

# VIVEKANANDHA

## COLLEGE OF ARTS AND SCIENCES FOR WOMEN ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).

An ISO 9001: 2008 Certified Institution  
(Affiliated to Periyar University, Approved by AICTE, recognized u/s 2 (f) & 12 (B) & Re-accredited with 'A' by NAAC)  
*Recognized under section 2(f) and 12(B) of UGC Act, 1956*  
An ISO 9001:2008 (Certificate Institution)



### DEPARTMENT OF BIOCHEMISTRY

**B.Sc., BIOCHEMISTRY**

### SYLLABUS AND REGULATIONS

**FOR CANDIDATES ADMITTED FROM 2021-2022  
ONWARDS UNDER AUTONOMOUS CBCS AND OBE  
PATTERN**

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

**A  
U  
T  
O  
N  
O  
M  
O  
U  
S**

## **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.,

- 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   | <b>Disciplinary knowledge:</b> 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 skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results. | K2              |
| PO2   | <b>Communication Skills:</b> 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 different groups.   | K1              |
| PO3   | <b>Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on 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   | <b>Problem solving:</b> ability to closely observe the situation, and apply lateral thinking and analytical skills.  | K3              |
| PO5   | <b>Analytical reasoning:</b> 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; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.   | K5              |
| PO6   | <b>Research-related skills:</b> 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   | <b>Cooperation/Team work:</b> 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 a team.   | K6              |
| PO8   | <b>Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experi   | K4              |

|      |  |    |
|------|--|----|
|      | ences from an open-minded and reasoned perspective. Ability to formulate logical and convincing arguments.   |    |
| PO9  | <b>Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. Ability to see the influence of location –regional, national, global-on critical thinking.  | K2 |
| PO10 | <b>Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.   | K3 |
| PO11 | <b>Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. Ability to critically analyse research literature and postulate hypothesis, questions and search for answers.   | K6 |
| PO12 | <b>Multicultural competence:</b> 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 diverse groups.   | K5 |
| PO13 | <b>Moral and ethical awareness/reasoning:</b> Ability to embrace 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 demonstrating the 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 adopting objective, unbiased and truthful actions in all aspects of work. | K3 |
| PO14 | <b>Leadership readiness/qualities:</b> 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 and efficient way.  | K6 |
| PO15 | <b>Lifelong learning:</b> 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 at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/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 with Chemistry 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          |
| CA Test I    | 30 to 35    | 2.5        | CA Test I/Review         | 5          |
| CA Test II   | 60 to 65    | 2.5        | CA Test II/Review II     | 5          |
| Model        | After 90    | 10         | Model/Model Presentation | 10         |
| Assignment   |             | 05         | Observation note         | 10         |
|              |             |            | Results in lab/Work      | 5          |
|              |             |            |                          |            |
| <b>Total</b> |             | <b>25</b>  |                          | <b>40</b>  |

### 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 valued 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 (20)          | 20         | Record work   | 5          |
| B            | Five marks (Either or) | 25         | Viva Voce     | 5          |
| C            | Ten marks (3/5)        | 30         | Sportters     | 10         |
|              |                        |            | Experiment I  | 20         |
|              |                        |            | Experiment II | 20         |
| <b>Total</b> |                        | <b>75</b>  | <b>Total</b>  | <b>60</b>  |

### 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 as 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 2018-19 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018-19 and thereafter.

## **XII. TRANSITORY PROVISIONS.**

Candidates who have undergone the UG Course of study before 2018-19 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 2019-2020. 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)

