# VIVEKANANDHA

## COLLEGE OF ARTS AND SCIENCES FOR WOMEN

**ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).**

**An ISO 9001: 2015 Certified Institution**
**(Affiliated to Periyar University, Approved by AICTE, recognized u/s 2 (f) & 12 (B) & Re-accredited with 'A+' by NAAC)**

A U T O N O M O U S

# DEPARTMENT OF BIOCHEMISTRY

## B.Sc., BIOCHEMISTRY

## SYLLABUS AND REGULATIONS

**FOR CANDIDATES ADMITTED FROM 2024-2025 ONWARDS UNDER AUTONOMOUS OBE AND CBCS PATTERN**

**VIVEKANANDHA EDUCATIONAL INSTITUTIONS**
**Angammal Educational Trust**
**Elayampalayam, Tiruchengode (Tk.), Namakkal (Dt.)**

## College Vision & Mission

### Vision

- To evolve into a center of excellence in higher education through creative and innovative practices to social equity for women.

### Mission

- To provide sufficient learning infrastructure to the students to pursue their studies.
- To provide good opportunity for higher education and conducive environment to the students to acquire education.
- To provide quality academic programs training activities and research facilities.
- To facilitate industry-institute interaction.

## DEPARTMENT OF BIOCHEMISTRY

### Vision

To be recognized as a centre for excellence in Biochemistry that provides an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to enhance the quality of life.

### Mission

- To help the students to gain more knowledge through visits to research Institutions, Industries, and hospitals through Job training and project work.
- To give an opportunity to students to meet eminent scientists working in various fields of Biochemistry by way of invited lectures, seminars & workshops
- Designing strategies and catalysts for making chemical bonds in new ways
- To provide opportunities to get hands on experience in –
  - Research oriented education in Biochemistry
  - Molecular Biology and Biotechnology
  - Apprenticeship in industries and service agencies
  - Entrepreneurship in Biochemistry-related areas.
- Promote research based projects/activities in the emerging areas of technology convergence.

## PROGRAMME EDUCATIONAL OBJECTIVES

1. To equip the graduates with the ability to prepare to a fast changing situations by gaining strength to learn and apply the new skills with competency
2. To teach the basic and essential knowledge in the field of Biochemistry both practically and theoretically with the team setup and with proper ethical practices.
3. To make the graduates to develop the spirit of empathy, humanity and commitment for Nation development

## PROGRAMME SPECIFIC OBJECTIVES (PSO)

1. To create interest among students so that they can pursue higher education in Biochemistry to take up the career of teaching, research or to serve the needs of medicine, agriculture related industrial establishments.
2. To make graduates understand Biochemistry with various application in clinical diagnosis, understanding pathology of diseases treatment of diseases, designing of drugs and understanding their metabolism and manufacture of various biological products like amino acids, proteins, antibiotics, hormones, enzymes, nutrients etc.,

3. To promote students with leadership quality to organize seminar, guest lectures and promote research based projects, to undergo internship programmes in the emerging areas of biological sciences.

**PO and Knowledge level**

| PO No | PROGRAMME OUTCOME | Knowledge Level |
|---|---|---|
| PO1 | ***Disciplinary knowledge:*** Ability to understand fundamental concepts of biology, chemistry and biochemistry, ability to relate various interrelated physiological and metabolic events. A general awareness of current developments at the forefront in Biochemistry and allied subjects, ability to critically evaluate a problem and resolve to challenge blindly accepted concept. Good experimental and quantitative skils encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results. | K2 |
| PO2 | ***Communication Skills:***Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share ones views and express herself; demonstrate the ability to listen carefully, read and write analytically and follow scientific viewpoints, and present complex information in a clear and concise manner to differentgroups. | K1 |
| PO3 | ***Critical thinking:***Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefson the basis of empirical evidence; ability to substantiate critical readings of scientific texts. Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. | K4 |
| PO4 | ***Problem solving:***ability to closely observe the situation, and apply lateral thinking and analytical skills. | K3 |
| PO5 | ***Analytical reasoning****:*Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesis data from a variety of sources; drawvalid conclusions and support them with evidence and examples, and addressing opposingviewpoints. | K5 |
| PO6 | ***Research-related skills:*** Ability to problematize; to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers. Ability to plan, execute and report the results of an experiment and write a research paper. | K6 |
| PO7 | ***Cooperation/Team work****:* Ability to work effectively and respectfully with diverse teams;facilitate cooperative or coordinated effort on the part of a group,and act together as a group in the interests of a common cause and work efficiently as a member of ateam. | K6 |
| PO8 | ***Scientific reasoning:***Ability to analyse, interpret and draw conclusions from quantitative/qualitativedata;andcriticallyevaluateideas,evidenceandexperiences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments. | K4 |
| PO9 | ***Reflective thinking:*** Critical sensibility to lived experiences, with self awareness and reflexivity of both self andsociety. Ability to see the influence of location –regional, national, global-on critical thinking. | K2 |

| | | |
|---|---|---|
| PO10 | ***Information/digital literacy:***Capability touse ICT in a variety of learning situations, demonstrate abilityto access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. | K3 |
| PO11 | ***Self-directed learning:***Ability to work independently, identify appropriate resources required for a project, and manage a project through tocompletion. Ability to critically analyse rerearch literature and postulate hypothesis, questions and search for answers. | K6 |
| PO12 | ***Multicultural competence:***Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diversegroups. | K5 |
| PO13 | ***Moral and ethical awareness/reasoning:*** Ability toembrace moral/ethical values in conducting one‟s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adoptingobjective, unbiased and truthful actions in all aspects ofwork. | K3 |
| PO14 | ***Leadership readiness/qualities:*** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth andefficientway. | K6 |
| PO15 | ***Lifelong learning:***Ability to acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed atpersonal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skilldevelopment/reskilling. | K6 |

## IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year Degree course shall be required to have passed

- A pass in +2 withChemistry as compulsory subject and studied Botany and Zoology or Biology in the plus 2.

## V. DURATION OF THE COURSE

- The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.
- The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.

## VI ASSESSMENT

Assessment of the students would be made through Continuous Internal Assessment (CIA) and External Assessment (EA) for passing each subject both theory and practical papers.

A candidate would be permitted to appear for the External Examination only on earning 75 % of attendance and only when his / her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

### A. CONTINUOUS INTERNAL ASSESSMENT (CIA)

The performance of the students will be assessed continuously by the teacher concern and the Internal Assessment Marks will be as follows:

**Distribution Of Continuous Assesment Marks (25/40)**

| Activity | Period (WD) | Marks (25) | Activity | Marks (40) |
|---|---|---|---|---|
| Attendance | 90 | 5 | Attendance | 5 |
| CIA Test I | 30 to 35 | 2.5 | CIA Test I/Review | 5 |
| CIA Test II | 60 to 65 | 2.5 | CIA Test II/Review II | 5 |
| Model | After 90 | 10 | Model/Model Presentation | 10 |
| Assignment | | 05 | Observation note | 10 |
| | | | Results in lab/Work | 5 |
| **Total** | | **25** | | **40** |

**Distribution of attendance mark**

| S. No. | Percentage | Marks | |
|---|---|---|---|
| | | Theory | Practical |
| 1 | 76-80 | 1 | 1 |
| 2 | 81-85 | 2 | 2 |
| 3 | 86-90 | 3 | 3 |
| 4 | 91-95 | 4 | 4 |
| 5 | 96-100 | 5 | 5 |

### A. EXTERNAL ASSESSMENT (EA)

The performance of the students would be assessed by examination at the end of each semester with a written test for theory for three hours and practical examination at the end of even semesters for six hours. Question papers would be set by the selected external examiners in the prescribed format and valuated by the external examiners with the help of the teacher concern.

The pattern of assessment is as follows:

**Distribution of Final Assesment Marks (75/60)**

| Section | Activity | Marks (75) | Activity | Marks (60) |
|---|---|---|---|---|
| A | One mark (10) | 10 | Record work | 5 |
| B | Seven marks (Either or) | 35 | Viva Voce | 5 |
| C | Ten marks (3/5) | 30 | Sportters | 10 |
| | | | Experiment I | 20 |
| | | | Experiment II | 20 |
| **Total** | | **75** | **Total** | **60** |

## VII. PASSING MINIMUM

### INTERNAL

There is no passing minimum for CIA

### EXTERNAL

In the EA, the passing minimum shall be 40% out of 75 Marks. (30 Marks)

## VIII. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
c) 50%and above but below 60% shall be declared to have passed the examinations in second class.
d) All the remaining successful candidates shall be declared to have passed the examinations in third class.
e) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for College rank.

## IX. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the degree only if she has undergone the above degree for a period of not less than three academic years comprising of six semesters and passed the examinations prescribed and fulfilled such conditions has have been prescribed therefore.

## X. PROCEDURE IN THE EVENT OF FAILURE

Candidates fail in any subject would be permitted to appear for each failed subject or subjects in the subsequent EA. However, final year students failed in one or two subjects would be allowed to appear for a supplementary exam within a month of the final result.

## XI. COMMENCEMENT OF THESE REGULATIONS

These regulations shall take effect from the academic year 2020-21 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2020-21 and thereafter.

## XII. TRANSITORY PROVISIONS.

Candidates who have undergone the UG Course of study before 2022-23 shall be permitted to appear for the examinations under those regulations for a period of three years i.e., upto and inclusive of the examination of April/May 2022. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

Supplementary examination will be conducted within a month. In case of failure she has to complete within 5 years. (3+5)

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)**
**DEPARTMENT OF BIOCHEMISTRY**
**CBCS AND OBE PATTERN SYLLABUS - UG**
**(For candidates admitted from 2023-2024 onwards)**

| Sem | Subject code | Part | Course | Subjects | Hrs/ week | Credit | Int. marks | Ext. mark | Tot. mark |
|---|---|---|---|---|---|---|---|---|---|
| I | 23U1LT01 | I | Language-I | Foundation Tamil-I | 6 | 3 | 25 | 75 | 100 |
| | 23U1LH01 | | | Hindi-I | | | | | |
| | 23U1LM01 | | | Malayalam-I | | | | | |
| | 23U1LE01 | II | English-I | English I | 4 | 3 | 25 | 75 | 100 |
| | 23U1BCC01 | III | Core-I | Biomolecules | 4 | 4 | 25 | 75 | 100 |
| | 23U1BCCP01 | | | Core Practical I (6 Hours) | 3 | 3 | 40 | 60 | 100 |
| | 23U1CHGE01 | III | Allied-I | Chemistry for Biological Sciences I | 4 | 3 | 25 | 75 | 100 |
| | 23U1CHGEP1 | | | Chemistry Practical for Biological and Physical sciecnes I (3 Hrs) | 3 | 2 | 40 | 60 | 100 |
| | 23U1ENAC01 | IV | Soft Skill | Soft Skills for effective communication | 2 | 2 | 25 | 75 | 100 |
| | 23U1VE01 | IV | - | Health, Human Values and Yoga | 2 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **22** | **230** | **570** | **800** |
| **Sem** | **Subject code** | **Part** | **Course** | **Subjects** | **Hrs/ week** | **Credit** | **Int. marks** | **Ext. mark** | **Tot. mark** |
| **II** | 23U2LT02 | I | Language-II | Foundation Tamil II | 6 | 3 | 25 | 75 | 100 |
| | 23U2LE02 | II | English-II | Communicative English II | 6 | 3 | 25 | 75 | 100 |
| | 23U2BCC02 | III | Core-II | Enzymes | 4 | 4 | 25 | 75 | 100 |
| | 23U2BCCP02 | III | | Core Practical II (6 Hours) | 3 | 3 | 40 | 60 | 100 |
| | 23U2CHGE02 | III | Allied-II | Allied Chemistry- II | 4 | 3 | 25 | 75 | 100 |
| | 23U2CHGEP2 | III | | Allied Chemistry Practical II(3 Hrs) | 3 | 2 | 40 | 60 | 100 |
| | 23U2CSAC02 | IV | Soft Skill | Office Automation | 2 | 2 | 25 | 75 | 100 |
| | 23U2ES01 | IV | - | Envirnmental Studies | 2 | 2 | 25 | 75 | 100 |
| | | | | **Total** | **30** | **22** | **230** | **570** | **800** |

