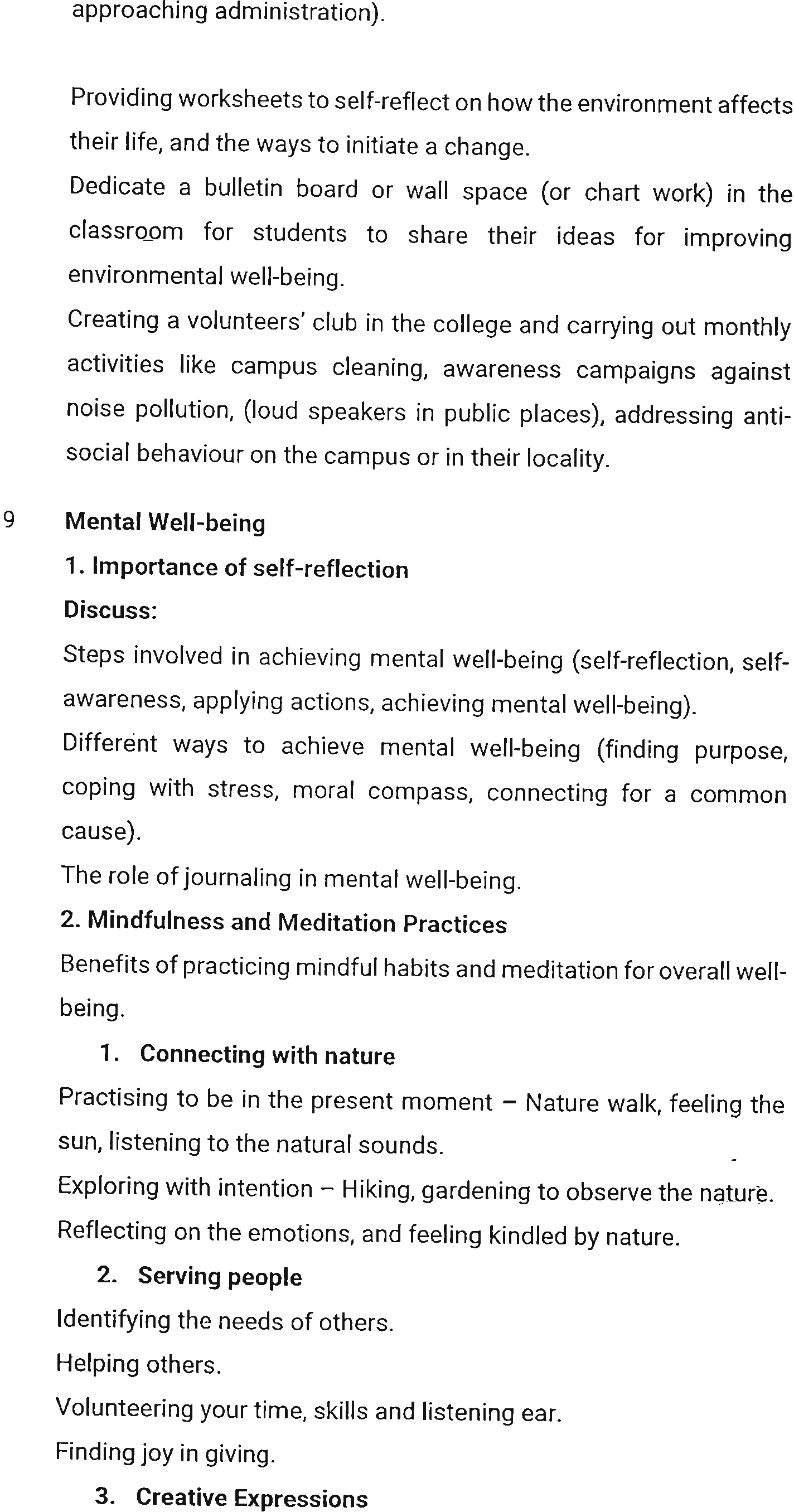


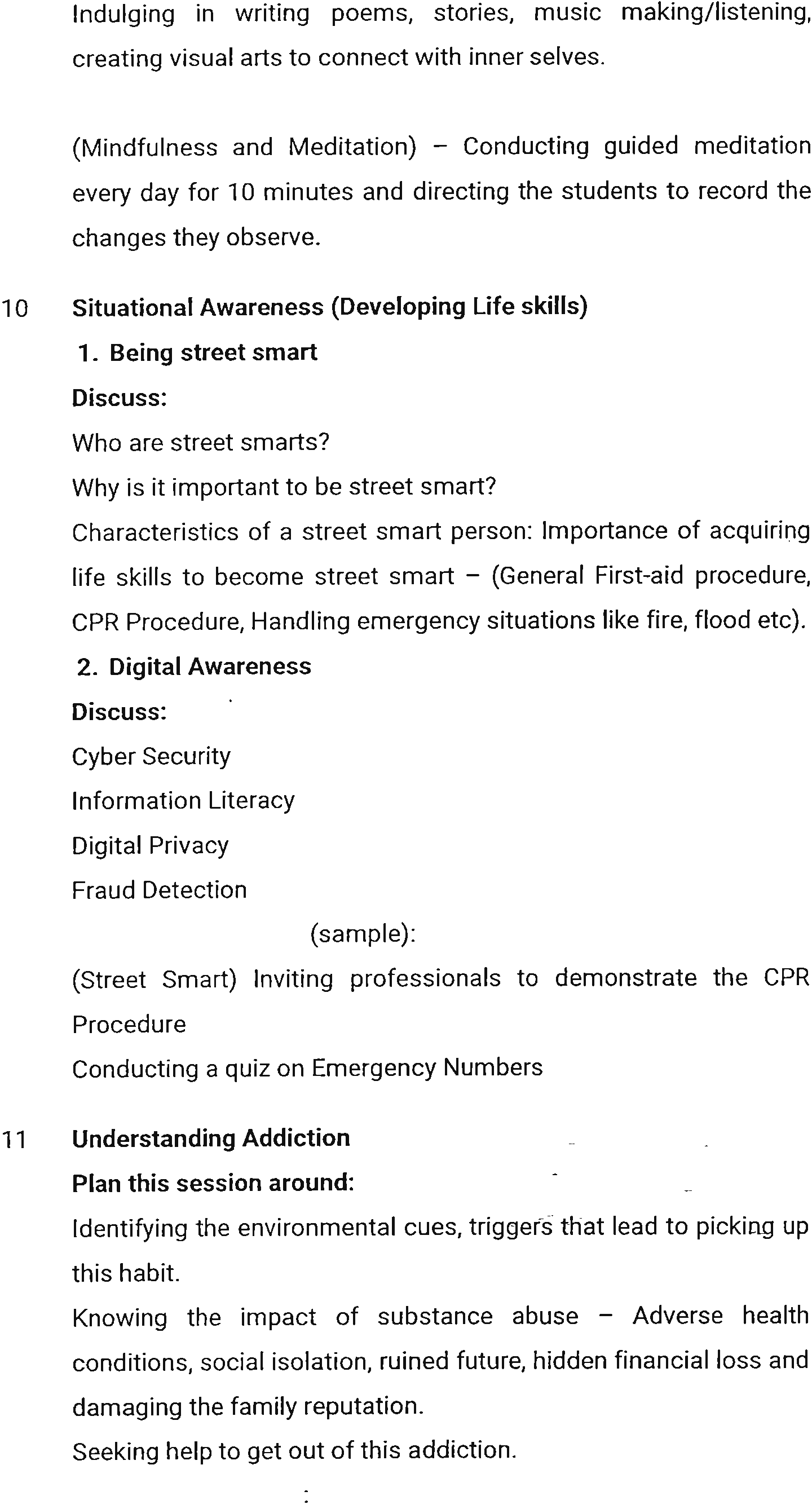


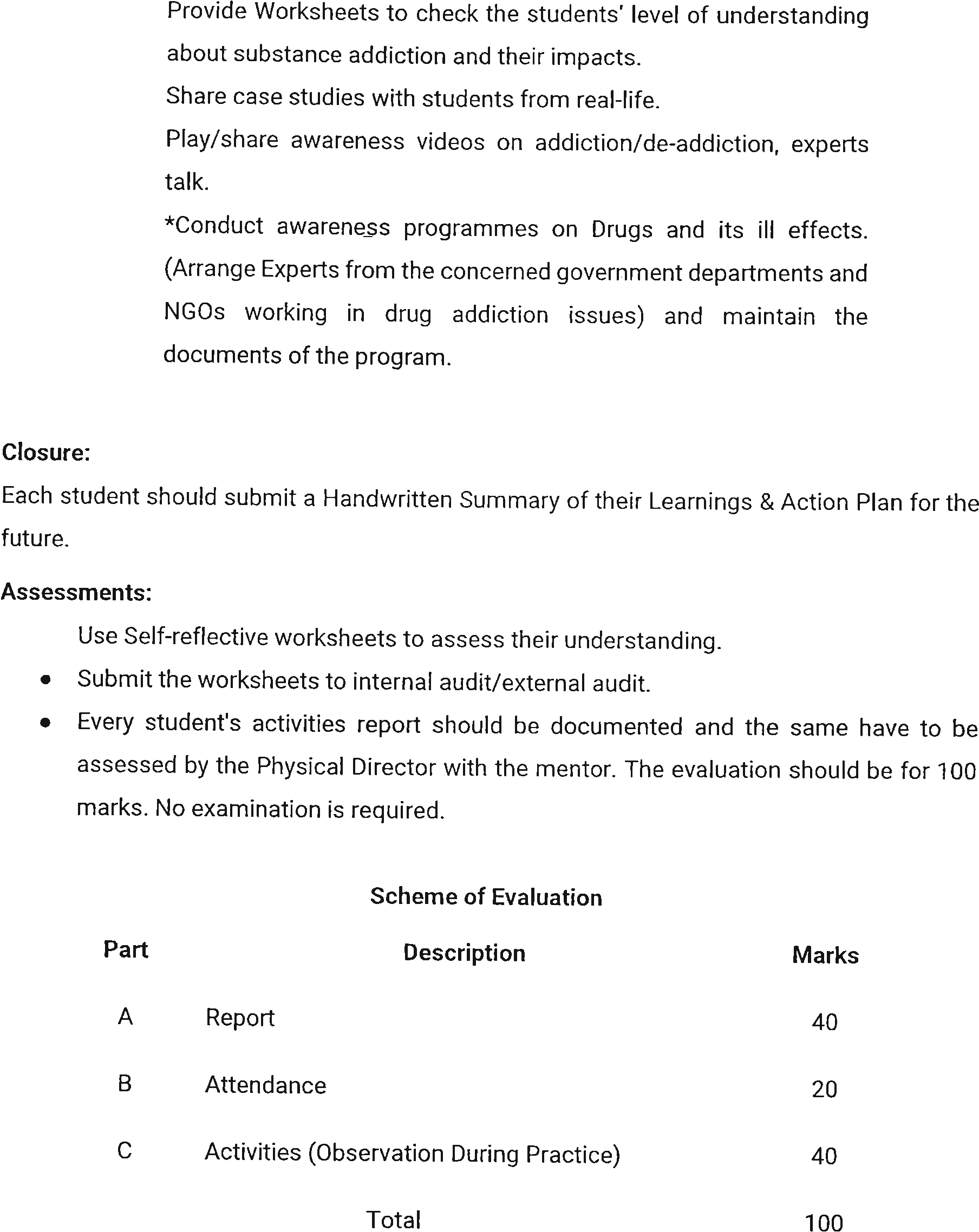


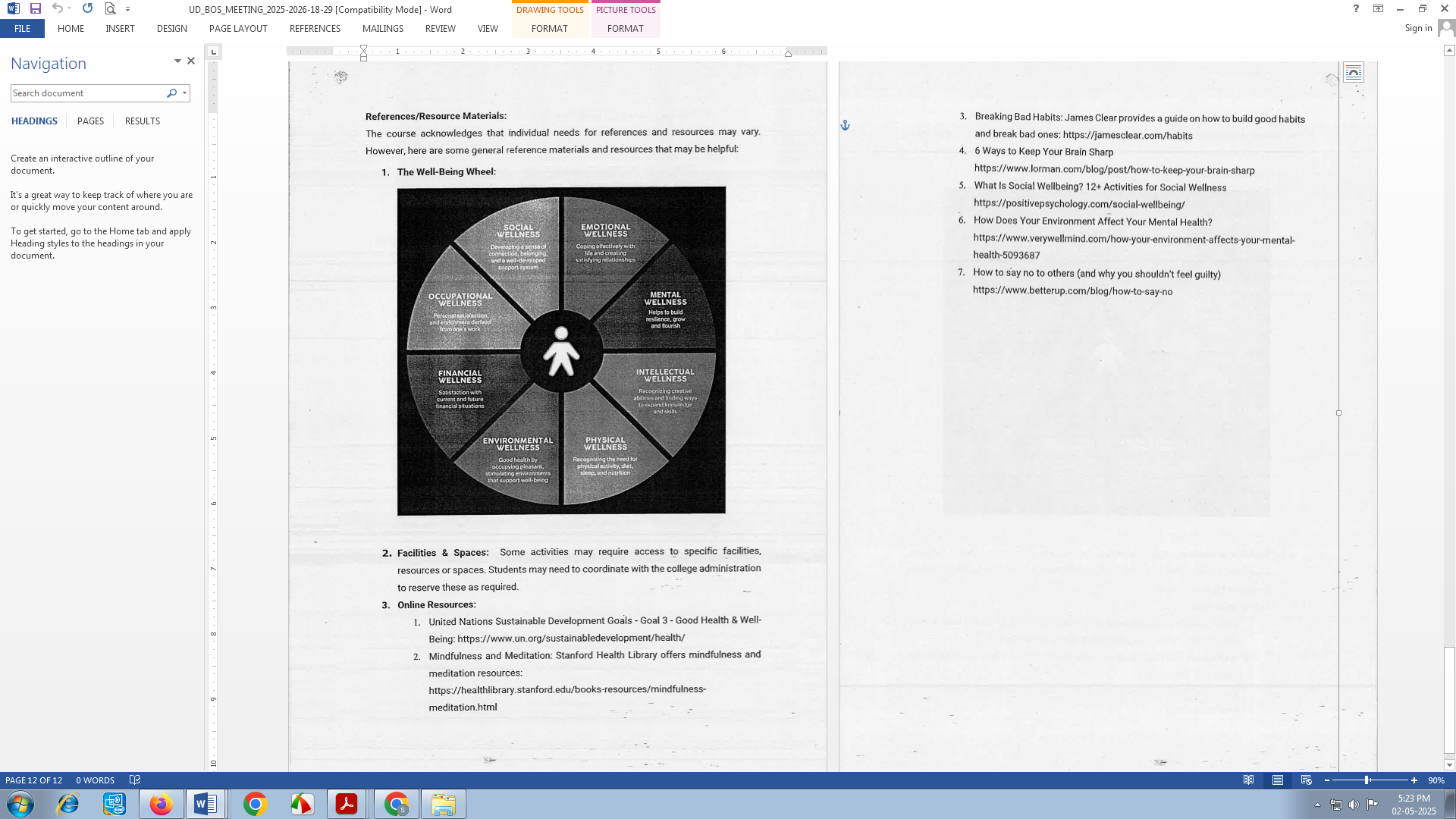
  


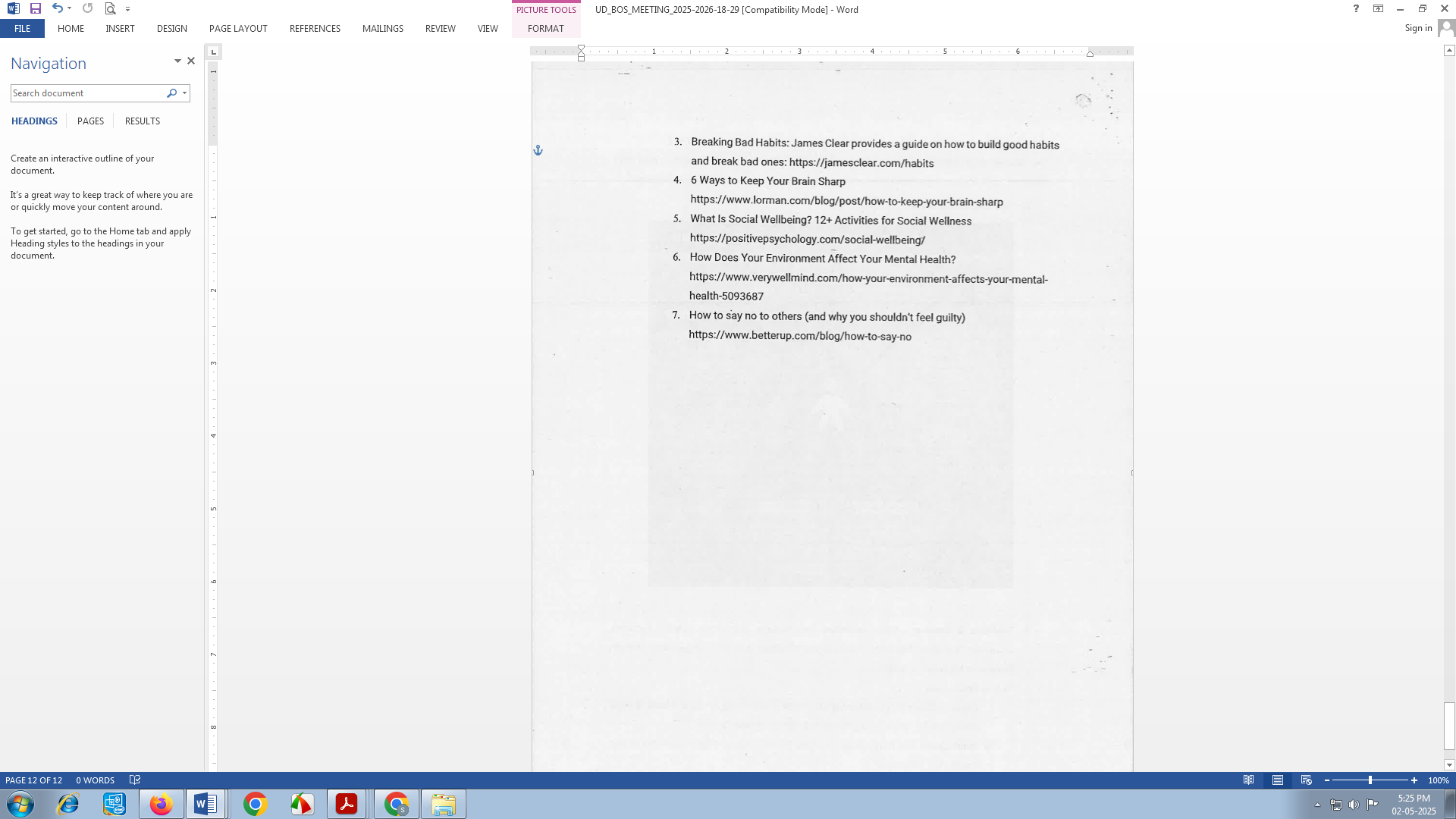












Annexure

**M. Sc., BIOCHEMISTRY**

**Syllabus**

**(With effect from 2024-2025)**

  
  
  
**DEPARTMENT OF BIOCHEMISTRY**

**Bharathiar University**

**(A State University, Accredited with “A++“ Grade by NAAC and 26th Rank among Indian Universities by MHRD-NIRF)**

**Coimbatore 641 046, INDIA**

**DEPARTMENT OF BIOCHEMISTRY**

**BHARATHIAR UNIVERSITY**

**COIMBATORE 641046**

**MISSION**

To educate and inspire the young minds from the basics to the latest innovations in science. To inculcate the traditional culture of ethics. To captivate unexplored sectors in research. Develop and enhance conservation of optimum academic environment to prepare professional graduates in the field of Biochemistry. To identify the local and global issues that need intervention by a Biochemist, and develop intelligent strategies and biochemical approaches in problem solving methods. Providing aspiring molecular life scientists with the opportunity to obtain a world-class education by engaging in a program of instruction that emphasizes: Quantitative analysis, Critical thinking, Rigorous and effective application of the scientific method, Fundamental chemical, biological and physical principles.

Candidate who has presented the work as “Not qualified as per CBCS” must resubmit the project again in the ensuing academic year.