## **XII. COURSE PATTERN**

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
SYLLABUS FRAME WORK**

| Subjects                           | Inst. Hour/Week | Credit    | Exam Hours | Internal   | External   | Total Marks | Subjects            | Inst. Hour/Week | Credit     | Exam Hours | Internal    | External    | Total Marks |
|------------------------------------|-----------------|-----------|------------|------------|------------|-------------|---------------------|-----------------|------------|------------|-------------|-------------|-------------|
| <b>YEAR I</b>                      |                 |           |            |            |            |             |                     |                 |            |            |             |             |             |
| <b>Semester I</b>                  |                 |           |            |            |            |             | <b>Semester II</b>  |                 |            |            |             |             |             |
| Language I                         | 6               | 3         | 3          | 25         | 75         | 100         | Language II         | 6               | 3          | 3          | 25          | 75          | 100         |
| English I                          | 6               | 3         | 3          | 25         | 75         | 100         | English II          | 6               | 3          | 3          | 25          | 75          | 100         |
| Core I                             | 4               | 4         | 3          | 25         | 75         | 100         | Core II             | 4               | 4          | 3          | 25          | 75          | 100         |
| Core I Practical                   | 3               | 3         | 3          | 40         | 60         | 100         | Core II Practical   | 3               | 3          | 3          | 40          | 60          | 100         |
| Allied I                           | 4               | 4         | 3          | 25         | 75         | 100         | Allied II           | 4               | 4          | 3          | 25          | 75          | 100         |
| Allied I Practical                 | 3               | -         | -          | -          | -          | -           | Allied II Practical | 3               | 4          | 3          | 40          | 60          | 100         |
| Valued added course                | 2               | 2         | 3          | 25         | 75         | 100         | Valued added course | 2               | 2          | 3          | 25          | 75          | 100         |
| Library                            | 1               | 0         | 0          | 0          | 0          | 0           | Library             | 1               | 0          | 0          | 0           | 0           | 0           |
| Sports                             | 1               | 0         | 0          | 0          | 0          | 0           | Sports              | 1               | 0          | 0          | 0           | 0           | 0           |
| <b>Total</b>                       | <b>30</b>       | <b>21</b> | <b>18</b>  | <b>165</b> | <b>435</b> | <b>600</b>  | <b>Total</b>        | <b>30</b>       | <b>25</b>  | <b>21</b>  | <b>205</b>  | <b>495</b>  | <b>700</b>  |
| <b>II YEAR TOTAL</b>               |                 |           |            |            |            |             |                     |                 | <b>46</b>  | <b>39</b>  | <b>370</b>  | <b>930</b>  | <b>1300</b> |
| <b>YEAR II</b>                     |                 |           |            |            |            |             |                     |                 |            |            |             |             |             |
| <b>Semester III</b>                |                 |           |            |            |            |             | <b>Semester IV</b>  |                 |            |            |             |             |             |
| Language III                       | 6               | 3         | 3          | 25         | 75         | 100         | Language IV         | 6               | 3          | 3          | 25          | 75          | 100         |
| English III                        | 6               | 4         | 3          | 25         | 75         | 100         | English IV          | 6               | 3          | 3          | 25          | 75          | 100         |
| Core III                           | 4               | 3         | 3          | 25         | 75         | 100         | Core IV             | 4               | 5          | 3          | 25          | 75          | 100         |
| Core III Practical                 | 3               | 3         | 3          | 40         | 60         | 100         | Core IV Practical   | 3               | 3          | 3          | 40          | 60          | 100         |
| Allied III                         | 4               | 3         | 3          | 25         | 75         | 100         | Allied IV           | 4               | 4          | 3          | 25          | 75          | 100         |
| Allied III Practical               | 3               | 3         | 3          | 40         | 60         | 100         | Allied IV Practical | 3               | 3          | 3          | 40          | 60          | 100         |
| SBEC I                             | 2               | 2         | 3          | 25         | 75         | 100         | SBEC II             | 2               | 2          | 3          | 25          | 75          | 100         |
| NMEC I                             | 2               | 2         | 3          | 25         | 75         | 100         | NMEC II             | 2               | 2          | 3          | 25          | 75          | 100         |
| Library                            | 1               | 0         | 0          | 0          | 0          | 0           | Library             | 1               | 0          | 0          | 0           | 0           | 0           |
| Sports                             | 1               | 0         | 0          | 0          | 0          | 0           | Sports              | 1               | 0          | 0          | 0           | 0           | 0           |
| <b>Total</b>                       | <b>30</b>       | <b>23</b> | <b>21</b>  | <b>205</b> | <b>495</b> | <b>700</b>  | <b>Total</b>        | <b>30</b>       | <b>23</b>  | <b>21</b>  | <b>205</b>  | <b>495</b>  | <b>700</b>  |
| <b>II YEAR TOTAL</b>               |                 |           |            |            |            |             |                     |                 | <b>92</b>  | <b>84</b>  | <b>780</b>  | <b>1980</b> | <b>2800</b> |
| <b>YEAR III</b>                    |                 |           |            |            |            |             |                     |                 |            |            |             |             |             |
| <b>Semester V</b>                  |                 |           |            |            |            |             | <b>Semester VI</b>  |                 |            |            |             |             |             |
| Core V                             | 5               | 5         | 3          | 25         | 75         | 100         | Core VII            | 5               | 5          | 3          | 25          | 75          | 100         |
| Core VI                            | 5               | 5         | 3          | 25         | 75         | 100         | Core VIII           | 5               | 5          | 3          | 25          | 75          | 100         |
| Core V Practical                   | 5               | 3         | 3          | 40         | 60         | 100         | Core VII Practical  | 5               | 3          | 3          | 40          | 60          | 100         |
| Core VI Practical                  | 5               | 3         | 3          | 40         | 60         | 100         | Core VIII Practical | 5               | 3          | 3          | 40          | 60          | 100         |
| Elective I                         | 4               | 3         | 3          | 25         | 75         | 100         | Elective II         | 4               | 3          | 3          | 25          | 75          | 100         |
| SBEC III                           | 2               | 2         | 3          | 25         | 75         | 100         | SBEC IV             | 2               | 2          | 3          | 25          | 75          | 100         |
| Library/Sports                     | 1               | 0         | 0          | 0          | 0          | 0           | Library/Sports      | 1               | 0          | 0          | 0           | 0           | 0           |
| Mini project                       | 1               | 1         | 6          | 0          | 0          | 0           | Extension work      | 1               | 1          | 0          | 0           | 0           | 100         |
| <b>Total</b>                       | <b>30</b>       | <b>24</b> | <b>29</b>  | <b>245</b> | <b>555</b> | <b>800</b>  | <b>Total</b>        | <b>30</b>       | <b>24</b>  | <b>23</b>  | <b>205</b>  | <b>205</b>  | <b>495</b>  |
| <b>TOTAL CREDIT FOR THE COURSE</b> |                 |           |            |            |            |             |                     |                 | <b>140</b> | <b>126</b> | <b>1230</b> | <b>2970</b> | <b>4200</b> |

**Distribution Of Duration And Credit Under Different Papers**



| <b>Part</b>  | <b>Paper</b>            | <b>Hours/Week</b> | <b>Weeks/Semester</b> | <b>Hour/Paper</b> | <b>No. of Papers</b> | <b>Credit/Paper</b> | <b>Total Hours</b> | <b>Total credit</b> |
|--------------|-------------------------|-------------------|-----------------------|-------------------|----------------------|---------------------|--------------------|---------------------|
| <b>I</b>     | <b>Language</b>         | 6                 | 15                    | 60                | 4                    | 3                   | 240                | 12                  |
| <b>II</b>    | <b>English</b>          | 6                 | 15                    | 60                | 4                    | 3                   | 240                | 12                  |
| <b>III</b>   | <b>Core paper</b>       | 5                 | 15                    | 75                | 8                    | 5                   | 600                | 40                  |
| <b>III</b>   | <b>Core practical</b>   | 5                 | 15                    | 75                | 8                    | 3                   | 600                | 24                  |
| <b>III</b>   | <b>Allied</b>           | 4                 | 15                    | 60                | 4                    | 4                   | 240                | 16                  |
| <b>III</b>   | <b>Allied practical</b> | 4                 | 15                    | 60                | 4                    | 3                   | 240                | 12                  |
| <b>IV</b>    | <b>Value Education</b>  | 1                 | 15                    | 15                | 2                    | 2                   | 30                 | 4                   |
| <b>IV</b>    | <b>SBEC</b>             | 2                 | 15                    | 30                | 4                    | 2                   | 120                | 8                   |
| <b>III</b>   | <b>Elective</b>         | 4                 | 15                    | 60                | 2                    | 3                   | 120                | 6                   |
| <b>IV</b>    | <b>NMEC</b>             | 2                 | 15                    | 30                | 2                    | 2                   | 60                 | 4                   |
| <b>IV</b>    | <b>Mini project</b>     | 1                 | 15                    | 15                | 1                    | 1                   | 15                 | 1                   |
| <b>IV</b>    | <b>Extension work</b>   | 1                 | 15                    | 15                | 1                    | 1                   | 15                 | 1                   |
| <b>TOTAL</b> |                         |                   |                       |                   |                      |                     |                    | <b>140</b>          |

#### Distribution Of Duration And Content Under Different Papers

| <b>S. No.</b> | <b>Hours/Week</b> | <b>Duration/Unit</b> | <b>Topic/Unit</b> |
|---------------|-------------------|----------------------|-------------------|
| 1             | 1                 | 3                    | 3                 |
| 2             | 2                 | 6                    | 6                 |
| 3             | 3                 | 9                    | 9                 |
| 4             | 4                 | 12                   | 12                |
| 5             | 5                 | 15                   | 15                |

**VEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN (AUTONOMOUS)**  
**DEPARTMENT OF BIOCHEMISTRY**  
**CBCS AND OBE PATTERN SYLLABUS - UG**  
**(For candidates admitted from 2020-2021 onwards)**

| Sem       | Subject code                  | Part               | Course                   | Subjects                           | Hrs/week  | Credit     | Int. marks | Ext. mark  | Tot. mark |
|-----------|-------------------------------|--------------------|--------------------------|------------------------------------|-----------|------------|------------|------------|-----------|
| I         | 20U1LT01                      | I                  | Language-I               | Tamil-I                            | 6         | 3          | 25         | 75         | 100       |
|           | 20U1LH01                      |                    |                          | Hindi-I                            |           |            |            |            |           |
|           | 20U1LM01                      |                    |                          | Malayalam-I                        |           |            |            |            |           |
|           | 20U1LE01                      | II                 | English-I                | Foundation English I               | 6         | 3          | 25         | 75         | 100       |
|           | 20U1BCC01                     | III                | Core-I                   | Biomolecules                       | 5         | 5          | 25         | 75         | 100       |
|           | 20U1BCP01                     |                    | Core-I Practical         | Major Practical-I                  | 4         | 3          | 40         | 60         | 100       |
|           | 20U1CHA01                     | III                | Allied-I                 | Allied chemistry I                 | 4         | 4          | 25         | 75         | 100       |
|           |                               |                    |                          | Allied Chemistry Practical I       | 3         | -          | -          | -          | -         |
| 20U1VE01  | -                             | -                  | Value education – (Yoga) | 2                                  | 2         | 25         | 75         | 100        |           |
|           |                               |                    | <b>Total</b>             | <b>30</b>                          | <b>20</b> | <b>165</b> | <b>435</b> | <b>600</b> |           |
| II        | 20U2LT02                      | I                  | Language-II              | Tamil-II                           | 6         | 3          | 25         | 75         | 100       |
|           | 20U2LH02                      |                    |                          | Hindi-II                           |           |            |            |            |           |
|           | 20U2LM02                      |                    |                          | Malayalam-II                       |           |            |            |            |           |
|           | 20U2LE02                      | II                 | English-II               | Foundation English-II              | 6         | 3          | 25         | 75         | 100       |
|           | 20U2BCC02                     | III                | Core-II                  | Major- Biochemical Techniques      | 4         | 4          | 25         | 75         | 100       |
|           | 20U2BCP02                     |                    | Core-II Practical        | Major Practical-II                 | 3         | 2          | 40         | 60         | 100       |
|           | 20U2CHA02                     | III                | Allied-II                | Allied Chemistry II                | 4         | 4          | 25         | 75         | 100       |
|           | 20U2CHAP01                    |                    |                          | Allied Chemistry Practical II      | 3         | 3          | 40         | 60         | 100       |
| 20U2VES01 | IV                            | -                  | Environmental studies    | 4                                  | 4         | 25         | 75         | 100        |           |
|           |                               |                    | <b>Total</b>             | <b>30</b>                          | <b>23</b> | <b>205</b> | <b>495</b> | <b>700</b> |           |
| III       | 20U3LT03                      | I                  | Language – III           | Tamil-III                          | 6         | 3          | 25         | 75         | 100       |
|           | 20U3LH03                      |                    |                          | Hindi-III                          |           |            |            |            |           |
|           | 20U3LM03                      |                    |                          | Malayalam-III                      |           |            |            |            |           |
|           | 20U3LE03                      | II                 | English-III              | Foundation English-III             | 6         | 3          | 25         | 75         | 100       |
|           | 20U3BCC03                     | III                | Core-III                 | Enzymes and Enzyme Technology      | 4         | 4          | 25         | 75         | 100       |
|           | 20U3BCN01                     |                    | NMEC I                   | Health and Hygiene Biochemistry in | 2         | 2          | 25         | 75         | 100       |
|           | 20U3BCN02                     |                    |                          | Diagnosis                          |           |            |            |            |           |
|           | 20U3BCP03                     | Core III Practical | Major Practical-III      | 3                                  | 2         | 40         | 60         | 100        |           |
|           | 20U3MBP03                     | III                | Allied-III               | Allied Microbiology                | 4         | 4          | 25         | 75         | 100       |
| 20U3UMB03 | Allied Microbiology Practical |                    |                          | 3                                  | 3         | 40         | 60         | 100        |           |

|                      |            |          |                     |                                     |                |            |             |             |             |
|----------------------|------------|----------|---------------------|-------------------------------------|----------------|------------|-------------|-------------|-------------|
|                      | 20U3BCS01  | IV       | SBEC-I              | Biostatistics                       | 2              | 2          | 25          | 75          | 100         |
|                      |            |          |                     | <b>Total</b>                        | <b>30</b>      | <b>23</b>  | <b>230</b>  | <b>570</b>  | <b>800</b>  |
| IV                   | 20U4LT04   | I        | Language-IV         | Tamil-IV                            | 6              | 3          | 25          | 75          | 100         |
|                      | 20U4LH04   |          |                     | Hindi-IV                            |                |            |             |             |             |
|                      | 20U4LM04   |          |                     | Malayalam-IV                        |                |            |             |             |             |
|                      | 20U4LE04   | II       | English-IV          | Foundation English-IV               | 6              | 3          | 25          | 75          | 100         |
|                      | 20U4BCC04  | III      | Core-IV             | Intermediary Metabolism             | 4              | 4          | 25          | 75          | 100         |
|                      | 20U4BCP04  |          | Core IV Practical   | Major Practical-IV                  | 3              | 2          | 40          | 60          | 100         |
|                      | 20U4BCN01  | III      | NMEC II             | Biochemistry and Health             | 2              | 2          | 25          | 75          | 100         |
|                      | 20U4BCN02  |          |                     | Molecular basis of human disease    |                |            |             |             |             |
|                      | 20U4CSA04  | III      | Allied-IV           | Allied Biotechnology                | 4              | 4          | 25          | 75          | 100         |
|                      | 20U4CSAP03 |          |                     | Allied Biotechnology Practical      | 3              | 3          | 40          | 60          | 100         |
| 20U4BCS02            | IV         | SBEC-II  | Computer in Biology | 2                                   | 2              | 25         | 75          | 100         |             |
|                      |            |          |                     | <b>Total</b>                        | <b>30</b>      | <b>23</b>  | <b>230</b>  | <b>570</b>  | <b>800</b>  |
| V                    | 20U5BCC05  | III      | Core-V              | Human Physiology                    | 5              | 5          | 25          | 75          | 100         |
|                      | 20U5BCC06  | III      | Core-VI             | Molecular Biology                   | 5              | 5          | 25          | 75          | 100         |
|                      | 20U5BCP05  | III      | Core-V Practical    | Major Practical-V                   | 6              | 5          | 40          | 60          | 100         |
|                      | 20U5BCP06  | III      | Core-VI Practical   | Major Practical-VI                  | 6              | 5          | 40          | 60          | 100         |
|                      | 20U5BCE01  | III      | Elective-I          | Drug Biochemistry                   | 4              | 3          | 25          | 75          | 100         |
|                      | 20U5BCE02  |          |                     | Nutritional Biochemistry            |                |            |             |             |             |
| 20U5BCS03            | IV         | SBEC-III | Genetic Engineering | 2                                   | 2              | 25         | 75          | 100         |             |
|                      |            |          |                     | Lib and Sports                      | 1              | 0          | -           | -           | -           |
| 20U5BCPR1            | III        | -        | -                   | Mini Project                        | 1              | 1          | -           | -           | -           |
|                      |            |          |                     | <b>Total</b>                        | <b>30</b>      | <b>26</b>  | <b>180</b>  | <b>420</b>  | <b>600</b>  |
| VI                   | 20U6BCC07  | III      | Core-VII            | Immunology and Immunotechniques     | 5              | 5          | 25          | 75          | 100         |
|                      | 20U6BCC08  | III      | Core-VIII           | Clinical Biochemistry               | 5              | 5          | 25          | 75          | 100         |
|                      | 20U6BCP07  | III      | Core-VII Practical  | Major Practical-VII                 | 6              | 5          | 40          | 60          | 100         |
|                      | 20U6BCP08  | III      | Core-VIII Practical | Major Practical-VIII                | 6              | 4          | 40          | 60          | 100         |
|                      | 20U6BCE03  | III      | Elective-II         | Biochemistry of                     | 4              | 3          | 25          | 75          | 100         |
|                      | 20U6BCE04  |          |                     | Hormones Cell Biology               |                |            |             |             |             |
|                      | 20U6BCS04  | IV       | SBEC-IV             | Biochemistry in diagnostic medicine | 2              | 2          | 25          | 75          | 100         |
|                      |            |          |                     |                                     | Lib and Sports | 1          | 0           | -           | -           |
| 20U6EX01             | -          | -        | -                   | Extension Work                      | 1              | 1          | -           | -           | -           |
|                      |            |          |                     | <b>Total</b>                        | <b>30</b>      | <b>25</b>  | <b>180</b>  | <b>420</b>  | <b>600</b>  |
| <b>Overall Total</b> |            |          |                     |                                     | <b>180</b>     | <b>140</b> | <b>1190</b> | <b>2910</b> | <b>4100</b> |