| Sem | Subject code | Part | Course | Subjects | Hrs/ week | Credit | Int. marks | Ext. mark | Tot. mark |
|---|---|---|---|---|---|---|---|---|---|
| III | 23U3LT03 | I | Language-III | Tamil-III | 6 | 3 | 25 | 75 | 100 |
| | 23U3LH03 | | | Hindi-III | | | | | |
| | 23U3LM03 | | | Malayalam-III | | | | | |
| | 23U3LE03 | II | English-III | English III | 6 | 3 | 25 | 75 | 100 |
| | 23U3BCC03 | III | Core-III | Intermediary Metabolism | 4 | 4 | 25 | 75 | 100 |
| | 23U3BCCP03 | | | Core Practical III (6 Hours) | 3 | 3 | 40 | 60 | 100 |
| | 23U3MBGE01 | III | Allied-III | Allied Microbilogy I | 4 | 4 | 25 | 75 | 100 |
| | 23U3MBGEP1 | | | Allied Microbiology Practical I (6Hrs) | 3 | 3 | 40 | 60 | 100 |
| | 23U3BCDE01 | III | Discipline Elective | Medical Laboratory Technology | 2 | 2 | 25 | 75 | 100 |
| | 23U3BCDE02 | | | Bioentrepreneurship | | | | | |
| | 23U3BCN01 | IV | NMEC | Health and Hygiene | 2 | 2 | 25 | 75 | 100 |
| | 23U3BCN02 | | | Life Style Disease | | | | | |
| | | | | **Total** | **30** | **24** | **230** | **570** | **800** |
| **Sem** | **Subject code** | **Part** | **Course** | **Subjects** | **Hrs/ week** | **Credit** | **Int. marks** | **Ext. mark** | **Tot. mark** |
| **IV** | 23U4LT02 | I | Language-I | Language - Tamil | 6 | 3 | 25 | 75 | 100 |
| | 23U4LE01 | II | English-I | English | 6 | 3 | 25 | 75 | 100 |
| | 23U4BCC04 | III | Core-IV | Biochemical Techniques | 4 | 4 | 25 | 75 | 100 |
| | 23U4BCCP04 | III | | Core Practical IV (6 Hours) | 3 | 3 | 40 | 60 | 100 |
| | 23U4BTGE04 | III | Allied-IV | Allied Biotechnology-I | 4 | 3 | 25 | 75 | 100 |
| | 23U4BTGEP2 | III | | Allied Biotechnology Practical I(3 Hrs) | 3 | 3 | 40 | 60 | 100 |
| | 23U4BCDE03 | III | Discipline Elective | First Aid | 2 | 2 | 25 | 75 | 100 |
| | 23U4BCDE04 | | | Tissue Culture | | | | | |
| | 23U4BCN03 | IV | NMEC | Biochemistry and Health | 2 | 2 | 25 | 75 | 100 |
| | 23U4BCN04 | | | Health and Nutrition | | | | | |
| | 23U4BCN05 | | | Sustainable Development Goals | | | | | |
| | | | | **Total** | **30** | **23** | **230** | **570** | **800** |

| Sem | Subject code | Part | Course | Subjects | Hrs/ week | Credit | Int. marks | Ext. mark | Tot. mark |
|---|---|---|---|---|---|---|---|---|---|
| V | 23U5BCC05 | III | Core-V | Cell Biology | 5 | 4 | 25 | 75 | 100 |
| | 23U5BCC06 | III | Core-VI | Nutritional Biochemistry | 4 | 4 | 25 | 75 | 100 |
| | 23U5BCC07 | III | Core-VII | Clinical Biochemistry | 5 | 5 | 25 | 75 | 100 |
| | 23U5BCCP05 | III | Practical | Core Practical V (6 Hours) | 5 | 4 | 40 | 60 | 100 |
| | 23U5BCCP06 | III | Practical | Core Practical VI (6 Hours) | 5 | 3 | 40 | 60 | 100 |
| | 23U5BCDE05 | IV | Elective | Bioinformatics for Beginners | 4 | 3 | 25 | 75 | 100 |
| | 23U5BCDE06 | | | Plant Biochemistry and Plant therapeutics | | | | | |
| | 23U5BCS01 | IV | SBEC | Biostatistics | 2 | 2 | 25 | 75 | 100 |
| | 23U5INT01 | | | Internship Training | | | | | |
| | | | | **Total** | **30** | **25** | **205** | **495** | **700** |
| **Sem** | **Subject code** | **Part** | **Course** | **Subjects** | **Hrs/ week** | **Credit** | **Int. marks** | **Ext. mark** | **Tot. mark** |
| VI | 23U6BCC08 | III | Core-VII | MolecularBiology | 5 | 4 | 25 | 75 | 100 |
| | 23U6BCC09 | III | Core-IX | HumanPhysiology | 5 | 4 | 25 | 75 | 100 |
| | 23U6BCC10 | III | Core-X | Immunology | 5 | 4 | 25 | 75 | 100 |
| | 23U6BCCP07 | III | Practical | Core Practical VII (6 Hours) | 5 | 3 | 40 | 60 | 100 |
| | 23U6BCCP08 | III | Practical | Core Practical VIII (6 Hours) | 5 | 3 | 40 | 60 | 100 |
| | 23U6BCDE07 | IV | Elective | Basics of Forensic Science | 3 | 3 | 25 | 75 | 100 |
| | 23U6BCDE08 | | | Pepetide Technology | | | | | |
| | 23U6BCPR1 | IV | Project | Mini Project | | 1 | 40 | 60 | 100 |
| | 23U6BCS02 | IV | SBEC | Medical Coding | 2 | 1 | 25 | 75 | 100 |
| | | - | - | Extension Activity | | 1 | | | |
| | | | | **Total** | **30** | **24** | **205** | **495** | **700** |
| | | | | **OVERALL TOTAL** | **180** | **140** | **1330** | **3270** | **4600** |

# BIOMOLECULES

| | | | |
|---|---|---|---|
| Paper | : Core I | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U1BCC01** | External | : 75 |

**LEARNING OBJECTIVES**

The main objectives of this course are to:

- Introduce the structure, properties and biological significance of carbohydrates
- Comprehend the classification, functions and acid base properties of amino acids
- Elucidate the various levels of organization of Proteins.
- Impart knowledge on the classification, properties and characterization of lipids.
- Acquaint with the classification, structure, properties and functions of nucleic acids

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Classify,illustratethestructureandexplainthephysicalandchemicalproperties of carbohydrates | K1 |
| **CO2** | Indicate the classification, structure, properties and biological functions of aminoacids. | K2 |
| **CO3** | Explain the classification and elucidate the different levels of structural organization | K2 |
| **CO4** | Elaborate on classification, structure, properties, functions and characterization of lipids | K3 |
| **CO5** | Describe the structure, properties and functions of different types of nucleic acids | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit- I** **12 Hours**

Carbohydrates- Classification and biological significance, physical properties- stereoisomerism,opticalisomerism,anomers,epimers and mutarotation. Monosaccharides: Occurrence, linearand cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and ketogroups.

Disaccharides: Structure and properties of reducing disaccharides(lactoseandmannose), non-reducing disaccharide (sucrose).

Polysaccharides: Homopolysaccharides-Occurrence, structure and biological significance of starch, glycogen and cellulose. Hetero polysaccharides-Structure and biological significance of mucopolysaccharides-hyaluronic acid,chondroitin sulphate and heparin.(Structural elucidation not needed).

**Unit- II** **12 Hours**

Aminoacids-Classification based on composition of sidechain and nutritional significance.General structure of amino acids. 3- and 1- letterabbreviations.Modified amino acidsin protein non- protein amino acids. Physical propertiesof amino acids, isoelectric point, titrationcurve (alanine,lysine,glutamic acid),optical activity. Chemical reactions due to carboxyl group,aminogroup and sidechains. Colour reactions of aminoacids.

**Unit -III:** **12 Hours**

Proteins-Classification basedon shape,composition,solubility and functions.Properties of proteins – Ampholytes, isoelectric point, salting in and salting out, denaturation and renaturation,UVabsorption.Levels of Organization of protein structure-Primarystructure Formation and characteristics of peptide bond, phi and psi angle, Secondary structure-α helix (eggalbumin), β- pleated sheath (keratin), triple helix (collagen). Tertiary structure– with reference to myoglobin.Quaternary structure with reference to haemoglobin.

**Unit -IV :** **12 Hours**

Lipids- Lipids: Bloor's classification, chemical nature and biological functions. Fattyacids:classification,nomenclature,structure and properties of fattyacids.Simple and mixed triglycerides: structure and general properties, Characterization of fats- iodine value, saponification value,acid number,acetyl number,polensky number,Reichert–Meissl number along with their significance. Compound lipids- Structure and functions of phospholipids and glycolipids. Derived lipids-Structure and functions of cholesterol,bile acids and bile salt

**Unit -V :** **12 Hours**

Nucleicacids-Structure of purine and pyrimidine bases,nucleosides and nucleotides and their biological importance. Types of DNA:A, B, C, Z DNA, structure and biological significance,superhelicity.Types of RNA:mRNA,tRNA,rRNA,hnRNA, snRNA,Secondary and tertiary structure of tRNA.Properties of DNA-Hypochromicand hyperchromic effect,melting temperature,viscosity. Denaturation and annealing.

**TEXT BOOKS:**

1. Biochemistry, U.Sathyanarayana&U.Chakrapani, 2013, 5thedition Elsevier India Pvt. Ltd., Books & Allied Pvt.Ltd.

2. Fundamentals of Biochemistry, J.L.Jain, Sunjay Jain, Nitin Jain, 2013, 7thedition S.Chand&CompanyLtd.

3.Text book of Medical Biochemistry, MNChatterjea, Rana Shinde, 2002, 8thedition, Jaypee Brothers.

**REFERENCE BOOKS**

1.David L.Nelson, Michael M.Cox, 2005, Principles of Biochemistry, 4thedition W.H. Freeman and Company.

2.Voet. D, Voet.J.G. and Pratt, C.W, 2004, Principles of Biochemistry, 4thedition John Wiley & Sons, Inc.

3.Zubay G.L, et.al, 1995, Principles of Biochemistry, 1stedition, Wm C. Brown Publishers.

**WEBRESOURCES**

https://www.britannica.com/science/biomoleculehttps://en.wikipedia.org/wiki/Biomoleculehttps://w ww.khanacademy.org/science/biology/macromolecules

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

## BIOLOGICAL CHEMISTRY

| | | | |
|---|---|---|---|
| Paper | : III | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U2BCGE02** | External | : 75 |

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Comprehend the importance of Chemistry and Biochemistry through the concept of acids and bases, and chemical bonding. | K1 |
| **CO2** | Demonstrates the formation of different types of solutions, concentrations of solution sand preparation of buffer solutions | K2 |
| **CO3** | Recall the Structure, Classification, Chemistry and Properties of Carbohydrates and Explain Various Biochemical Cycles involved in Carbohydrate Metabolism. | K2 |
| **CO4** | Recall the Structure, Classification, Chemistry and Properties of Lipids, Nucleic acid and Explain Various Biochemical Cycles involved in Fatty acid and Nucleic acid Metabolism. | K3 |
| **CO5** | Understand the Structure, Classification, Chemistry and Properties of proteins amino acids and Identify and explain nutrients in foods and the specific functions in maintaining health. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit- I** **12 Hours**

Atomic theory, formation of molecules, electronic configuration of atoms- s & p shapes of atomic orbitals. Types of chemical bonds. Classification of organic compounds - Hybridization in methane, ethane, acetylene, and benzene. Definition with examples- electrophiles, nucleophiles

**Unit-II** **12 Hours**

Acids & Bases properties and differences, Concepts of acids and bases . Concentration of solution, ways of expressing concentrations of solutions – per cent by weight, normality, molarity, molality, mole fraction. pH of solution, pH scale, measurement of pH. Buffer solutions, properties of buffers, Henderson-Hasselbalch equation.

**Unit-III** **12 Hours**

Importance to Biochemistry-the chemical foundation of life- buffering action in biological system. Classification of carbohydrates. Properties of carbohydrates. Ring structure of sugars and conformations of sugars. Metabolism of Carbohydrates – Glycogenesis, Glycogenolysis, Glycolysis, TCA cycle, bioenergetics of carbohydrate metabolism.

**Unit-IV** **12 Hours**

Classification of Lipids. Characteristics, Properties and Biological importance of lipids. Metabolism of Fatty acids, phospholipids, cholesterol. B-oxidation of fatty acids. Classification of nucleic acids. Purine and Pyrimidine bases. Classification of DNA & RNA.

**Unit-V** **12 Hours**

Classification and structure of amino acids. Structural conformation of proteins. Classification of proteins. Properties and biological importance of amino acids and proteins. Vitamins (Biological functions, daily requirements, deficiency symptoms and diseases-Structure not required) and Hormones. ATP production. Oxidative phosphorylation, ETC.

**TEXT BOOKS**


- P.L. Soni , A Text-book of Inorganic Chemistry, 11th Edition, S. Chand & Sons publications
- Abhilasha Shourie, Shilpa S, Chapadgoankar& Anamika Singh (2020) Textbook of Biochemistry 1st Edition
- J.L. Jain, 2016, Fundamentals of Biochemistry, S. Chand publication, 7th edition.
- A.C. Deb, 2016, Fundamentals of Biochemistry, New central book agencies, 7th edition.
- Satyanarayana .U, 2016, Biochemistry, MJ publishers 3rd edition (2006).

**REFERENCE BOOKS**


- Lehninger (2013) Principles of Biochemistrty 4th edition WH Freeman and Company NY
- Murray et al., (2003) Harper‟s biochemistry 26th edition Appleton and Lange Publishers Florida USA
- Geoffrey L. Zubay, William W. Parson, Dennis E. Vance, 1995, Principles of Biochemistry, W.C. Brown Publishers, 1995, 3rd edition.
- Lubert Stryer (2007) Biochemistry –Stanford University 5th Edition-W H Freemann and company San Francisco
- Bahl Arun, Bahl B. S. (2016), A Textbook of Organic Chemistry, 22nd Edition, S. Chand & Sons publications


**WEB RESOURCES**


http/dwb4.unl.edu/chem869p/chem869plinks/s

www.longwood.edu/staff/buckalewdw/C3%20Biomolecules.pp

https://www.britannica.com › science › biochemistry

https://]ww.sciencedirect.com › topics › agricultural-and-biological-sciences

https://biochemistry.org › education › careers › becoming-a-bioscientist › w

# BASIC AND CLINICAL BIOCHEMISTRY

| | | | |
|---|---|---|---|
| Paper | : I | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U1BCGE01** | External | : 75 |

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Explain the structure, classification , biochemical functions and significance of carbohydrates and lipids | K1 |
| **CO2** | Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation. | K2 |
| **CO3** | Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism. | K2 |
| **CO4** | Discuss and evaluate the pathology of aminoacid metabolic disorders. | K3 |
| **CO5** | Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit- I** **12 Hours**

Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex).