**SUPPORTIVE PAPERS OFFERED FOR OTHER DEPARTMENT STUDENTS**

Paper I : Tools and techniques in bioscience

Paper II : Medical lab technology

Paper III : Clinical diagnosis in health and disease

**CO-SCHOLASTIC COURSES**

**VALUE ADDED COURSES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Subject** | **Hrs Per week** | **University**  **examination** | |
| **Duration in Hrs.** | **Max.**  **Marks** |
| 20BCVAC1 | Animal Cell Culture Techniques | 2 | 45 | 50 |
| 20BCVAC2 | Pharmacovigilance | 2 | 45 | 50 |

**#JOB ORIENTED COURSES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Subject** | **Hrs Per week** | **University**  **examination** | |
| **Duration in Hrs** | **Max**  **Marks** |
| 20BCJOC1 | Quality control Biologist | 2 | 45 | 50 |
| 20BCJOC2 | Medical Laboratory Technologist | 2 | 45 | 50 |

**#** Offered in collaboration with industries. 

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | | | |
|  | Health & Wellness | 1 | - | | - | | | 100 | - | | 100 | |
| **ONLINE COURSES** | | | | | | | | | | | | |
|  | Swayam, MOOC Course etc., | - | | - | | - | 50 | | | - | | 50 |
| The scholastic courses are only counted for the final grading and ranking. However, for the  award of the degree, the completion of co-scholastic courses is also mandatory. | | | | | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Subject** | **Hrs Per week** | **University**  **examination** | |
| **Duration in Hrs.** | **Max.**  **Marks** |
| 20BCVAC1 | Animal Cell Culture Techniques | 2 | 45 | 50 |
| 20BCVAC2 | Pharmacovigilance | 2 | 45 | 50 |

**PRACTICAL COMPONENTS:**

The M.Sc., Biochemistry Core Practical Examination having the following Marks:

**INTERNAL MARKS: 25**

|  |  |
| --- | --- |
| Major Practical | 10 marks |
| Minor Practical | 5 marks |
| Spotters (A, B, C, D and E) | 5x2 =10 marks |
| **Total** | **25 Marks** |

**EXTERNAL MARKS: 75**

|  |  |
| --- | --- |
| Major Practical | 30 marks |
| Minor Practical | 20 marks |
| Spotters (A, B, C, D and E) | 5x2 =10 marks |
| Record and Viva | 10+5 =15 marks |
| **Total** | **75 Marks** |

**THEORY COMPONENTS:**

The M.Sc. Biochemistry Core and Elective theory Examination having the following Marks.

**CORE AND ELECTIVE PAPERS: MAXIMUM MARKS*–* 100**

**INTERNAL MARKS: 25**

|  |  |
| --- | --- |
| Test | 15 marks |
| Assignment | 5  marks |
| Seminar | 5 marks |
| **Total** | **25 Marks** |

**EXTERNAL MARKS: 75**

**SECTION – A:10x1=10 Marks (Question No. 1 to 10)**

Choose the best Answer type. Answer all questions. All questions carry equal marks.

**SECTION – B: 5x5=25 Marks (Either or type*–* Question No. 11 to 15)**

Answer all questions. All question carry equal marks. Each answer should not exceed 2 pages.

**SECTION – C: 5x8=40 Marks (Either or type*–* Question No. 16 to 20)**

Answer all questions. All Question carry equal marks. Each answer should not exceed 4 pages.

**SUPPORTIVE PAPERS**: **MAXIMUM MARKS50 INTERNAL MARKS: 12**

|  |  |
| --- | --- |
| Test | 6 marks |
| Assignment | 3  marks |
| Seminar | 3  marks |
| **Total** | **12 Marks** |

**EXTERNAL MARKS: 38**

**SECTION – A: 5x1 = 5 Marks (Question No. 1 to 5)**

Short answer type questions. Answer all questions. All questions carry equal marks.

**SECTION – B: 3x3 = 9 Marks (Either or type*–* Question No. 6 to 8)**

Answer all questions. Each question carries 5 marks.

**SECTION – C: 4x6 = 24 Marks (Either or type*–* Question No. 9 to 12)**

Answer all questions. All question carries equal marks. Each answer should not exceed 2 pages.