## BIOMOLECULES

|                        |                  |
|------------------------|------------------|
| Paper : Core I         | Total Hours : 60 |
| Hours/Week : 5         | Exam Hours : 03  |
| Credit : 5             | Internal : 25    |
| Paper Code : 20U1BCC01 | External : 75    |

### Aim

To understand the structure, properties and functions of biomolecules.

### Objective

The objective of the students to understand the structure, properties and functions of biomolecules like carbohydrates, lipids, proteins, nucleic acids, vitamins and minerals.

### OUTCOME

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Familiarize about the definition, occurrence, Biological function, different type of carbohydrates | K1              |
| CO2       | Explain the type, structure and function of lipids and lipoproteins                                | K2              |
| CO3       | Describe the classification of amino acids and structural organization of protein                  | K2              |
| CO4       | Understand the structure and biological significance of nucleic acids                              | K3              |
| CO5       | Understand the sources and importance of vitamins and minerals.                                    | 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 Carbohydrates**

**12 Hours**

Introduction, sources, general structure, Classification and properties of Carbohydrates. Monosaccharides-Types, Structure, properties and biological functions of monosaccharides. Stereoisomerism-structural and optical isomerism, mutarotation. Reactions of monosaccharides, monosaccharide derivatives. Oligosaccharides- Structure, properties and biological functions of disaccharides. Polysaccharides- Classifications of polysaccharides. Structures, properties and biological functions of Homopolysaccharides (starch, glycogen, cellulose, and chitin) and heteropolysaccharides -Hyaluronic acid, Chondroitin sulphate, Heparin, dermatan sulfate and keratan sulfate.

### **Unit- II Fatty acids and Lipids**

**12 Hours**

Fatty acids- Definition, structure, classification and properties of fatty acids. **Lipids-** Introduction, structure, classification (simple, conjugated and derived lipids), properties and functions. Occurrence, structure, physical and chemical properties of triacylglycerols (TG), phospholipids, glycolipids and cholesterol. Lipoproteins: Definition, types and functions of lipoproteins.

### **Unit -III: Amino acids and Proteins**

**12 Hours**

Amino acids-Definition, Structure, classification, physical, chemical and electrochemical properties, Non-standard, Non-protein aminoacids. Peptides- Biologically important peptides (glutathione, angiotensins, oxytocin, vasopressin and aspartame). Protein- Classifications, properties and function. Protein architecture and bonds responsible for protein structure.

### **Unit -IV : Nitrogenous bases and Nucleicacids:**

**12 Hours**

Nitrogenous bases- Structure of Purines and Pyrimidines. Nucleosides, nucleotides and formation of phosphodiester bond. Nucleicacids- DNA – Types of DNA, Structure of DNA – Watson and Crick model, properties and function of DNA. Unusual Bases. RNA – Types & structure (mRNA, tRNA, rRNA and hnRNA) , properties and functions. Nucleoproteins-Types and functions.

### **Unit -V : Vitamins and Minerals**

**12 Hours**

Vitamins- Definition, classification and properties of vitamins. Structure, sources, RDA, functions, deficiency of fat soluble (A, D, E, K) and Water soluble vitamins (B complex and Vitamin C). Minerals- Definition, Sources, requirements, functions and deficiency of micro and

macro minerals.

### **TEXT BOOKS:**

1. Jain, J.L. 2009. **Fundamentals of Biochemistry**. Multi colour Edition. S.Chand and Co Ltd, New Delhi.
2. Satyanarayana, U. 2019, **Biochemistry**. 5<sup>th</sup> Edition. Books and Allied (P) Ltd.
3. Zubay, G. 2016, **Biochemistry**. Revised enlarged Edition, WCB. McGraw-Hill, New York.

### **REFERENCE BOOKS:**

1. Nelson, D.L. and Cox, M. M. 2017, **Lehninger's Principles of Biochemistry**. 8<sup>th</sup> Edition. Freeman Publishers. New York.
2. Stryer, L. and Hall, J.E. 2019, **Biochemistry**: Library of Congress Cataloguing-in-Publication Data, Bery, Jeremy Mark.
3. Robert Murray, Bender, 2018, **Harper's Illustrated Biochemistry**. 32<sup>nd</sup> Edition, McGraw Hill.
4. Voet and Voet, 2018, **Biochemistry**, 5<sup>th</sup> edition. John Wiley and Sons publications, New York.

### **WEB SOURCES**

1. <http://ull.chemistry.uakron.edu/genobc/>.
2. <http://www.biology.arizona.edu/biochemistry/biochemistry.html>.
3. <http://downloads.hindawi.com/journals/bmri/2018/4012145.pdf>
4. <https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/nucacids.htm>
5. <https://healthy-kids.com.au/food-nutrition/nutrients-in-food/vitamins-minerals/>

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

**YEAR I – SEMESTER II**  
**BIOCHEMICAL TECHNIQUES**

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : Core II   | Total Hours | : 60 |
| Hours/Week | : 5         | Exam Hours  | : 03 |
| Credit     | : 5         | Internal    | : 25 |
| Paper Code | : 20U2BCC02 | External    | : 75 |

**Aim**

To understand the principles, instrumentation, working and application of the instruments in the laboratories.

**Objectives**

The students learned the principles and applications of the techniques such as chromatography, electrophoresis, centrifugation, autoradiography, Solid and liquid Scintillation counting.