**Unit-II** **12 Hours**

Amino acids – General properties, functions, classification and biological significance. Proteins–Properties, functions, classification, Structural organization and biological significance.

**Unit-III** **12 Hours**

Disorders of carbohydrate metabolism: diabetes mellitus, hyperglycemia ,hypoglycemia, galactosemia, Disorders of lipid metabolism hyperlipidemia, hypercholesterolemia, Hypertriglyceridemia, Lipid Storage Diseases

**Unit-IV** **12 Hours**

Disorders of amino acid metabolism: Alkaptonuria, phenylketonuria, Tyrosinemia, Albinism, Maple Syrup Disease.

**Unit-V** **12 Hours**

Evaluation of organ function tests: Assessment and clinical manifestations of Renal function test, Liver function test, Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine amino transferase, creatine kinase.

**TEXT BOOKS**


- Satyanarayana, U. and Chakrapani, U(2014).Biochemistry,4th Edition, Made Simple Publisher.
- Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company.
- AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd.
- Vasudevan. D.M.Sreekumari.S, Kannan Vaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers
- Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015). Biochemistry, 8th edition. WH Freeman publisher.


**REFERENCE BOOKS**


- AmitKessel&Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2nd Edition, Chapman and Hall.
- David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY.
- LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9th Edition ,W.H.Freeman& Co. New York.
- Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.
- Joy PP, Surya S. and AswathyC (2015). Laboratory Manual of Biochemistry, Edition 1.,Publisher:Kerala agricultural university.


**WEB RESOURCES**

- https://www.abebooks.com › plp
- https://kau.in/document/laboratory-manual-biochemistry
- https://www.medicalnewstoday.com
- https://journals.indexcopernicus.com

# ENZYMES

| | | | |
|---|---|---|---|
| Paper | : Core II | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U2BCC02** | External | : 75 |

**LEARNING OBJECTIVES**

The main objectives of this course are to

- Provide fundamental knowledge on enzymes and their properties.
- Understand the mechanism of action of enzymes and the role of coenzymes in catalysis.
- Introduce the kinetics of enzymes and determine the Km and Vmax.
- Explain the effect of inhibitors on enzyme activity
- Understand the role of enzymes in clinical diagnosis and industries.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Identify the major classes of enzymes, differentiate between a chemical catalyst and a biocatalyst and define the units of enzymes. | K1 |
| **CO2** | Explain the mechanism of enzyme catalysis and the role of coenzymes in enzyme action. | K2 |
| **CO3** | Illustrate the steady state kinetics, interpret MM plot and LB plot based on kinetics data, and determine Km and Vmax. | K2 |
| **CO4** | Distinguish the types of inhibition along with its importance in biochemical reactions | K3 |
| **CO5** | Comprehend the various methods for production of immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**Unit- I** **12 Hours**

Introduction to enzymes: Nomenclature and Classification based on IUB with examples, enzyme as catalyst-Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities. Concept of Active site, Lock and key hypothesis and induced fit theory, Enzyme expression Units-IU, turnover number, katal and specific activity.

**Unit- II** **12 Hours**

Mechanism of enzyme catalysis – Acid Base catalysis, covalent catalysis, electro static catalysis, metal ion catalysis, proximity and orientation effect. Coenzymes -Definition, types, co-enzymatic forms of vitamins- NAD/NADP, FAD, FMN, Coenzyme A TPP, PLP, lipoic acid and biotin. Multienzyme complexes - Pyruvate dehydrogenase complex. Isoenzyme with reference to LDH and CK.

**Unit- III** **12 Hours**

Enzyme kinetics --Definition of kinetics, Factors affecting enzyme activity - temperature, pH, substrate and enzyme concentration, activators-cofactors, Derivation of Michaelis-Menton equation for unisubstrate reactions , Lineweaver - Burk plot, Eadie –Hofstee plot Significance of Km and V max and their determination using the plots

**Unit- IV** **12 Hours**

Enzyme inhibition - Reversible and irreversible inhibition - types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot, (Kinetic derivations not required), Determination of Km and Vmax in the presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positive and negative modulators.

**Unit-V** **12 Hours**

Applications of enzymes -Immobilized enzymes - methods of immobilization- adsorption, covalent bonding, cross linking, encapsulation, entrapment and applications of immobilized enzymes. Biosensors – e.g. Glucose sensors. Industrial applications of enzymes – Food, textile and pharmaceutical industries.

**TEXT BOOKS**

1. U.Sathyanarayana & U. Chakrapani, 2013, Biochemistry, 4 th edition, Elsevier India Pvt. Ltd., Books & Allied Pvt. Ltd. 2. Dr. G.R Agarwal, Dr. Kiran Agarwal & O.P. Agarwal, 2015, 2.Textbook of Biochemistry (Physiological chemistry), 18thedition, Goel Publishing House,

3. T. Devasena, 2010, Enzymology, 1 stedition, Oxford University Press.

**REFERENCE BOOKS**

1. Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, 2 nd edition, East West Press Pvt.Ltd. Page 60 of 116

2. David L. Nelson, Michael M. Cox, 2005, Principles of Biochemistry, 4 thedition W.H. Freeman and Company,

3. Voet. D, Voet.J. G.and Pratt, C.W, 2004, Principles of Biochemistry, 4th edition JohnWiley & Sons,Inc.

4. Zubay G.L, et.al., 1995, Principles of Biochemistry, 1 stedition, Wm C.Brown Publishers.

**WEB RESOURCES**

www.biologydiscussion.com/notes/enzymesnoteshttps://www.britannica.com/science/protein/Themechanism-of-enzymatic-ctionhttps://www.youtube.com/watch?v=oVJ2LJxO6tU

**YEAR I – SEMESTER I**
**CORE PRACTICAL I**

| | | | |
|---|---|---|---|
| Paper | : Core Practical I | Total Hours | : 75 |
| Hours/Week | : 3 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U1BCCP01** | External | : 60 |

**Learning Objectives**

The main objectives of this course are to

- Identify the biomolecules carbohydrates and amino acids by qualitative test
- Determine the quality of Lipids by titrimetric methods
- Isolate nucleic acids from plant and animal source

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | S | M | S | L | L | M | S | M | M | M | M | M |
| CO2 | S | M | M | S | M | S | M | L | S | M | M | L | L | L | L |
| CO3 | S | S | L | M | S | M | M | L | S | M | M | L | L | L | L |

S- Strong; M-Medium; L-Low

I) Qualitative test

**1) Carbohydrates**

a) Glucose b) Fructose c) Arabinose d) Maltose e) Sucrose f) Lactose g)Starch

**2) Amino acids**

a) Arginine b) Cysteine c) Histidine d) Proline e) Tryptophan f) Tyrosine g) Methionine

**II) Titrimetric methods**

1) Determination of Saponification value of edible oil
2) Determination of Iodine number of edible oil
3) Determination of Acid number of edible oil

**III) Group Experiments**

1) Isolation of DNA from plant/animal source.
2) Isolation of RNA from rich source.

**TEXT BOOKS**

1. David T Plummer, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-HillEdition

2. J. Jayaraman Laboratory Manual in Biochemistry New Age International (P) Limited Fifthedition 2015

3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher'sthird edition 2018

**REFERENCE BOOKS**

1. Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on Biochemistry Everest publishing house1stEdition, 2019

2. Introductory practical Biochemistry – S.K. Sawhney, Randhir Singh, 2nded, 2005.

3. Biochemical Tests – Principles and Protocols. Anil Kumar, Sarika Garg and Neha Garg.VinodVasishtha Viva Books Pvt Ltd, 2012.

4. Harold Varley, Practical Clinical Biochemistry, CBS. 6thedition, 2006.

5. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4thedition, Cambridge University press, Britain.1995.

**WEB RESOURCES**

1. https://www.pdfdrive.com/instant-notes-analytical-chemistry-e912659.html 14

2. https://www.pdfdrive.com/analytical-biochemistry-e46164604.html

3. https://www.pdfdrive.com/biochemistry-books.html

## YEAR I – SEMESTER II
### Core Practical II

| | | | |
|---|---|---|---|
| Paper | : Core Practical II | Total Hours | : 75 |
| Hours/Week | : 3 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U2BCCP02** | External | : 60 |

**LEARNING OBJECTIVES**

**The main objectives of this course are to**

- Learn the parts of microscope
- Investigate the cells under microscope.
- Image the cells using different stains
- Identify the cells, organelles and stages of cell division
- Identify the spotters

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | S | M | S | L | L | M | S | M | M | M | M | M |
| CO2 | S | M | M | S | M | S | M | L | S | M | M | L | L | L | L |
| CO3 | S | S | L | M | S | M | M | L | S | M | M | L | L | L | L |

S- Strong; M-Medium; L-Low

**I MICROSCOPY AND STAINING TECHNIQUES**

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. Staining and visualization of mitochondria by Janus green stain

**II GROUP EXPERIMENT**

7. Identification of different stages of mitosis in onion root tip
8. Identification of different stages of meiosis in onion bulb

**III SPOTTERS**

9. a) Cells: Nerve, plant and Animal cell

b) Organelles: Mitochondria, Chloroplast, Endoplasmic reticulum

c) Mitosis stages: Prophase, Anaphase, Metaphase, Telophase.

**TEXT BOOKS**

1. Rickwood, D and J.R.Harris Cell Biology: Essential Techniques, John wikey1996.

2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.

3. Ganesh M.K.and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2ndEdn.

**REFERENCE BOOKS**

1. Essential practical handbook of Cell biology ,Genetics and Microbiology - A Practical manualDebarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017

2. Cell biology Practical, Dr. Venu gupta ISBN8193651219, Prestige publisher, 1st Jan 2018.

3. Cell and Molecular biology, De Robertis, 8th edition, 1st June, 1987

**WEB RESOURCES**

1. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

2. https://www.microscopemaster.com/organelles.html

3. https://www.pdfdrive.com/biochemistry-books.htm

4.http://medcell.med.yale.edu/histology/cell_lab.php#:~:text=The%20electron%20microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.

5. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

# INTERMEDIARY METABOLISM

| | | | |
|---|---|---|---|
| Paper | : III | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U3BCC03** | External | : 75 |

**OBJECTIVES**

The main objectives of this course are to

- Review the basic concepts of free energy transformation and describe biological oxidation.
- Illustrate the pathways of carbohydrate metabolism.
- Explain the pathways of oxidation and biosynthesis of lipids.
- Detail the catabolism of amino acids and synthesis of specialized products from amino acids.
- Acquaint the metabolism of nucleic acids and its regulation

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | State the concepts of bioenergetics and illustrate the mechanism of flow of electrons and the production of ATP | K1 |
| **CO2** | Elaborate the biochemical reactions and integration of pathways of carbohydrate metabolism. | K2 |
| **CO3** | Sketch the oxidation and biosynthesis of fatty acids, phospholipids, triglycerides and cholesterol with suitable examples | K2 |
| **CO4** | Explain catabolism of amino acids, synthesis of nonessential amino acids and specialized products from amino acids. | K3 |
| **CO5** | Describe the metabolism of nucleic acids with necessary illustrations and its regulation | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **12 Hours**

Bioenergetics-High energy compounds: Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADP cycle. Biological Oxidation: Electron transport chain -its organization and function. Inhibitors of ETC. Oxidative phosphorylation, P/O ratio, Peter Mitchell's chemiosmotic hypothesis. Mechanism of ATP synthesis, uncouplers of oxidative phosphorylation, substrate level phosphorylation with examples

**UNIT II** **12 Hours**

Metabolism of carbohydrates - Glycolysis, TCA Cycle, Amphibolic nature and integrating role of TCA cycle. Anaplerosis, Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis and its regulation, glyoxylate cycle, Entner-Duodoroff pathway and Cori cycle

**UNIT III** **12 Hours**

Metabolism of lipids -Oxidation of fatty acids - α, β and ω -oxidation ofsaturated fatty acids, Oxidation of fatty acids with odd number of carbon atoms andunsaturated fatty acids, Ketogenesis, Biosynthesis of saturated fatty acids and unsaturatedfatty acids, Biosynthesis and degradation of triglycerides, phospholipids and cholesterol.

**UNIT IV** **12 Hours**

Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle and its regulation

**UNIT V** **12 Hours**

Metabolism of nucleotides-Biosynthesis of purines and pyrimidines, - denovo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide.

**TEXT BOOKS**

1. U.Sathyanarayana & U.Chakrapani, 2015, Biochemistry, 4 th Elsevier India Pvt.Ltd.,

2. M.N. Chatterjea and Rana Shinde, 2002, Text book of Medical Biochemistry, 5 th edition Jaypee Brothers Medical Publishers Pvt. Ltd.

**REFERENCE BOOKS**

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M.Cox, 2008, 5 thedition, W.H.Freeman and Company.

2. Robert K.Murray, Daryl K.Granner, Victor W. Rodwell, 2006, Harper's Illustrated Biochemistry, 27th edition, McGraw Hill Publishers.

3. Principles of Biochemistry Voet.D, Voet. J.G, and Pratt C.W., 2010, 4 th edition, JohnWiley & Sons, Inc,. Page 63 of 116

4. Principles of Biochemistry, Geoffrey L. Zubay, William W. Parson, Dennis E.Vance, 1995, 2 nd Edition, Wm.C. Brown Publishers.

5. Biochemistry, Garret, R. H. and Grisham, C. M. 2005, 3 rd Edition. Thomson Learning INC.

**WEB RESOURCES**

1.https://nptel.ac.in/courses/104/105/104105102/

2.http://www.nptelvideos.in/2012/11/biochemistry-i.html

3.https://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes _ ch15_metabolism_current-v2.0.pdf

## MEDICAL LABORATORY TECHNOLOGY

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U3BCDE01** | External | : 75 |

**LEARNING OBJECTIVES**

The main objectives of this course are to

- Impart knowledge on specimen collection and disposal of waste.
- Acquaint knowledge on collection, preservation and transfusion of blood.
- Quantify the biomolecules in biological sample
- Understand the significance of various tests and their interpretation in diseased conditions
- Acquaint knowledge on enzymes, hormones and Immunoglobulins as markers for diagnosis.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Collect & preserve of biological samples. | K2,K1 |
| **CO2** | Estimate the various constituents in biological sample | K3 |
| **CO3** | Perform the routine procedures adopted in blood bank | K2 |
| **CO4** | Analyze and interpret the values for both normal and disease conditions. | K2 |
| **CO5** | Assay the enzymes and hormones &interpret clinical implications | K2 |

- **Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **6Hrs**

Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste – Noninfectious waste, biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines.

**Unit II** **6Hrs**

Determination of Blood group and Rh factor -Basic blood banking procedures- crossmatching, screening test. Blood transfusion and hazards. Hematology: blood, Haemoglobin, Differential countPCV, ESR, RBC, WBC and Platelet count. Fully automated and Semiautomated Analyser

**Unit III** **6Hrs**

Estimation of blood sugar – Enzymatic method, HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral, vitamin and CSF analysis.

**Unit III** **6Hrs**

Immunodiagnostics -Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA, Skin test – Montaux and Lepramin test.

**Unit V** **6Hrs**

Assay of clinically important enzymes- Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance.

**Text Books**

1 Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IV Th edition,Vol I,2022

2. Ramnik Sood, Text Book of Medical Laboratory Technology, Jaypee Publishers, 2006

3. Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th edition, W.B. Saunders Company

**Web Resources**

1. https://www.youtube.com/watch?v=QNYlX5Ne9lQ
2. https://www.slideshare.net/doctorrao/ agglutination-tests-and-immunoassys
3. https://microbenotes.com/introduction-to-precipitation-reaction/

## BIOENTREPRENEURSHIP

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U3BCDE02** | External | : 75 |

**LEARNING OBJECTIVES**

Impart knowledge on bio entrepreneurship and the types of industries

- Learn about business plan, proposal and funding agencies
- Understand the market strategy and the role of information technology in expansion of business
- Provide insights on legal requirement and accounting to establish as Bio entrepreneurship
- Familiarize about business bio incubators centres

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Understand the concept and scope for entrepreneurship | K2,K1 |
| **CO2** | Identify various operations involved in a venture creation | K3 |
| **CO3** | Gather funding and launching a winning business | K2 |
| **CO4** | Nurture the organization and harvest the rewards | K2 |
| **CO5** | Illustrate about the Business incubator centres and Bio entrepreneurship | K2 |

- **Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **6Hrs**

Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks, Copyrights and patents

**Unit II** **6Hrs**

Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability.

**Unit III** **6Hrs**

Market Strategy- Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market; Introduction to information technology for business administration and Expansion.

**Unit IV** **6Hrs**

Legal Requirements, Finance and Accounting; Registration of company in India; Ministry of Corporate Affairs (MCA); basics in accounting: introduction to concepts of balance sheet, profit and loss statement, double entry, bookkeeping; finance and break-even analysis; difficulties of entrepreneurship in India

**Unit V** **6Hrs**

Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development; quality control and quality assurance; Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP.

**TEXT BOOKS**

1. Adams, D. J. (2008). Enterprise for life scientists: Developing innovation and entrepreneurship in the biosciences. Bloxham: Scion - ISBN 10: 1904842364 / ISBN 13: 9781904842361

2. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303 3. Onetti, A (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 1138616907 / ISBN 13: 9781138616905

4. Kapeleris, D. H. (2006). Innovation and entrepreneurship in biotechnology: Concepts, theories & cases - ISBN-13: 978-1482210125, ISBN-10: 1482210126

**REFERENCE BOOKS**

1. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management New Himalaya. New Himalaya House Delhi:pub - ISBN : 9789350440810 9350440814

2. Ono, R. D. (1991). The Business of Biotechnology, From the Bench of the Street. ButterworthHeinemann - ISBN 10: 1138616907 / ISBN 13: 9781138616905

3. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press - ISBN-10 : 812243049X ,ISBN-13 : 978-8122430493

**WEB SOURCES**

1. http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/
2.https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-ntroductionto-entrepreneurship/

## HEALTH AND HYGIENE

| | | | |
|---|---|---|---|
| Paper | : **NMEC I** | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U3BCN01** | External | : 75 |

**Aim**

- Learn the functions of biomolecules.
- Understand the physiological changes of various diseases.
- Know about the nutritional requirements and dietary management of the diseases.

**Objectives:**

Explain about the sources, function of carbohydrates and disorders of carbohydrate metabolismand
Expound the dietary sources, recommended daily allowance and over consumption of minerals

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Gain an appreciation and knowledge of how to deal with health . | K1 & K2 |
| **CO2** | To understand the importance of personal health and hygien | K1 & K2 |
| **CO3** | Provide comprehensive personal hygiene based on accepted scientific theories and research within the scope of accepted | K1,K2& k3 |
| **CO4** | Illustrate the awareness of personal hygiene and its applications | K1 & K2 |
| **CO5** | Ability to apply the knowledge in their day to day life | K1 & K2 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | S | M | M | M | M | L | S | L | M | S | M | L |
| CO2 | L | M | M | S | L | L | L | M | M | S | S | M | L | S | M |
| CO3 | S | M | M | M | M | S | L | M | S | L | L | M | L | S | M |
| CO4 | S | M | L | M | S | M | L | M | S | S | L | M | L | M | M |
| CO5 | S | L | M | M | M | S | S | L | S | M | L | L | S | M | S |

S- Strong; M-Medium; L-Low

**UNIT I** **6 Hrs**

Overview- Introduction , General health, Signs of good health, Personal Hygiene, Hygiene specificities, Handling common Illnesses, Choosing a doctor.

**UNIT II** **6 Hrs**

Nutrition and Health – Definition of Food and Nutrition. Nutrients – Sources and functions of Proteins, fats, carbohydrates, vitamins and minerals. Balanced Diet.Nutritional Profile of

principle foods – Cereals, Millets, Vegetables, Fruits, Milk, and Milk products, Fish, meat, alcoholic beverages, egg and soft drink.

**UNIT III** **6 Hrs**

Maternal and child Health-Mother and child-Intra natal and Post natal care.Complications of post portal period, restoration of mother to optimum health.Breast feeding; Family planning methods –definition, Natural methods andArtificial methods.

**UNIT IV** **6 Hrs**

Dental Health – Tooth development, Developmental tooth anomalies , Promotion of Oral health, Viral infections, Oral ulcerations, Dental caries – Diagnostic methods, Non- surgical management and prevention.

**UNIT V** **6 Hrs**

Mental Health – Strategies of Stress Management: Prevention of stress Challenging Stressful Thinking; Problem Solving; Emotional and cognitive coping styles. Types and causes of mental illness – Preventive aspects;Alcoholism, Drug dependence – Commonly abused drugs.

**TEXT BOOKS**

1. **Ahmed. M. N**., Hygiene and health, Anmol publications, New Delhi, 15th edi., 2011.
2. **Ashtekar. S.,**Health and Healing –A Manual of Primary health care, Orient Longmans publishers. 2010.
3. **Park. K.,**Social and preventive medicine, Bhanot publishers, Japalpur, 18thedition, 2017.

**REFERENCE BOOKS**

1. **Patil. R.S.,**Practical Community Health, Vora medical publishers, New Delhi, 3st edi 2010.
2. **Prabhakara. G. N.,**Preventive and social medicine, Jaypee Publications., New Delhi, 1st edi, 2010.
3. **Sridhar Rao. B.,** Community Health Nursing, A.I.T.B.S. Publishers, New Delhi, 3rdedi 2014,

Revised reprint 2009.

**WEB OF REFERENCE**

1.https://www.healthline.com/health/personal-hygiene
2.https://www.otsuka.co.jp/en/nutraceutical/about/nutrition/functions/
3.https://americanpregnancy.org/preventing-pregnancy/natural-family-planning/

## LIFE STYLE DISEASE

| | | | |
|---|---|---|---|
| Paper | : **NMEC II** | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U3BCN02** | External | : 75 |

**SUBJECT DESCRIPTION:**

The objectives of this course are to

- Create awareness on lifestyle diseases among adolescents.
- List out the lifestyle diseases.
- Explain the common lifestyle diseases and their prevention.
- Acquaint the disorders associated with women's health.
- Impart life skills so as to prevent life style diseases.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Define Life style diseases and describe the contributing factors | K1 |
| **CO2** | Enumerate the top life style Diseases and its impact on life | K1 |
| **CO3** | Elaborate the treatment and prevention measures of common lifestyle diseases. | K2 |
| **CO4** | Highlight the life style diseases that affects the women's health | K3 |
| **CO5** | Illustrate the various measures for prevention of life style diseases | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | S | M | M | M | M | L | S | L | M | S | M | L |
| CO2 | L | M | M | S | L | L | L | M | M | S | S | M | L | S | M |
| CO3 | S | M | M | M | M | S | L | M | S | L | L | M | L | S | M |
| CO4 | S | M | L | M | S | M | L | M | S | S | L | M | L | M | M |
| CO5 | S | L | M | M | M | S | S | L | S | M | L | L | S | M | S |

S- Strong; M-Medium; L-Low

**UNIT – I** **06 Hours**

Lifestyle diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation.

**UNIT – II** **06 Hours**

Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country.

**UNIT – III** **06 Hours**

Causes, symptoms, types, preventive measures and treatment of Obesity, cardio vascular diiseases, diabetes and cancer.

**UNIT – IV** **06 Hours**

Women's lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. Nutrition Counselling and Education

**UNIT – V** **06 Hours**

Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity, sleep-wake cycle, stress management and meditation.

**TEXT BOOKS**

1. James M R, Life style Medicine,2nd Edition, CRC Press,2013

2. Akira Miyazaki, New Frontiers in Life style-Related Disease, Springer,2008

**REFERENCE BOOKS**

1. Steyn K, Life style and related risk factors for chronic diseases

2. Willett W C, Prevention of chronic disease by means of diet and lifestyle.

3. Kumar M & R. Kumar,. Guide to prevention of lifestyle diseases. Deep & Deep publications

**WEB RESOURCES**

1. https://youtu.be/jDdL2bMQXfE

2. https://youtu.be/7WnpSB14nDM

3. https://youtu.be/ollz9MqtW-U

## YEAR II – SEMESTER III
## CORE PRACTICAL III

| | | | |
|---|---|---|---|
| Paper | : Core Practical III | Total Hours | : 75 |
| Hours/Week | : 3 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U3BCCP03** | External | : 60 |

**Learning objectives**

The objectives of this course are to

- Impart hands-on training in the estimation of various constituents by titrimetric method
- Prepare Biochemical preparations
- Determine the ash content and extraction of lipid

**TITRIMETRY**

1. Estimation of ascorbic acid in a citrus fruit.
2. Estimation of calcium in milk.
3. Estimation of glucose by Benedict's method in honey.
4. Estimation of phosphorous (Plant source)

**BIOCHEMICAL PREPARATIONS**

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.
6. Starch from potato.
7. Casein and Lactalbumin from milk.

**GROUP EXPERIMENT**

8. Determination of ash content and moisture content in food sample
9. Extraction of lipid by Soxhlet's method.

**Text books**

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,

2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGrawHill Publishing Company Limited, 2001.

**Reference books**

1. Biochemical Methods, Sadasivam S and Manickam A, 4 thedition, New Age InternationalPublishers, 2016

2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.

3. Bowman and Robert M. 2006. Present Knowledge in Nutrition. 9 thedition, International LifeSciences Publishers.

4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1 Stedition Jaypee Brothersmedical publishers.

5. Martha H.and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition.3rd edition. Chand Publishers.

**Web resources**

1. https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide- for-authors

2. http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf

3.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

4.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

# BIOCHEMICAL TECHNIQUES

| | | | |
|---|---|---|---|
| Paper | : Core IV | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U4BCC04** | External | : 75 |

**Learning objectives**

The objectives of this course are to

- Introduce the basic principles, types and applications of various sedimentation techniques.
- Provide an understanding of the underlying principles of chromatographic techniques
- Demonstrate experimental skills in various electrophoretic techniques.
- Appraise the use of colorimetric and spectroscopic techniques in biology
- Impart knowledge about the measurement of radioactivity and safety aspects of radioactiveisotopes.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Describe the basics of measurements and various biological buffer systems of blood | K1 |
| **CO2** | Demonstrate the principle, techniques and applications of chromatography | K2 |
| **CO3** | Explain the various electrophoresis and centrifugation techniques and their applications in Biochemistry | K3 |
| **CO4** | Categorize the colorimetry and Spectroscopic techniques for the assessment ofbiologicalSamples | K3 |
| **CO5** | Classify the radioactive tracer techniques and applications of radioisotopes | K2 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | M | L | L | L | M | S | M | L | L | M | L | L |
| CO2 | M | M | M | S | M | M | L | M | M | S | L | L | S | L | L |
| CO3 | M | M | M | S | M | M | L | M | M | S | L | L | S | L | L |
| CO4 | M | L | S | M | M | L | L | S | M | M | L | M | M | L | L |
| CO5 | L | L | M | M | S | S | S | M | L | L | S | S | L | M | M |

S- Strong; M-Medium; L-Low

**UNIT – I** **12 Hours**

Centrifugation - Basic principles, RCF, Sedimentation coefficient, Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, Rate zonal and Isopycnic techniques, construction, working and applications of analytical ultracentrifuge – Determination of molecular weight (Derivation excluded).