**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 of biological Samples         | 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

## **CONTENT**

### **UNIT – I Buffere and Soutlion**

**12 Hours**

pH Scale- methods of calculating pH from Henderson's –Hasselbalch equation, buffer solutions, buffer systems of blood - protein, bicarbonate, Hemoglobin and phosphate buffer system. Various ways of expressing the concentrations of solutions - molality, molarity, normality, mole fraction and percentage solution. Simple problems to be worked out.

### **UNIT – II Chromatography**

**12 Hours**

Chromatography- principle, instrumentation and applications - Paper chromatography, Thin layer chromatography, Column chromatography, GLC, Ion exchange chromatography, Affinity chromatography, High performance Thin Layer chromatography (HPTLC) and Molecular sieve chromatography

### **UNIT – III Electrophoresis and Centrifugation**

**12 Hours**

Electrophoresis -Principle, instrumentation and applications of paper electrophoresis, Agarose gel, Native PAGE, SDS-PAGE and Isoelectric focusing . Centrifugation- types of centrifuges, Analytical ultracentrifugation and its applications in determination of molecular weight, Preparative ultracentrifugation- Differential and density gradient centrifugation.

### **UNIT – IV Colorimetry**

**12 Hours**

Colorimetry- colour and absorption spectra, Beer and Lambert's law , working of a Single cell photoelectric colorimeter, measurement of extinction coefficient, calibration curve. Spectrophotometry – instrumentation and applications of UV-Visible and IR Spectrophotometers. comparison and advantages of spectrophotometer over colorimeter. Fluorimetry – principle, instrumentation and applications - determination of Thiamine and Riboflavin. Flame photometer - principle, instrumentation and applications.

### **UNIT – V Radio isotope techniques**

**12 Hours**

Radio isotope techniques- The nature of radioactivity, detection and measurement of radioactivity, detection based on gas ionization- Geiger Muller counter- principle and applications. Detection based on excitation- Liquid Scintillation counter-principle and applications. Applications of radioisotopes in biological sciences. Hazards and safety aspects of radioactivity.



## **TEXT BOOKS**

1. Allen, J.P. (2008), Biophysical Chemistry, 1st Edition, Markono Print Media Limited, Singapore.
2. Upadhyay, A., Upadhyay, K., and Nath, N., (2014), Biophysical chemistry – principle & techniques, Himalaya publishing House, Mumbai.
3. Gurdeep, R. Chatwal and Aanand. S.K. (2009). Instrumental Methods of Chemical Analysis, Himalaya publishing House, New Delhi.

## **REFERENCE BOOKS**

1. Keith Wilson, and John Walker, (2010), Principles and techniques of Biochemistry and Molecular Biology, 7th Edition, Cambridge University Press, New York, USA.
2. Pattabhi, V and Gautham, (2015), Biophysics, Narosa Publishing House PVT Ltd, New Delhi.
3. Wilson, K and Goulding, KH (1987). A Biologist Guide to Principles and Tecchniques of Practrical Biochemistry, 3rd edition, Edward Arnold Publishers. Londen, UK.
4. Nicolau, C., (1973), Experimental methods in Biophysical chemistry, Wiley–Blackwell Publisher,
5. Keith Wilson and Kenneth, (1994). Goulding A Biologist Guide to Principles and Tecchniques of Biochemistry, EdWard Arnold Publishers. UK.

## **WEB SOURCES:**

1. [https://chem.libretexts.org/Ancillary\\_Materials/Reference/Organic\\_Chemistry\\_Glossary/Henderson-Hasselbach\\_Equation](https://chem.libretexts.org/Ancillary_Materials/Reference/Organic_Chemistry_Glossary/Henderson-Hasselbach_Equation)
2. <https://www.pharmatutor.org/pharma-analysis/write-a-note-on-size-exclusion-chromatography-with-applications>
3. <https://microbenotes.com/centrifugation-principle-types-and-applications/>
4. <https://microbenotes.com/uv-spectroscopy-principle-instrumentation-applications/>
5. <https://www.cpp.edu/~pbsiegel/bio431/texnotes/chapter4.pdf>

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

## YEAR I – SEMESTER I

### CORE - BIOCHEMISTRY PRACTICAL – I

|            |                     |             |      |
|------------|---------------------|-------------|------|
| Paper      | : Core Practical I  | Total Hours | : 75 |
| Hours/Week | :5                  | Exam Hours  | : 06 |
| Credit     | : 3                 | Internal    | : 40 |
| Paper Code | : <b>20U1BCCP01</b> | External    | : 60 |

#### Courses Outcome

- CO1 Learn and understand the principles of reactions involved in the qualitative analysis of carbohydrates and amino acids
- CO2 Demonstrate the acid and iodine number of lipids
- CO3 Analyze, interpret and identify the unknown carbohydrates and amino acids

#### 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. Preparation of Solution

1. Normal, Molar, Percentage solution and calculation

#### II. Qualitative Analysis

##### A. Analysis of Carbohydrates

- a) Monosaccharides-Glucose, Fructose, Galactose and Pentose.
- b) Disaccharides-Sucrose, Maltose and Lactose.
- c) Polysaccharides-Starch

##### II. Qualitative analysis of Amino acids

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

##### III. Analysis of lipids (Demonstration)

- a) Oil, Unsaturated fat and Sterol

## **REFERENCE BOOKS:**

1. Biochemical Methods 1992, by **S.Sadasivam and A. Manickam**, Second Edition, New Age International Publishers, New Delhi.
2. Laboratory Manual in Biochemistry, 1981. **J.Jayaraman**, New Age International publishers, New Delhi.

**YEAR I – SEMESTER II**  
**CORE - BIOCHEMISTRY PRACTICAL – II**

|            |                     |             |      |
|------------|---------------------|-------------|------|
| Paper      | : Core Practical II | Total Hours | : 60 |
| Hours/Week | :5                  | Exam Hours  | : 06 |
| Credit     | : 3                 | Internal    | : 40 |
| Paper Code | : <b>20U2BCCP02</b> | External    | : 60 |

**Courses Outcome**

- CO1      Imbibe the usage of paper chromatography, TLC, SDS- PAGE, colorimeter and spectrophotometer, flame photometry
- CO2      Comprehend the principles involved in the estimation of sodium and potassium
- CO3      Analyze and interpret the results of estimation of ascorbic acid

**I. Quantitative Analysis**

- a) Estimation of Glycine aminoacid by Formal titration method.
- b) Estimation of Ascorbicacid by 2,6 Di Chlorophenol Indophenol Dyemethod.
- c) Estimation of Sodium and Potassium by Flame Photometry
- d) Estimation of DNA by Diphenylamine method.

**II. Qualitative Experiments**

- a) Preparation of buffer and its pH measurements using pH meter.
- b) Separation of amino acids by Paper Chromatography (Ascending and Descending)
- c) Separation of amino acids by TLC.