**UNIT – II** **12 Hours**

Chromatography - adsorption, partition. Principle, instrumentation and applications of paper chromatography, thin layer chromatography, ion-exchange chromatography, gel permeation chromatography and affinity chromatography. 9 Hrs

**UNIT – III** **12 Hours**

Electrophoresis – General principles, factors affecting electrophoretic mobility. Tiselius moving boundary electrophoresis. Electrophoresis with paper and starch. Principle, instrumentation and applications of agarose gel electrophoresis and SDS-PAGE. 9 Hrs

**UNIT – IV** **12 Hours**

Basics of Electromagnetic radiations - Energy, wavelength, wave number and frequency. Absorption and emission spectra, Lambert – Beer Law, Light absorption and transmittance. Colorimetry - Principle, instrumentation and applications. Visible and UV spectrophotometry – Principle, instrumentation and applications –enzyme assay, structural studies of proteins and nucleic acids.

**UNIT – V** **12 Hours**

Radioactivity - Types of Radioactive decay, half- life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger Muller Counter. Methods based upon excitation - Solid & Liquids scintillation counters. Autoradiography. Biological applications and safety aspects of radioisotopes.

**TEXT BOOKS**

1. Avinash Upadhyay, Kakoli Upadhyay&Nirmalendu Nath, 2002, Biophysical Chemistry,Principles and Techniques, 3rdedition, Himalaya Publishing House.

2. L.Veerakumari, 2009, Bioinstrumentation, 1stedition, MJP Publishers.

3. Keith Wilson & John Walker, 2000, Practical Biochemistry-Principles and techniques,

Cambridge University Press, 4thedition.

**REFERENCE BOOKS**

1. Terrance G. Cooper The tools of Biochemistry, 1977, John Wiley &Sons,Singapore.

2. Gurumani, Research Methodology for Biological Sciences, 2011, 1stedition, MJP Publishers.

3. Saroj Dua, Neera Garg, Biochemical Methods of Analysis, 2010, 1stedition, NarosaPublishing house.

**WEB RESOURCES**

1. https://www.britannica.com/science/chromatography

2.https://www.youtube.com/watch?v=xgxFBQZYXlE

3.https://www.youtube.com/watch?v=7onjVBsQwQ8

## YEAR II – SEMESTER IV
### Core Practical IV

| | | | |
|---|---|---|---|
| Paper | : Core Practical IV | Total Hours | : 75 |
| Hours/Week | : 3 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U4BCCP04** | External | : 60 |

**Learning objectives**

The objectives of this course are to:

- Acquaint the students with colorimetric estimations of biomolecules.
- Equip skills on various separation techniques.
- Impart knowledge about the estimation of minerals and vitamins.

**Colorimetry**

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of DNA by Diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Estimation of Phosphorus by Fiske and Subbarow method.

**Chromatography**

1. Separation and identification of sugars and amino acids by paper chromatography.
2. Separation and identification of amino acids and lipids by thin layer chromatography.

**Demonstration**

1. Separation of serum and plasma from blood by centrifugation.
2. Separation of serum proteins by SDS-PAGE.

**TEXT BOOKS**

1. J. Jayaraman, Laboratory Manual in Biochemistry New Age International (P) LimitedFifth edition 2015.

2. S. Sadasivam A.Manickam Biochemical Methods Newage International Pvt Ltd publishers 3rd edition 2018.

3. Keith Wilson and John Walker Principles and techniques of Practical BiochemistryCambridge University Press2010, 7$^{th}$edition.

**REFERENCE BOOKS**

1. S. K. Sawhney and Randhir Singh, Introductory Practical Biochemistry. Alpha ScienceInternational, Ltd. 2nd edition, 2005.

2. David T.Plummer, 2001, An Introduction to Practical Biochemistry, 3 Rdedition, TataMcGraw- Hill publishing company limited.

3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBSPublishers and distributors, India Sixth Edition,1988.

**WEB RESOURCES**

https://www.pdfdrive.com/biochemistry-books.html

# FIRST AID

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U4BCDE03** | External | : 75 |

**LEARNING OBJECTIVES**

The main objectives of this course are to:

- Provide knowledge on the basics of first aid.
- Perform first aid during various respiratory issues.
- Demonstrate the first aid to treat injuries.
- Learn the first aid techniques to be given during emergency.
- Familiarize the first aid during poisoning.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Discuss on the rules of first aid, dealing during emergency and first aid techniques | K2,K1 |
| **CO2** | Understand the first aid techniques to be given during different types of respiratory problems | K3 |
| **CO3** | Provide first aid for injuries, shocks and bone injury | K2 |
| **CO4** | Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions | K2 |
| **CO5** | Gain expertise in giving first aid for insect bites and chemical poisoning | K2 |

- **Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **6Hrs**

Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.

**Unit II** **6Hrs**

Basics of Respiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma

**Unit III** **6Hrs**

Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones.

**Unit IV** **6Hrs**

First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy

**Unit V** **6Hrs**

First aid in poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant, acid and alkali poisoning

**TEXT BOOKS**

1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.Manjul Mungali 1SBN-978-93-92208-19-5

2) Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf

3) Red Cross First Aid/CPR/AED Instructor Manual

**WEB RESOURCES**

1)https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online

2)https://www.firstaidforfree.com/

# TISSUE CULTURE

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : **23U4BCDE04** | External | : 75 |

**LEARNING OBJECTIVES**

The main objectives of this course are to:

- Introduce the tools and techniques used in tissue culture technique.
- Acquire knowledge on preparation of growth medium for culture techniques.
- Impart knowledge on procedures involved gene transfer.
- Acquaint with the process of tissue culture technique.
- Understand the importance of plant and animal tissue culture for the production and evaluation of bioactive compounds

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Introduction to plant tissue culture | K2,K1 |
| **CO2** | Brief knowledge on preparation of tissue culture media | K3 |
| **CO3** | Understanding on different methods of gene transfer | K2 |
| **CO4** | Gain knowledgeon plant and animal cell culture techniques | K2 |
| **CO5** | Study of applications of genetically modified plants and animals | K2 |

- **Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **6Hrs**

Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques.

**Unit II** **6Hrs**

Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.

**Unit III** **6Hrs**

Methods of gene transfer in plants and animals - direct and indirect gene transfer methods.

**Unit IV** **6Hrs**

Cell culture technique - Explants selection, sterilization and inoculation.

**Unit V** **6Hrs**

Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview - Applications of animal cell culture

**TEXT BOOKS**


1. Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing Corporation.
2. Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.
3. Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.
4. Grierson and Covey, S.N.1988. Plant Molecular biology.Blackie.
5. Chawla, H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.


**REFERENCE BOOKS**


1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, arias Publications. 1995.

2.Stewart Jr., C.N., "Plant Biotechnology and Genetics: Principles, Techniques and Applications" Wiley-Interscience, 2008.

3.Freshney, R. I. (2010). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell, 2010.6th Edition.

4.Davis, J. M. (2008). Basic Cell Culture. Oxford University Press. New Delhi.

5.Davis, J. M. (2011).Animal Cell Culture.John Willy and Sons Ltd. USA.

6Freshmen R. I. (2005).Culture of Animal Cells.John Willy and Sons Ltd. USA.

7.Butler, M. (2004). Animal Cell Culture and Technology.Taylor and Francis.Keywork USA. 8.Verma, A. S. and Singh, A. (2014).Animal Biotechnology. Academic Press, ELSEVIER, USA


**WEB RESOURCES**

https://www.britannica.com/science/tissue-culture

https://en.wikipedia.org/wiki/Plant_tissue_culture

## BIOCHEMISTRY AND HEALTH

| | | | |
|---|---|---|---|
| Paper | NMEC III | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | :**23U4BCN03** | External | : 75 |

**Aim**

- Learn the functions of biomolecules.
- Understand the physiological changes of various diseases.
- Know about the nutritional requirements and dietary management of the diseases.

**Objectives:**

Explain about the sources, function of carbohydrates and disorders of carbohydrate metabolismand
Expound the dietary sources, recommended daily allowance and over consumption of minerals

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Familiarize about the definition, occurrence, and types of carbohydrates | K1 & K2 |
| **CO2** | Recall and understand the classification, chemistry and functions of aminoacids | K1 & K2 |
| **CO3** | Imbibe and interpret the definition, occurrence, and types of lipids | K1,K2& k3 |
| **CO4** | Evolve the physiological functions and significance of vitamins | K1 & K2 |
| **CO5** | Correlate the need of macro and micronutrients with the metabolic and physiological functions of the human body. | K1 & K2 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | S | M | M | M | M | L | S | L | M | S | M | L |
| CO2 | L | M | M | S | L | L | L | M | M | S | S | M | L | S | M |
| CO3 | S | M | M | M | M | S | L | M | S | L | L | M | L | S | M |
| CO4 | S | M | L | M | S | M | L | M | S | S | L | M | L | M | M |
| CO5 | S | L | M | M | M | S | S | L | S | M | L | L | S | M | S |

S- Strong; M-Medium; L-Low

**UNIT – I** **06 Hours**

**Carbohydrate:** Sources of carbohydrates, importance of carbohydrates in living organisms, Normal level of sugar in blood, factors influencing blood glucose, renal threshold value, Diabetes mellitus:- Types, Complications, management-monitoring methods of blood glucose level and GTT.

**UNIT – II** **06 Hours**

**Proteins:** Sources of proteins and amino acids, essential and non-essential aminoacids, Importance of proteins in living organisms, normal level of serum proteins, protein deficiency disorders:-Kwashiorkor and Marasmus.

**UNIT – III** **06 Hours**

**Lipids:** Sources of lipids, essential and non-essential fatty acids, importance of fats and lipids in living organism, role of lipoproteins in human body. Normal levels of cholesterol and TG. Disorders:- Hypertension and Atherosclerosis .

**UNIT – IV** **06 Hours**

**Vitamins:** Sources, RDA, importance, deficiency disorders of water soluble and fat soluble vitamins in humans.

**UNIT – V** **06 Hours**

**Minerals:** Sources, Biological importance and deficiency disorders of Na, K, Ca, Mg, P, Fe, Zn, Se and Iodine in humans.

**TEXT BOOK**

1. Deb.A.C., Fundamentals of Biochemistry, 10 th edition, 2011, New central book agency Pvt Ltd. 2. Biochemistry (2013) by U.Satyanarayana and U. Chakrapani, 4th edition, Elsevier.

3. Ambika Shanmugam's Biochemistry for Medical Students by K. Ramadevi, 8th Edition, Wolters kluvel

3. **Medical Biochemistry** (2005) 2nd ed., Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd. (Philadelphia), ISBN:0-7234-3341-0.

**REFERENCE BOOK**

1. Textbook of medical physiology by C. Guyton, John E. Hall.—12th ed, 2011, Saunders, an imprint of Elsevier Inc.

2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

**WEB OF REFERENCE**

1.https://www.webmd.com/diabetes/type-2-diabetes-guide/diagnosing-type-2-diabetes#1

2.https://www.healthline.com/nutrition/essential-amino-acids

3.https://www.ncbi.nlm.nih.gov/pubmed/1694933

**PEDOGOGY: CHALK and Talk , PPT, Seminar, Models**

## HEALTH AND NUTRITION

| | | | |
|---|---|---|---|
| Paper | NMEC IV | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | :**23U4BCN04** | External | : 75 |

**Objectives:**

Gain basic knowledge about health.

- Understand about vitamins.
- Learn about functions of fat on health.
- Understand the types of minerals and its functions
- Know about the importance of carbohydrates and proteins on health

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Understand about the importance of health and diet | K1 & K2 |
| **CO2** | Discuss about the classification properties and deficiencies of vitamins | K1 & K2 |
| **CO3** | Understand about sources and functions of fats and lipids on health | K1,K2& k3 |
| **CO4** | Detail about the different typed of minerals and its role in health | K1 & K2 |
| **CO5** | Relatetherole of proteins and carbohydrates on health | K1 & K2 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | S | M | M | M | M | L | S | L | M | S | M | L |
| CO2 | L | M | M | S | L | L | L | M | M | S | S | M | L | S | M |
| CO3 | S | M | M | M | M | S | L | M | S | L | L | M | L | S | M |
| CO4 | S | M | L | M | S | M | L | M | S | S | L | M | L | M | M |
| CO5 | S | L | M | M | M | S | S | L | S | M | L | L | S | M | S |

S- Strong; M-Medium; L-Low

**UNIT – I** **06 Hours**

Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value.

**UNIT – II** **06 Hours**

Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances.

**UNIT – III** **06 Hours**

Sources and functions of dietary fats, role of fats in health and diseases.

**UNIT – IV** **06 Hours**

Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc.

**UNIT – V** **06 Hours**

Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications.

**TEXT BOOKS**

1 S.Davidson and J.R.Passmore (1986) Human Nutrition and Dietetics, (8th ed), Churchill Livingstone

2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics (10th ed), Churchill Livingstone

3. M. Swaminathan (1995) Principles of Nutrition and Dietetics, Bappco

**REFERENCE BOOKS**

1. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall

**WEB RESOURCES**

1.https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages.