**REFERENCE BOOKS:**

1. Biochemical Methods 1992, by **S.Sadasivam and A. Manickam**, Second Edition, New Age International Publishers, New Delhi.
2. Laboratory Manual in Biochemistry, 1981. **J.Jayaraman**, New Age International publishers, New Delhi.
3. An Introduction to Practical Biochemistry (1998) 3rd ed., **Plummer D. T.**, Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-

**YEAR II – SEMESTER III**  
**ENZYMES AND ENZYME TECHNOLOGY**

|            |                    |             |      |
|------------|--------------------|-------------|------|
| Paper      | : Core III         | Total Hours | : 60 |
| Hours/Week | : 4                | Exam Hours  | : 03 |
| Credit     | : 4                | Internal    | : 25 |
| Paper Code | : <b>20U3BCC03</b> | External    | : 75 |

**Aim**

To inculcate knowledge on enzymes, classification, structure kinetics and applications.

**Objectives**

On successful completion of the course the students will acquire knowledge about mechanism of action, enzyme kinetics, purification and application of the enzymes.

**COURSE OUTCOME:**

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Explain the hypothesis models , classification and enzymes units of enzymes                                | K1              |
| CO2       | Apply appropriate methods for determination of enzymes kinetics and enzymatic reactions                    | K1              |
| CO3       | Describe the enzyme inhibition , mechanism of action and isoenzymes  | K2              |
| CO4       | Explain the mechanism of catalysis and co- enzymes which involve in the maintenance of body's homeostatsis | K3              |
| CO5       | Use appropriate enzymes for enzyme technology and applications   | K3              |

**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

## CONTENT

### Unit I Enzymology

(12 Hours)

Introduction, Enzyme characteristics, Enzyme commission numbers and Classification of enzymes. Definition-Holoenzyme, co-enzyme, co-factors, apoenzymes, prosthetic group, abzymes, ribozymes and enzyme units and enzyme turnover number. Definition-active site, specificity of enzyme, energy activation, transition state, Lock and key model, induced fit model. Ping-pong reaction, bisubstrate reaction and multi substrate reaction

### Unit II Enzyme kinetics

(12 Hours)

Order of reaction-Zero, First order reaction, Michaelis – Menton equation, Line – Weaver and Burk plot, Eadie – Hofstee plot. Significance of  $K_m$  and  $V_{max}$ . Factors affecting the enzyme activity - pH, temperature, Concentration of enzyme and substrate, Product concentration and activators.

### Unit III Enzyme inhibition

(12 Hours)

Reversible and irreversible inhibition- competitive, non-competitive and uncompetitive, regulation of enzyme activity – feedback, allosteric enzymes, cooperativity - aspartate transcarbamylase. Isoenzymes - Lactate dehydrogenase.

### Unit IV Mechanism of Catalysis and Co-Enzymes

(12 Hours)

Outline of mechanism of enzyme action - acid base catalysis, covalent catalysis, metal ions catalysis. Proximity orientation effects, Multienzyme Complex- Mechanism of lysozyme and chymotrypsin. Coenzymes-structure and functions of TPP, NAD, NADP, FAD, FMN, coenzyme A and biotin.

### Unit V Enzyme Technology and Applications

(12 Hours)

Immobilized enzymes Methods – non-covalent adsorption and deposition, physical entrapment, covalent attachment and bio-conjugation and uses of immobilized enzymes, Effects of immobilized enzyme-thermal and stability. Isolation and purification of enzymes- dialysis, ultra-centrifugation, affinity chromatography. Medical, industrial and agricultural use of enzymes

## TEXT BOOKS

1. Nicholas., C. Price, (2016). **Fundamentals of Enzymology**. 3<sup>rd</sup> Edition, Oxford University Press.
2. Trevor Palmer, (2010). **Enzymes**. 5<sup>th</sup> Edition, Affiliated East – West press (P) Ltd.
3. Gary Walsh, Denis, and Headon, (2014). 2<sup>nd</sup> Edition **Protein Biochemistry and**

**Biotechnology.**John

Wiley and Sons Ltd, USA.

### **REFERENCES BOOKS**

1. Dixon, E.Cwebb, (1999). **Enzymes.**3<sup>rd</sup> Edition, CJRthorne and K.F.Tipton,Longmans Green &Co , London and Academic Press, New York.
2. Punekar 2018 Enzymes: Catalysis Kinetics and Mechanism, Springer Publisher
3. Khan 2015 Principles of enzymes Technology 1<sup>st</sup> Edition PH1 Learning Pvt Ltd

### **WEB RESOURCES**

<http://expasy.org/enzyme/>.

<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>.

[www1.lsbu.ac.uk/water/enztech/inhibition.html](http://www1.lsbu.ac.uk/water/enztech/inhibition.html)

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

## YEAR II – SEMESTER III

### HEALTH AND HYGIENE

|            |                    |             |      |
|------------|--------------------|-------------|------|
| Paper      | : <b>NMEC I</b>    | Total Hours | : 30 |
| Hours/Week | : 2                | Exam Hours  | : 03 |
| Credit     | : 2                | Internal    | : 25 |
| Paper Code | : <b>20U3BCN01</b> | External    | : 75 |

#### Aim

To understand the biomolecules, physiological changes, nutritional requirements and dietary management of the diseases.

#### Objectives

Explain about the sources, function of carbohydrates and disorders of carbohydrate metabolism and 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 issues   | 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 standard care | 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 Overview Health****6 Hrs**

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

**UNIT II Nutrition and Health****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 Maternal and child Health****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 (BBT, Cervical and mucous methods). Artificial methods – Hormonal contraceptives, gonadal steroids, oral pills and Depot formulations.

**UNIT IV Dental Health****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 Mental Health****6 Hrs**

Mental Health – Types and causes of mental illness – Preventive aspects; Alcoholism, Drug dependence – Commonly abused drugs. Health in Old age – Aging, caring for older people, care of bedridden.

**TEXT BOOKS**

1. **Ahmed. M. N.**, *Hygiene and health*, Anmol publications, New Delhi, 15<sup>th</sup> 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, 18<sup>th</sup> edition, 2017.

**REFERENCE BOOKS**

1. **Patil. R.S.**, *Practical Community Health*, Vora medical publishers, New Delhi, 3<sup>st</sup> edi 2010.
2. **Prabhakara. G. N.**, *Preventive and social medicine*, Jaypee Publications., New Delhi, 1<sup>st</sup> edi, 2010.
3. **Sridhar Rao. B.**, *Community Health Nursing*, A.I.T.B.S. Publishers, New Delhi, 3<sup>rd</sup> edi 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/>
4. <https://www.webmd.com/mental-health/mental-health-types-illness#1>

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

## YEAR II – SEMESTER III

### BIOCHEMISTRY IN DIAGNOSIS

|            |                    |             |      |
|------------|--------------------|-------------|------|
| Paper      | : <b>NMEC II</b>   | Total Hours | : 30 |
| Hours/Week | :2                 | Exam Hours  | : 03 |
| Credit     | : 2                | Internal    | : 25 |
| Paper Code | : <b>20U3BCN02</b> | External    | : 75 |

#### Aim

To understand the techniques, diagnostic and significance of bio-chemical, hormones and Clinical interperations

#### Objectives

This course presents about the techniques, diagnostic values and significance and the interpretation of various enzymes, bio-chemical parameters, hormones and immunoglobulins.

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Remember the approaches to clinical quality control, accuracy and collection and preservation of biological samples such as blood, urine and fluids | K1              |
| CO2       | Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC  | K1              |
| CO3       | Apply the knowledge abnormal constituents of urine chemical such as protein, keton bodies, bile pigments and their clinical interpretation          | K2              |
| CO4       | Analyse and describe the critical based knowledge collection, preservation, abnormal constituent of stools and microscopy studies.                  | K3              |
| CO5       | Evaluate and discuss the estimate the biochemical GTT, SGOT, SGPT and LDH etc   | 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 Approaches to clinical biochemistry**

**06 Hours**

Quality control- Concepts of accuracy, precision, sensitivity and reproducibility, Collection of clinical specimens, preservatives for blood and urine, transport of biological samples. Biomedical waste disposal, First aid equipment in laboratory accident- Precautions and first aid equipment

### **UNIT – II Hematology**

**06 Hours**

Hematology- Composition and functions of blood, Haemoglobin, Differential count- PCV, ESR, RBC, WBC and Platelet count. Fully automated and Semiautomated Analysis.

### **UNIT – III Physical examination of urine**

**06 Hours**

Physical examination of urine- Volume, colour, odour, appearance, specific gravity and pH. Chemical examination of urine: Qualitative tests for Reducing sugar, protein, ketone bodies, Bile pigment, bile salt, Urobilinogen, and mucin. Microscopic Examination of urine.

### **UNIT – IV Stool examination**

**06 Hours**

Collection of fecal specimen, preservation, physical examination:- volume, colour, odour and appearance. Chemical examination:- reducing sugar, occult blood test, detection of steatorrhea. Microscopic examination of stool.

### **UNIT – V Biochemical components in Blood**

**06 Hours**

Estimation of Biochemical components in Blood- Glucose, GTT, Glycosylated haemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of enzyme activity: SGOT, SGPT and LDH.

### **TEXT BOOK**

1. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.

### **REFERENCE**

1. Kanai L.Mukherjee, Medical Laboratory Technology Vol. I.Tata McGrawHill 1996, New Delhi.
2. Text book of Biochemistry with clinical correlation, Thomas M. Devlin, 3rd edition, A. John Wiley-Liss Inc. Publication.

3. Tietz Fundamentals of Clinical Chemistry- (5th edition) C.A. Burtis, E.R. Ashwood (eds)  
Saunders WB Co.

### **WEB OF REFERENCE**

1. <https://onlinelibrary.wiley.com/doi/abs/10.1002/0470869526.ch3>
2. <http://fb.lt.cz/en/skripta/v-krev-a-organy-imunitniho-systemu/1-slozeni-krve/>
3. [https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis\\_microscopic\\_exam](https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinalysis_microscopic_exam)
4. <https://www.webmd.com/a-to-z-guides/what-is-a-stool-culture#1>
5. <https://www.webmd.com/diabetes/guide/glycated-hemoglobin-test-hba1c>

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

## YEAR II – SEMESTER III

### CORE - BIOCHEMISTRY PRACTICAL – III

|            |                      |             |      |
|------------|----------------------|-------------|------|
| Paper      | : Core Practical III | Total Hours | : 75 |
| Hours/Week | :5                   | Exam Hours  | : 06 |
| Credit     | : 3                  | Internal    | : 40 |
| Paper Code | : 20U3BCCP03         | External    | : 60 |

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Remember the approaches to isolation and separation of starch from Potato, Lecithin from Egg Yolk, Casein from milk | K1 & K2         |
| CO2       | Understand the estimation of protein by Lowrys Method   | K1 & K2         |
| CO3       | Apply the Extraction of Muscle LDH from rabbit muscle using a piston homogenizer                                    | 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    |

S- Strong; M-Medium; L-Low

#### I. Preparation:

1. Buffer Preparation
2. Starch from Potato
3. Lecithin from Egg Yolk
4. Casein from Milk

#### II. Enzyme assay

1. Estimation of Protein by Lowry's Methods
2. Optimization of pH, temperature, substrate concentration and Enzyme concentration of Salivary Amylase, Catalase.
3. Evaluation of Enzyme kinetics  $K_m$ ,  $V_{max}$ ,  $K_{cat}$  from crude enzyme

4. To determine specific activity of alkaline phosphatase enzyme.

### **III. Extraction** (Group Experiment)

Extraction of muscle LDH from rabbit muscle using a piston homogenizer.

### **REFERENCES**

1. Jayaraman, S. (2003). **Laboratory Manual in Biochemistry**. 2<sup>nd</sup> Edition .New Age International (P) Limited. New Delhi
2. Sadasivam S and Manickam P. (2004) **Biochemical Methods**. 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.
3. Price, N.C and Stevens, L., (1999) **Fundamentals of Enzymology** 3rd ed., Oxford University Press Inc., (New York), ISBN:13: 978-0-19-806439-8.

## YEAR II – SEMESTER IV

### INTERMEDIARY METABOLISM

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : Core IV   | Total Hours | : 75 |
| Hours/Week | : 5         | Exam Hours  | : 03 |
| Credit     | : 5         | Internal    | : 25 |
| Paper Code | : 20U4BCC04 | External    | : 75 |

#### Aim

To understand the metabolic reactions of biomolecules, energy production, different mechanism and regulatory that control metabolic reactions under normal condition.

#### Objective

The objective of the paper is to make the students to study about bioenergetics of important metabolic pathways and metabolic changes of molecules in the body. Also to know about the interrelationship between carbohydrate, fat and protein metabolism.

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Demonstrate the important carbohydrate metabolic pathways and understand the principle mechanism in energy transfer reactions. living   | K1 & K2         |
| CO2       | Explain the synthesis and importance of lipids in living system.  | K1 & K2         |
| CO3       | Gain knowledge on types and significance of anabolic and catabolic reactions of amino acids and understand the interrelationship between carbohydrate, lipid and protein metabolism | K1, K2 & k3     |
| CO4       | To acquire knowledge on biological oxidation and ETC  | K1 & K2         |
| CO5       | Discriminate the synthesis and degradation of the nucleic acids.  | 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



## **CONTENT**

### **UNIT – I Carbohydrate Metabolism**

**12 Hours**

Introduction, glycolysis, TCA cycle, and its energetics. Glycogen metabolism- glycogenesis and glycogenolysis, Alternative pathways- HMP pathway, gluconeogenesis, glyoxylate cycle and its importance.