2. nhp.gov.in/healthyliving/healthydiet

3. www.anme.com.mx/libros/PrinciplesofNutrition.pdf

## YEAR II – SEMESTER IV

## SUSTAINABLE DEVELOPMENT GOALS

| | | | |
|---|---|---|---|
| Paper | : NMEC V | Total Hours | :30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 2 | Internal | : 25 |
| Paper Code | : 23U4BCN05 | External | : 75 |

**SUBJECT DESCRIPTION:**

The Sustainable development goals (SDGs) aim to transform the world. These goals are set to eradicate the poverty and inequality, protect the globe, confirm that all people of the world are in good health, justice and prosperity. SDGs represent a significant international step in fixing humanity on a trajectory towards sustainable development.

**OBJECTIVE:**

The SDGs are a set of 17 goals set up by the UN Assembly in the year 2015. With an aim to reach global peace and prosperity by 2030, significant issues like quality education, climate change, clean water and poverty are among the few that need considerable attention. On the completion of this course, participants will understand sustainable development and its related concepts. The will inspire participants on how they can make a difference in the mindset of Gen Next.

**COURSE OUTCOME:**

| **ɔurse No** | **Course Outcome** | **ıowledge Level** |
|---|---|---|
| **CO1** | Define and describe the need for sustainability, role of United Nations for SDGs | K1 & K2 |
| **CO2** | Explain the scope of SDGs, design for sustainability, learn about innovation | K2& K3 |
| **CO3** | Framework, structure and significance of first eight goals of SDGs | K3& K4 |
| **CO4** | Framework, structure and significance from eight to seventeenth goals of SDGs | K3& K4 |
| **CO5** | The connections between seventeen goals will be learnt | K5 |

**Mapping with Programme Outcomes**

| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PO13** | **PO14** | **PO15** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | L | M | S | S | M | S | M | M | M | S | S | S | L | M | M |
| **CO2** | S | M | S | S | S | L | M | S | S | M | S | L | S | M | M |
| **CO3** | M | S | L | M | M | S | S | L | M | S | M | M | M | S | S |
| **CO4** | S | S | S | M | M | M | S | M | M | M | M | M | S | S | S |
| **CO5** | S | S | M | M | M | S | L | M | M | L | M | S | M | L | M |

S- Strong; M-Medium; L-Low

## SYLLABUS

**UNIT – I Sustainable development** **6 Hours**

Definition, Aspects of sustainability, Origin and development of ideas and concepts of sustainable development and trends. Transition from MDGs to SDGs. The Role of UN and the Need for SDGs and Adoption by the World.

**UNIT-II** **6 Hours**

Scope and Inclusion and Agenda 2030, Our Common Future and Philosophy behind SDGs, Distinction between Development and Sustainable Development. Circular economy, Design for sustainability, Thinking Alternatives and Innovation.

**UNIT –III** **6 Hours**

Framework and Structuring of Seventeen SDGs. SDG 1: No Poverty, SDG 2: Zero Hunger, SDG 3: Good Health and Well-being, SDG 4: Quality Education, SDG 5: Gender Equality, SDG 6: Clean Water and Sanitation, SDG 7: Affordable and Clean Energy, SDG 8: Decent Work and Economic Growth

**UNIT – IV** **6 Hours**

Framework and Structuring of Seventeen SDGs. SDG 9: Industry, Innovation and Infrastructure, SDG 10: Reduced Inequality, SDG 11: Sustainable Cities and Communities, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 14: Life Below Water, SDG 15: Life on Land, SDG 16: Peace and Justice Strong Institutions, SDG 17: Partnerships to achieve the Goal,

**UNIT-V** **6 Hours**

Interrelationships and Connections between Seventeen SDGs, SDG Structure and Order at Levels of People, Ecological and Financing the SDGs and Global Funds, Implementation Planning, Capacity Building and Finance Nodal Agency for Implementation in India.

**REFERENCE**

**Text Book**


1. Rogers, Peter P., Kazi F. Jalal, and John A. Boyd. "An introduction to sustainable development." (2012).
2. Sachs, J. D. 2015. The Age of Sustainable Development. Columbia University Press, New York.


**Reference Book**


3. Dent, David, Olivier Dubois, and Barry Dalal-Clayton. Rural planning in developing countries: supporting natural resource management and sustainable livelihoods. Routledge, 2013.
4. Sala, Serenella, Biagio Ciuffo, and Peter Nijkamp. "A systemic framework for sustainability assessment." Ecological Economics 119 (2015): 314-325.


**Online Sources**


1. https://india.un.org/en/sdgs
2. https://unacademy.com/content/upsc/study-material/ncert-notes/sustainable-development-in-the-indian-context.
3. https://cdn.visionias.in/value_added_material/22352-sustainable-development.pdf
4. https://www.drishtiias.com/pdf/1594392281-sustainable-development-3.pdf


**PEDOGOGY: CHALK and Talk, PPT, Seminar, Models**

# CELL BIOLOGY

| | | | |
|---|---|---|---|
| Paper | : V | Total Hours | : 60 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U5BCC05** | External | : 75 |

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Provide basic understanding of architecture of cells and its organelles. | K1 |
| **CO2** | Understand the organization of prokaryotic and eukaryotic genome. | K2 |
| **CO3** | Educate on the structural organization of bio membrane and transport mechanism | K2 |
| **CO4** | Impart knowledge on cell cycle, cell division and basics of cells | K3 |
| **CO5** | Familiarize the concept of mechanism of cell-cell interactions. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **12 Hours**

Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultra-structure of nucleus, mitochondria, RER, SER, golgiapparatus, lysosome, peroxisome and their functions.

**UNIT II** **12 Hours**

Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome - prokaryotic and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure.Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.

**UNIT III** **12 Hours**

Biomembranes - Structural organization of bilipid layer model and basic functions transport across cell membranes- uniport, symport and antiport. Passive and active transport.

**UNIT IV** **12 Hours**

Cell cycle-Definition and Phases of Cell cycle-Celldivision-Mitosis and Meiosis and

its significance, Cancer cells- definition, types and characteristics of cancer cells.

**UNIT V** **12 Hours**

Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions - Typesgap junctions, tight junctions and Desmosomes.

**TEXT BOOKS**

1. Arumugam.N, CellBiology.Saras publication (10 th edition , paperback), 2019

2. Devasena.T.CellBiology.Oxford University Press India-ISBN: 9780198075516, 0198075510,
2012

3. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4”ed). Garland Science.

**REFERENCEBOOKS**

1. S.C,R.CellBiology.New age Publishers -ISBN-10: 8122416888/ISBN-13: 978-8122416886, 2008

2. Cooper,G.A.The Cell: A Molecular Approach. Sinauer Associates, Inc -ISBN10: 0878931066 /ISBN 13: 9780878931064, 2013

3...E.M.F.,D.R,Cell and Molecular Biology. Lippincott Williams& Wilkins Philadelphia - ISBN: 0781734932 9780781734936, 2006

4. Lodish H.A, Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6thEdition, WH. Freeman Publishers, New York, USA.

**WEB RESOURCES:**

https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf

https://www.medicalnewstoday.com/article/320878.php

https://biologydictionary.net /cell

# NUTRITIONAL BIOCHEMISTRY

| | | | |
|---|---|---|---|
| Paper | : Core VI | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U5BCC06** | External | : 75 |

**LEARNING OBJECTIVES**

The objectives of this course are to

- Create awareness about the role of nutrients in maintaining proper health
- Understand the nutritional significance of carbohydrates, lipids and proteins.
- Understand the importance of a balanced diet.
- Study the effect of additives, emulsifiers, and flavour enhancing substances in food.
- Study the significance of nutraceuticals.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Explore scientific basis of nutrients and knowledge of nutritional biochemistry | K2,K1 |
| **CO2** | Capable of describing chemical composition of nutritional worth of food | K3 |
| **CO3** | Understood the Effects of methods Nutrient analysis and energy content | K2 |
| **CO4** | Understood the scientific active constituents micro and macro nutrients | K2 |
| **CO5** | Understood the components of foods based on knowledge of nutrients in diet and health | K2 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **12 Hrs**

Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods. Modules of energy. Calorific and nutritive value of foods. Measurement ofCalories by bomb calorimeter. Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI.

**Unit II** **12 Hrs**

Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.

**Unit III** **12 Hrs**

Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects.

**Unit IV** **12 Hrs**

Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.

**Unit IV** **12 Hrs**

Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits.

**Text books**

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's

Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.

2. M.Swaminadhan (1995) Principles of Nutrition and Dietics. Bappco.

3. Tom Brody (1998). Nutritional Biochemistry (2nded), Academic press, USA

4. Garrow, JS,James WPT and Ralph A (2000). Human nutrition and dietetics (10thed) Churchill Livingstone.

5. Andreas M.Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1sted) CRC

**Reference Books**

1. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives.2nd Ed. Marcel Dekker.

2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.

3. Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010

4. Food biochemistry& food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.

5. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell, UK.

**Web resources**

http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf

https://study.com/academy/lesson/energy- yielding-nutrients-carbohydratesfat-protein.html.

https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals

# CLINICAL BIOCHEMISTRY

| | | | |
|---|---|---|---|
| Paper | : VII | Total Hours | : 60 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 5 | Internal | : 25 |
| Paper Code | : **23U5BCC07** | External | : 75 |

**OBJECTIVES**

The main objectives of this course are to

- Comprehend the basic concepts and disorders of carbohydrate metabolism
- Explain the disorders of lipid metabolism.
- Elucidate the liver function test and kidney function test.
- Designate the gastric function test.
- Familiarize the clinical enzymology.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Explain the concepts of hormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment. | K1 |
| **CO2** | Analyze the lipid profile and different deficiency state. | K2 |
| **CO3** | Describe the liver and kidney functions and specific diagnosti methods used for biological sample. | K2 |
| **CO4** | Detail about the composition of gastric juice and special test for diagnosis. | K3 |
| **CO5** | Elaborate the enzyme markers used for diagnostic studies. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **12 Hours**

Disorders of carbohydrate metabolism: Maintenance of blood glucose by hormone with special reference to insulin and glucagon. Abnormalities in glucose metabolism: Diabetes mellitus; types, causes, biochemical manifestations, diagnosis and treatment, glycated hemoglobin. Inborn errors of carbohydrate metabolism, glycosuria, Fructosuria, Pentosuria, Galactosemia and Glycogen storage diseases

**UNIT II** **12 Hours**

Disorders of Lipid Metabolism: Lipid Profile, Atherosclerosis, Fatty liver and hyperlipidemia. Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach`s disease, Niemann-Pick disease, lipotropic agents.

**UNIT III** **12 Hours**

Liver Function Tests: Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubin in serum (Diazo method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's Sulphur test). Thymol turbidity test, prothrombin time, serum enzymes in liver disease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH)

Kidney Function Tests: Measurement of urine pH, volume, specific gravity, osmolality, sediments in urine, inulin, urea and creatinine clearance tests. Concentration and dilution tests. Phenol red test. Levels of plasma protein and its significance related to kidney function. Proteinuria

**UNIT IV** **12 Hours**

Gastric Function test: Composition of gastric juice, collection of gastric contents, examination of gastric residuum, fractional test meal (FTM), stimulation testalcohol and histamine stimulation, Tubeless gastric analysis

**UNIT V** **12 Hours**

Clinical enzymology: Enzymes of diagnostic importance- LDH, creatine kinase, transaminases, phosphatases, Isoenzymes of lactate dehydrogenase, Types of tests for SARS-CoV-2, Aritficial Intelligence and Machine learning in diagnostic technologies

**TEXT BOOKS**

1. MN Chatterjee and Rana Shinde,Text Book of Medical Biochemistry, Jaypee Brothers Medical Publishers (P) LTD, New Delhi, 8 th Edition, 2012

2. Ambika Shanmugam's Biochemistry for medical students, 8 th edition, published by Wolters Kluwer India Pvt. Ltd.

**REFERENCE BOOKS**

1. Philip. D. Mayne, Clinical Chemistry in diagnosis and treatment.ELBS Publication, 6 th edition, 1994.

2. Thomas M. Devlin (2014) Text book of Biochemistry with clinical correlations (7thed). John Wiley and sons.

3. Tietz Fundamentals of clinical chemistry and molecular Diagnostics (2014) (7thed) Saunders

**WEB RESOURCES**

1. https://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydratemetabolism

2. https://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests

3.https://onlinecourses.nptel.ac.in/noc20_ge13/preview

## BIOINFORMATICS FOR BEGINNERS

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 30 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U5BCDE05** | External | : 75 |

**LEARNING OBJECTIVES**

Impart knowledge on bioinformatics and applications

- Learn about biological databases
- Understand the local and global sequence alignment
- Provide insights on BLAST and Microarray
- Familiarize about structural genomics and visualization tools

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Introduce the fundamentals of Bioinformatics and its applications Genome, metabalome & Transcriptome. | K2,K1 |
| **CO2** | Classify biological database and to correlate the different file formats used by nucleic acid, protein database, structural and metabolic database. | K3 |
| **CO3** | Develop algorithms for interpreting biological data. | K2 |
| **CO4** | Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes | K2 |
| **CO5** | Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method. | K2 |

- **Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | L | M | L | M | S | L | S | S | M | M | S | L | L |
| CO2 | M | L | M | S | S | S | L | M | M | M | S | L | M | S | M |
| CO3 | L | M | L | M | L | L | S | L | S | S | M | M | L | L | L |
| CO4 | S | L | M | S | S | L | L | S | L | L | S | L | M | S | S |
| CO5 | M | M | L | M | L | M | S | L | S | S | M | M | L | L | L |

S- Strong; M-Medium; L-Low

**Unit I** **6Hrs**

Introduction to Bioinformatics – Bioinformatics and its applications. –Genome, Metabolome - Definition and its applications. Metabolome - Metabolome database- E.coli metabolome database, Human Metabolome database. Transcriptome - Definition and applications.

**Unit II** **6Hrs**

Biological Databases - definition, types and examples – Nucleotide sequence database (NCBI, EMBL, Genebank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database - PDB, Metabolic database-KEGG

**Unit III** **6Hrs**

Sequence Alignment-Local and Global alignment-Dot matrixanalysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm. Heuristic methods of sequence alignment

**Unit IV** **6Hrs**

BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNAMicroarray-Procedure and applications.

**Unit V** **6Hrs**

Structural genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualization tools. RASMOL, Swiss PDB viewer. NutrigenomicsDefinition and applications.

**TEXT BOOKS**

1. Basic of Bioinformatics by Rui Jiang Xuegong Zhang and Michael Q. Zhang Editors

2. Bioinformatics for Beginners Genes, Genomes, Molecular Evolution, Databases and Analytical Tools By: Supratim Choudhuri (Author)

3. Bioinformatics by Saras publication

4. Introduction to Bioinformatics by Arthur Lesk

**REFERENCE BOOKS**

1. Computation in BioInformatics Multidisciplinary Applications S Balamurugan, Anand T. Krishnan, Dinesh Goyal, Balakumar Chandrasekaran

2. Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal

**WEB RESOURCES**

1. https://nptel.ac.in/courses/102/106/102106065/

2. http://www.digimat.in/nptel/courses/video/102106065/L65.html

3. https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes

## PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 60 |
| Hours/Week | : 4 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U5BCDE06** | External | : 75 |

**OBJECTIVES**

The main objectives of this course are to

- Convey the knowledge of photosynthesis.
- Detail the structure and types of secondary metabolites.
- Impart the idea on various plant hormones.
- Emphasize the effects of free radicals and the importance of antioxidants
- Understand the role of medicinal plants in treating diseases.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Gain knowledge on photosynthetic apparatus, pigments present, pathways,and significance of photosynthesis | K1 |
| **CO2** | Learn in detail about the structure, types, sources, biosynthesis and functions secondary metabolites. | K2 |
| **CO3** | Understand the structure and functions of plant hormones. | K2 |
| **CO4** | Discuss about free radicals, types and its harmful effects. Role of | K3 |
| **CO5** | Identify the plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **6 Hours**

Photosynthesis- Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, path of carbon in photosynthesis- Calvin cycle, Hatch – lack pathway (4 ways) CAM path way, significance of photosynthesis

**UNIT II** **6 Hours**

Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite

**UNIT III** **6 Hours**

Plant hormones Structure and function of plant hormones suchas ethylene, cytokinIns, auxins, Absicic acid, Florigin and Gibberlins.

**UNIT IV** **6 Hours**

Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, phytochemicals as antioxidants.

**UNIT V** **6 Hours**

Plant therapeutics: Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.

**TEXT BOOKS**

1. Singh M.P and Panda. H2005. Medicinal Herbs with their formulations, Daya publishinghouse, Delhi

2. Plant Physiology-Devlin N.Robert and Francis H.Witham,CBS Publications

3. Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W.

4. Anderson and John Brardall, Black well Scientific Publications, 1994.

## REFERENCE BOOKS

1. Khan,I.A and Khanum.A2004.Role of biotechnology in medicinal and aromatic plants,Vol.1and Vol.10,Ukka 2 publications, Hyderabad.

2. Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University, 4thEdition, 2010

3. Plant biochemistry (2008), Caroline bowsher, Martin steer,Alyson Tobin, garland science.

4.Plant physiology and development (sixth edition) by Lincoln Taiz ,Eduardo Zeiger , IanMax Moller and Angus Murphy publisher ; Oxford university press

## WEB RESOURCES

1 https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory- chapter-secondary-metabolites

2 https://www.toppr.com/guides/biology/plant-growth-and development/plantgrowth

## Core Practical V

| | | | |
|---|---|---|---|
| Paper | : Core Practical V | Total Hours | : 75 |
| Hours/Week | : 5 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U5BCCP05** | External | : 60 |

**Learning objectives**

The objectives of this course are to

- Introduce the methods of sample collection (blood & urine) for analytical purpose.
- Impart practical knowledge on the assay of activity of various diagnostically importantenzymes
- Understand the estimation procedure for various important biomolecules.
- Help students learn the routine qualitative analysis of urine sample for diagnostic purpose.
- Train students on various hematological tests and its significance.

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1. Collection and preservation of blood and urine samples.

2. Estimation of creatinine by Jaffe's method (serum & urine)

3. Estimation of urea by diacetyl monoxime method (serum & urine)

4. Estimation of uric acid (serum & urine)

5. Estimation of cholesterol by Zak's method

6. Estimation of Glucose by Ortho Toluidine method

7. Estimation of Protein by Lowry's method

8. Estimation of Hemoglobin by Shali's/Drabkins method

9. Assay of SGPT and SGOT

10. Qualitative analysis of

A) Normal constituents of urine

a) Urea, b) Creatinine, c) Phosphorus, d) Calcium

B) Abnormal constituents

a) Calcium

b) Sugar (Glucose, fructose, pentose)

c) Protein

d) Aminoacids (Tyrosine, Histidine, Tryptophan)

e) Ketone bodies

f) Bile pigments with clinical significance.

**TEXT BOOKS**

1. Manickam, S.S.(2018).Biochemical Methods(3rd ed.).New age International PvtLtd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408

2. Plummer, D.T. An Introduction to Practical Biochemistry. Tata Mc GrawHill- ISBN: 97800708416

3. Alan H Gowenlock. 1998. Varley's Practical Clinical Biochemistry, 6th edition, CBS Publishers, India.

4. B. Godkar. 2020. Textbook of Medical Laboratory Technology Vol 1 & 2 Paperback, 3rd edition, Bhalani Publishers.

5. Kanai L Mukerjee. 1996. Medical Lab Technology, Vol I& II, 1st edition, Tata Mcgraw Hill, Pennsylvania.

6. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 4th edition, Jaypee Brothers Medical Publishers, New York.

**REFERENCE BOOKS**

1. Singh,S.K.(2005). Introductory Practical Biochemistry (2nd ed.).Alpha Science International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026

2. Ashwood, B. a. (2001). Tietz, Fundamentals of Clinical chemistry. WB Saunders Company, Oxford Science Publications USA - ISBN 10: 0721686346 / ISBN 13: 978072168634

**WEB RESOURCES**

1.https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors

2.http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf

3.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y

4.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical_biochemistrypdf.pdf?sequence=1&isAllowed=y *

## Core Practical VI

| | | | |
|---|---|---|---|
| Paper | : Core Practical VI | Total Hours | : 75 |
| Hours/Week | : 5 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U5BCCP06** | External | : 60 |

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Isolation and identification of genomic DNA from animal and plant tissue | K1 & K2 |
| **CO2** | Learn about Bacterial Transformation method | K1 & K2 |
| **CO3** | Explore Restriction enzyme digestion and DNA Ligation Process | K1,K2 & k3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | M | S | S | S | S | M | M | L | M | M | M | M | M |
| CO2 | S | M | M | S | M | S | M | M | L | L | M | L | L | S | S |
| CO3 | S | S | M | M | S | M | M | M | L | L | M | L | L | S | M |

S- Strong; M-Medium; L-Low

**Immunology**

1. Immunodiffusion – Single radial and double diffusion
2. Immunoelectrophoresis
3. Rocket immunoelectrophoresis
4. Haemagglutination and passive hemagglutination
5. Identifying blood group and Rh typing
6. Direct and Indirect ELISA method
7. Antigen Antibody reaction- Pregnancy and WIDAL Test.

**TEXT BOOKS**

1.**An Introduction to Practical Biochemistry**. David, T. Plummer, (1988). 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.

2. Molecular Cloning – Sambrook and Russel, Cold Spring Harbor, Laboratory Press 2001

**REFERENCES**

1. Experiments in molecular Biology, R.J Slater, Humana Press 1986

2. Experimental Procedures in Life Sciences, S.Rajan and R.Selvi Christy, CBS Publishers &Distributors Pvt Ltd,2018

3. Experimental Biochemistry – B.S.Roa and V.Deshpande, I.K. International Pvt Ltd.

# MOLECULAR BIOLOGY

| | | | |
|---|---|---|---|
| Paper | : VIII | Total Hours | : 60 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U6BCC08** | External | : 75 |

**OBJECTIVES**

The objectives of this course are to

- Provide insights into the central dogma of molecular biology and explain themechanism of DNA replication.
- Elaborate the mechanism of transcription and reverse transcription.
- Highlight the characteristics of genetic code and describe the process of protein synthesis.
- Introduce the concept of regulation of gene expression in prokaryotes

Familiarize the different types of mutations and explain the mechanism of DNA repair.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Illustrate the Central Dogma of molecular biology, explain the multiplication of DNA in the cell and describe the types andmodes | K1 |
| **CO2** | Elaborate the mechanism of transcribing DNA into RNA and discuss the formation of different types of RNA. | K2 |
| **CO3** | Decipher the genetic code and summarize the process oftranslation. | K2 |
| **CO4** | Comprehend the principles of gene expression and explain the concept of operon in prokaryotes. | K3 |
| **CO5** | Distinguish the types of mutations and explain the various mechanisms of DNA repair. | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **12 Hours**

Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimental evidences by Griffith's transforming principle, Avery, McLeod and McCarthy's experiment, and Hershey and Chase Experiment. Replication in prokaryotes: Modes of replication, Meselson and Stahl's experimental proof for semiconservative replication. Mechanism of Replication – Initiation, events at Ori C, Elongation – replication fork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitors of replication. Models of replication-theta, rolling circle and D loop model.

**UNIT II** **12 Hours**

Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post- transcriptional modifications; inhibitors of transcription. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.

**UNIT III** **12 Hours**

Genetic Code and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongation and termination of protein synthesis, post-translational modifications and inhibitors of protein synthesis.

**UNIT IV** **12 Hours**

Regulation Of Gene Expression In Prokaryotes – Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, regulation of lac operon and trp operon

**UNIT V** **12 Hours**

Mutation: Types-Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation – induced mutations.DNA repair: Direct repair, Photoreactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair.

**TEXT BOOKS**


1. Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition, An eBooks India.
2. David Friefelder, 1987, Molecular Biology, 2nd edition, Narosa Publishing House.

3.Dr.P.S.Verma and Dr.V.K.Agarwal, 2013, Cell biology, Genetics, Molecularbiology, Evolution and Ecology, 1stedition, S.Chand & Company Pvt.Ltd.

## REFERENCE BOOKS

1. Karp, G., 2010, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley& Sons. Inc.

2. De Robertis, E.D.P. and De Robertis, E.M.F., 2010, Cell and Molecular Biology, 8th edition, Lippincott Williams and Wilkins, Philadelphia.

3. James. D. Watson, 2013, Molecular Biology of the Gene 7th edition, Benjamin Cummings.

4. George M. Malacinski,1992, Freifelder's Essentials of Molecular Biology, 4th edition, Narosapublishing House.

## WEB RESOURCES

2. www.mednotes.net/notes/biology

3. https://www.onlinebiologynotes.com/repair-mechanism-of mutation/

4. https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/

# HUMAN PHYSIOLOGY

| | | | |
|---|---|---|---|
| Paper | : IX | Total Hours | : 60 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 4 | Internal | : 25 |
| Paper Code | : **23U6BCC09** | External | : 75 |

## OBJECTIVES

The main objectives of this course are to

- Aid in understanding the physiology of respiratory and circulatory systems
- Explain the structure and physiology of the nervous and muscular system
- Explicate the functions of digestive and excretory system of the body.
- Impart knowledge about the process of reproduction.
- Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis and reproduction.

## COURSE OUTCOME:

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Explain the exchange of gases, design of blood vessels and cardiac cycle. | K1 |
| **CO2** | Summarize the events in transmission of nerve impulsesmechanism of muscle contraction. | K2 |
| **CO3** | Elaborate the structure and functions of digestive system, structure of nephron and mechanism of urine formation and role of kidney in maintenance of pH. | K2 |
| **CO4** | Describe the process of Oogenesis, Spermatogenesis, Fertilization, and Parturition. | K3 |
| **CO5** | Understand the role of different hormones that regulate metabolism, growth, glucose homeostasis and reproductive function. | K3 |

## Mapping with Programme Outcomes

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **12 Hours**

Respiratory System – Overview of respiratory system, Types of respiration, Transportof respiratory gases, Exchange of respiratory gases in lungs and tissues –Chloride Shift & Bohr's effect, Lungsurfactant. Circulatory System-Structure and functions of the Heart. Arterial and venous system, Cardiac cycle, Pace maker, Blood pressure and Factors affecting blood pressure.

**UNIT II** **12 Hours**

Nervous system- Structure of neuron, synaptic transmission, reflex action, neurotransmission- Resting membrane and Action potential. neurotransmitters- acetylcholine, Nor adrenaline, Dopamine, Serotonin, Histamine, GABA, Substance P. Muscular system- structure and types of muscles - skeletal, smooth and cardiac muscles, muscle proteins- types and functions, mechanism of muscle contraction.

**UNIT III** **12 Hours**

Digestive system- composition, functions of saliva, gastric pancreatic intestine and bile secretions, structure of digestive system, Digestion, absorption of carbohydrates, lipids, proteins. Excretory system – Structure of nephron, mechanism of urine formation, Concentration and acidification of Urine. Role of kidneys in the maintenance of acid base balance.

**UNIT IV** **12 Hours**

Reproductive system: Oogenesis, spermatogenesis, capacitation and transport of sperm- blood testis barrier. Fertilization, early development, Implantation, Placentation and Parturition.

**UNIT V** **12 Hours**

Endocrinology- Classification of hormones, endocrine glands and their secretions, structure and functions of Insulin, thyroxine. Steroid hormones - Corticosteroids, Sex hormones – testosterone and estrogen, menstrual cycle.

**TEXT BOOKS**

1.K.Sembulingam & Prema Sembulingam, 2016, Essentials of Medical Physiology, 7thedition, Jaypee Brothers Medical Publishers (P) Ltd.

2. Chatterjee.C.C., 1988, Human Physiology – VolI & II, 1$^{st}$edition, Medical Allied Agency.

3.Animal Physiology – Mariakuttikan and Arumugam, Saras publication, 2017.

**WEB RESOURCES**

- https://www.youtube.com/watch?v=6qnSsV2syUE
- https://www.youtube.com/watch?v=9_h0ZXx1lFw
- https://slideplayer.com/slide/9431799/

# IMMUNOLOGY

| | | | |
|---|---|---|---|
| Paper | : Core | Total Hours | : 60 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U6BCC10** | External | : 75 |

**OBJECTIVES**

The objectives of this course is to

- Introduce the structure and functions of lymphoid organs and cells of the immune system
- Illustrate the structure and classification of antibodies and adaptive immune response
- Impart knowledge on the types of immunity and uses of vaccines
- Provide an understanding of immune related diseases and transplantation
- Study the Ag-Ab interaction and immunological techniques to identify antigens and antibodies

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Associate structure and function of the organs involved in our body's natural Defence | K1 |
| **CO2** | Classify antigens and antibodies and the role of lymphocytes in defending the host | K2 |
| **CO3** | Describe the types of immunity and the uses of vaccines | K2 |
| **CO4** | Understand the immune related diseases and mechanism of Transplantation | K3 |
| **CO5** | Examine the immunological tests and relate it to the immune status of an Individual | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **6 Hours**

Structure and function of primary lymphoid organs (thymus, bone marrow), secondary lymphoid organs (spleen, lymph node), Cells involved in immune system- Functions- Phagocytosis –Inflammation

**UNIT II** **6 Hours**

Antigens - Nature, Immunogens, and haptens, cross reactions - Immunoglobulin- types- structure and function. Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell. Differentiation of T and B lymphocyte -Humoral and cell mediatedimmunity. Monoclonal antibody – Production and application in biology.

**UNIT III** **6 Hours**

Immunity and its types-Innate, Acquired, active and passive.- Natural and Artificial - Commonly used toxoid vaccines, rDNA Vaccines, DNAand subunit vaccines, Chemokines, Single cell technology, anti-tumour immunity.

**UNIT IV** **6 Hours**

Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto- immune diseases with examples. Organ specific and systemic autoimmunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents.

**UNIT V** **6 Hours**

Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID -Oudin Procedure, Oakley Fulthrope Procedure, Radio immunodiffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb's test Complement Fixation test-Wasserman's reaction, RIA, ELISA.

**TEXT BOOKS**

1. Kuby, J. (2018). Immunology (5th ed). W.H. Freeman - ISBN-10: 1319114709 / ISBN-13: 978-

1319114701

2. Rao, C. V. (2017). Immunology (3rd Ed.). Chennai: Alpha Science

Int. Ltd - ISBN-10:1842652559/ ISBN 13:978-1842652558

3. Tizard (1995). An Introduction to Immunology. Harcourt Brace College Publications

## REFERENCES BOOKS

1. Kenneth M. Murphy, Paul Travers, Mark Walport - (2007), Janeway's Immunobiology,7thedition, Garland Science.

2. Abul K. Abbas, Andrew H. Lichtman, Jordan S. Pober - (1994), Cellular and molecularimmunology, 2ndedition, B. Saunders Company.

3. Basic Immunology Functions and Disorders of the Immune System, 6th Edition - January 25, 2019 Authors: Abul Abbas, Andrew Lichtman, Shiv Pillai, ISBN: 9780323549431eBook ISBN: 9780323639095

4. Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt - (2006), Roitt's Essential Immunology, 11th edition, Wiley-Blackwell

## WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_bt40/preview
2. https://onlinecourses.swayam2.ac.in/cec20_bt05/preview
3. https://youtu.be/8uahFPl6ny8

## BASICS OF FORENSIC SCIENCE

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 60 |
| Hours/Week | : 3 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U6BCDE07** | External | : 75 |

**OBJECTIVES**

The main objectives of this course are to

- Gain knowledge on the basic practices of forensic analysis.
- Perform investigation using fresh blood.
- Carry out the analysis using body fluids
- Investigate the presence of forms of drugs and poisons in body fluids.
- Execute the identification test on multiple samples.

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Gain knowledge on basics of forensic science and method for collection and preservation of samples | K1 |
| **CO2** | Assess the paternity ,maternity problems and DNA profiling | K2 |
| **CO3** | Identify the presence of alcohol ,insecticides and pesticides in body fluids | K2 |
| **CO4** | Detail on the test performed to identify the presence of drugs and poisons in body fluids | K3 |
| **CO5** | Identify species and sex from the available body fluids | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **6 Hours**

Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis.

**UNIT II** **6 Hours**

Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling.

**UNIT III** **6 Hours**

Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides.

**UNIT IV** **6 Hours**

Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids.

**UNIT V** **6 Hours**

Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids.

**REFERENCE BOOKS**

1. An Introduction to Forensic DNA Analysis by Norah Rudin & Keith Inman USA, Second edition.

2. Forensic Science Handbook, Volume 2 & 3 by Saferstein, Richard E.

3. Forensics by Embar-Seddon, Ayn and Pass. Allan D. 5. Forensic Medicine by Adelman, Howard C & Kobilinsky, Lawrence

# PEPTIDE TECHNOLOGY

| | | | |
|---|---|---|---|
| Paper | : ELECTIVE | Total Hours | : 60 |
| Hours/Week | : 3 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 25 |
| Paper Code | : **23U6BCDE08** | External | : 75 |

**OBJECTIVES**

The objectives of studying peptide technology typically encompass both theoretical understanding and practical applications across various disciplines.

- Understanding Peptide Chemistry and Synthesis
- Exploring Peptide Functionality and Biological Activities
- Applications in Biotechnology and Medicine

**COURSE OUTCOME:**

| Course No | Course Outcome | Knowledge Level |
|---|---|---|
| **CO1** | Introduction to Peptides: Overview of Peptides | K1 |
| **CO2** | Peptide Synthesis Methods | K2 |
| **CO3** | Peptide Structure and function | K2 |
| **CO4** | Peptides in Agriculture and Food Science | K3 |
| **CO5** | Protein Identification and Characterization | K3 |

**Mapping with Programme Outcomes**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | S | M | S | S | S | M | S | S | S | M | S | S | S |
| CO2 | S | S | S | S | S | M | S | M | M | S | S | S | S | S | S |
| CO3 | S | S | M | M | S | M | L | M | S | L | M | S | L | S | M |
| CO4 | S | M | S | L | S | S | M | L | S | M | S | L | S | M | M |
| CO5 | S | S | S | S | M | S | S | S | L | L | S | M | S | L | S |

S- Strong; M-Medium; L-Low

**CONTENT:**

**UNIT I** **6 Hours**

Introduction to Peptides**:** Overview of Peptides**:** Definition, structure, classification (based on length, function, source). Properties of Peptides**:** Physical and chemical properties, stability, solubility

**UNIT II** **6 Hours**

Synthesis of Peptides: Peptide Synthesis Methods: Solid-phase synthesis, liquid-phase synthesis, recombinant DNA technology. Protecting Groups**:** Importance, types, strategies for deprotection.

**UNIT III** **6 Hours**

Structure and Function: Peptide Structure**:** Primary, secondary (α-helix, β-sheet), tertiary, and quaternary structures.Functional Peptides: Enzymatic, hormonal, antimicrobial, and other bioactive peptides.

**UNIT IV** **6 Hours**

Peptides in Agriculture and Food Science Bioactive Peptides in Food: Functional foods, health benefits. Plant Peptides: Signaling peptides, defense peptides.

**UNIT V** **6 Hours**

Protein Identification and Characterization Database Searching: Peptide sequencing, protein identification algorithms (e.g., Mascot, SEQUEST).Post-Translational Modifications (PTMs): Types, detection methods (e.g., phosphorylation, glycosylation).

**TEXT BOOK:**


1. Peptide Chemistry and Drug Design by Ben M. Dunn, 2015 Edition: 1st Edition
2. Peptides: Chemistry and Biology 2009 by Norbert Sewald and Hans-Dieter Jakubke Edition: 2nd Edition
3. Handbook of Biologically Active Peptides" 2013 by Abba J. Kastin Edition: 2nd Edition
4. Bioactive Peptides: Applications for Improving Nutrition and Health" 2010 by Dave J. McClements and Eric A. Decke Edition: 1st Edition

# MEDICAL CODING

| | | | |
|---|---|---|---|
| Paper | : SBEC | Total Hours | : 30 |
| Hours/Week | : 2 | Exam Hours | : 03 |
| Credit | : 1 | Internal | : 25 |
| Paper Code | : **23U6BCS02** | External | : 75 |

**Course objectives**

The objectives of this course are to

- Understand the basic concept of Medical coding
- Familiarize the student about medical terminology
- Understand about the classification of diseases based on WHO/AHA
- Understand about the CPT code used for diseases as per American Medical Association
  (AMA)

**UNIT – I** **6 Hours**

Introduction to Medical coding, coding theory, Health care Common Procedure Coding,
First Aid and CPR.

**UNIT – II** **6 Hours**

Introduction to Medical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding.

**UNIT – III** **6 Hours**

Documenting medical records - Importance of Documentation, Types of dictation formats.

**UNIT – IV** **6 Hours**

Introduction to Human Anatomy and Coding, ICD-10- CM classification system.

**UNIT – IV** **6 Hours**

Introduction to CPT coding, types of CPT coding Medical Law and Ethics. 6hrs

**Text books**

1. Understanding Medical Coding, A comprehensive guide Sandra L Johnson RobinLinker
2. Buck's Step – by – step Medical Coding Elsevier reference

**Reference books**

1. Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CMcoding guidelines made easy2017.
2. Besty J Shiland- Medical terminology and anatomy for ICD-10.

## YEAR III – SEMESTER VI
## Core Practical VII

| | | | |
|---|---|---|---|
| Paper | : Core Practical VII | Total Hours | : 75 |
| Hours/Week | : 5 | Exam Hours | : 06 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U6BCCP07** | External | : 60 |

### A. Urine Analysis

1. Physical properties of urine : Microscopic and visual observation for normal and abnormal constituents, color, density, crystals and pH etc
2. Determination of Creatine and Creatinine in urine – Alkali-Picrate method
3. Estimation of Uric acid – Caraway's method
4. Determination Chloride by VanSlyke's method

### B. Blood Analysis

1.Estimation of blood glucose by Asatoor and King method.
2. Estimation of serum creatine and creatinine by – Alkali-Picrate method.
3. Estimation of Determination of Total proteins in whole blood – Biuret method
4. Determination of Bilirubin [ Conjugated & Unconjugated] in serum

### C. HAEMATOLOGY

1. Estimation of Hemoglobin
2. Enumeration of RBC/WBC
3. Differential count
4. Determination of blood grouping
5. Bleeding time, clotting time
6. ESR

### REFERENCES

1.An Introduction to Practical Biochemistry. David, T. Plummer, (1988). 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2.Laboratory Manual in Biochemistry. Pattabiraman, T.N. (1998). 3rd Edition. All India Publishers and Distributors. Chennai.
3. Laboratory Mannual in Biochemistry.Jayaraman, S. (2003). 2nd Edition. New Age International (P) Limited. New Delhi
4. Biochemical Methods. Sadasivam S and Manickam P. (2004) 2nd Edition. New Age International (P) Limited. New Delhi.

## YEAR III – SEMESTER VI
### Core Practical VIII

| | | | |
|---|---|---|---|
| Paper | : Core Practical VIII | Total Hours | : 45 |
| Hours/Week | : 5 | Exam Hours | : 03 |
| Credit | : 3 | Internal | : 40 |
| Paper Code | : **23U6BCCP08** | External | : 60 |

1. Isolation of genomic DNA from bacteria
2. Isolation of genomic DNA from plant
3. Isolation and identification of genomic DNA from animal tissue
4. Isolation of plasmid DNA
5. Restriction enzyme digestion
6. Transformation
7. DNA Ligation
8. SDS-PAGE - Demo

**REFERENCES**


1.David, T. Plummer, (1988). **An Introduction to Practical Biochemistry**. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.

2.Pattabiraman, T.N. (1998). **Laboratory Manual in Biochemistry**. 3rd Edition. All India Publishers and Distributors. Chennai.

3.Jayaraman, S. (2003). **Laboratory Mannual in Biochemistry**. 2nd Edition. New Age International (P) Limited. New Delhi

4. Sadasivam S and Manickam P. (2004) **Biochemical Methods** 2nd Edition. New Age International (P) Limited. New Delhi.

# B.Sc., BIOCHEMISTRY
# QUESTION PAPER PATTERN
**MAXIMUM MARKS – 75 marks**
**DURATION – 3 hours**

**PART – A (10 marks)**

1. Multiple choice questions

**PART – B (5 X 7 = 35 marks)**

2. Either or Type

3. From each unit two questions

**PART – C (3 X 10 = 30 marks)**

1. Any three out of five (open choice)

2. From each unit one question