### **UNIT-II Lipid Metabolism**

**12 Hours**

Introduction, Oxidation of fatty acids (alpha, beta, omega oxidation). Denovo synthesis of Fatty acid, Biosynthesis of cholesterol, Biosynthesis of TG, Phospho lipids (Phosphatidyl serine, Phosphatidyl ethanolamine), Ketone bodies and its metabolism

### **UNIT –III Protein Metabolism:**

**12 Hours**

Degradation of proteins –Deamination, Transamination and Decarboxylation. Transport of ammonia. Urea cycle. Catabolism of carbon skeleton of aminoacids (Alpha Keto Glutarate, Pyruvate, Aromatic aminoacids) . Interrelation between carbohydrates, fat and protein metabolism.

### **UNIT–IV Biological oxidation**

**12 Hours**

Introduction, Enzymes in biological oxidation, Redoxpotential, Electron Transport Chain and its inhibitors, structure of ATPase complex, chemiosmotic theory, Oxidative phosphorylation and its inhibitors, Mitochondrial shuttle system.

### **UNIT-V Purine Nucleotide Metabolism**

**12 Hours**

Introduction, Biosynthesis (Denovo) Salvage Pathway and degradation of purine Nucleotide. Pyrimidine nucleotides Metabolism: Introduction, Biosynthesis and degradation of pyrimidine. Inhibitors of nucleic acid metabolism.

## **TEXT BOOKS**

1. Nelson, David, L. and Cox, (2008). Lehninger Principles of Biochemistry. 5<sup>th</sup> Edition, W.H. Freeman and Co., New York.
2. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2008). Fundamentals of Biochemistry, 3<sup>rd</sup> Edition. John Wiley & Sons, New Jersey.
3. Eric, E. Conn, P.K. Stumpf, G. Brueins, and Ray, H. Doi, (2005). Outlines of Biochemistry. 5<sup>th</sup> Edition, John Wiley and sons, Singapore.
4. Lubert Stryer, (1995). Biochemistry. 4<sup>th</sup> Edition .WH freeman and co, Sanfrancisco.

## **REFERENCE BOOKS**

1. Devlin, T.M. (2002) Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York.
2. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry. McGraw Hill.

## **WEB SOURCES**

[www.britannica.com/science/glyoxylate-cycle](http://www.britannica.com/science/glyoxylate-cycle)

<https://www.uic.edu/classes/phar/.../transaminationofaminoacid.html>

[www.slideshare.net/YESANNA/transamination-deamination](http://www.slideshare.net/YESANNA/transamination-deamination)

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

**YEAR II – SEMESTER VI**  
**BIOCHEMISTRY AND HEALTH**

|            |            |             |      |
|------------|------------|-------------|------|
| Paper      | NMEC III   | Total Hours | : 30 |
| Hours/Week | :4         | Exam Hours  | : 03 |
| Credit     | : 3        | Internal    | : 25 |
| Paper Code | :20U4BCN03 | External    | : 75 |

**Aim**

To understand the nutritional requirements and dietary management of the various diseases.

**Objectives**

Explain about the sources, function, disorders of biomolecules and recommended daily allowance and consumption of biomolecules

| 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 Carbohydrate**

**06 Hours**

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 Proteins****06 Hours**

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

**UNIT – III Lipids****06 Hours**

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. Hypertension and Atherosclerosis .

**UNIT – IV Vitamins****06 Hours**

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

**UNIT – V Minerals****06 Hours**

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**

## YEAR II – SEMESTER IV

### CORE - BIOCHEMISTRY PRACTICAL – IV

|            |                     |             |      |
|------------|---------------------|-------------|------|
| Paper      | : Core Practical IV | Total Hours | : 75 |
| Hours/Week | :5                  | Exam Hours  | : 03 |
| Credit     | : 3                 | Internal    | : 40 |
| Paper Code | : 20U4BCCP04        | External    | : 60 |

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Remember the approaches to clinical quality control, accuracy and collection and preservation of biological samples such as blood, urine and fluids | K1 & K2         |
| CO2       | Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC  | K1 & K2         |
| CO3       | Apply the knowledge abnormal constituents of urine chemical such as protein, keton bodies, bile pigments and their clinical interpretation          | 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   | 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    |

S- Strong; M-Medium; L-Low

#### I. COLORIMETRY

1. Estimation of Glucose - Ortho Toludine Method
2. Estimation of Fructose - Seliwanoff's Method
3. Estimation of Pentose - Bial's Method
4. Estimation of Urea - DAM Method
5. Estimation of Cholesterol - Zaks Method
6. Estimation of Protein - Biuret Method
7. Estimation of Phosphorus - Fiske Subbarow Method.

## **REFERENCES**

1. **Medical Laboratory Technology** - a Procedure Manual for Routine Diagnostic Tests Vol. I (2010), Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (New Delhi). ISBN: 9780070076594 / ISBN:9780070076631

2. **Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests** VoI.II (2010), Mukherjee, K.L., Tata Mc Graw – Hill Publishing Company Ltd. (New Delhi), ISBN: 9780070076648.

3. **Experimental Biochemistry: A Student Companion** (2005) Rao, B.S. and Deshpande, V., IK International Pvt. Ltd. (New Delhi), ISBN: 81-88237-41-8.

## YEAR II – SEMESTER IV

### CORE - BIOCHEMISTRY PRACTICAL – IV

|            |                     |             |      |
|------------|---------------------|-------------|------|
| Paper      | : Core Practical IV | Total Hours | : 75 |
| Hours/Week | :5                  | Exam Hours  | : 03 |
| Credit     | : 3                 | Internal    | : 40 |
| Paper Code | : <b>20U4BCCP04</b> | External    | : 60 |

**I. 1** .Estimation of Glucose by Ortho Toludine Method 15 Marks

(Or)

2. Estimation of Fructose by Seliwanoff's Method

**II.1**.Estimation of Urea by DAM Method 15 Marks

(Or)

2. Estimation of Protein by Biuret Method

Record 10

Spotters 20

## YEAR III – SEMESTER V

### HUMAN PHYSIOLOGY

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : CORE V    | Total Hours | : 60 |
| Hours/Week | : 5         | Exam Hours  | : 03 |
| Credit     | : 5         | Internal    | : 25 |
| Paper Code | : 20U5BCC05 | External    | : 75 |

#### Aim

This course present to focus on the understanding the physiological activities and mechanism of various organs and its anatomy.

#### Objective

The objective of the course is to understood clearly on various vital organs and endocrinological activities of human body.

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Demonstrate about digestive system and its regulation alimentary parts of human and body fluids body.   | K1 & K2         |
| CO2       | Discriminate respiratory system and excretory system.   | K3              |
| CO3       | Types, functions and physiology of muscle, function of heart.   | K5              |
| CO4       | Assess the Sympathetic parasympathetic nervous system and synaptic transmission                         | K4              |
| CO5       | Interpret about male and female reproductive system and its physiological function, hormonal regulation | K5              |

#### 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 Digestive System**

**12 Hours**

Secretions of digestive tract, digestion, absorption, assimilation of carbohydrates, proteins, fats.

### **Unit II Blood Composition and function**

**12 Hours**

Red blood cells, Hemoglobin, white blood cells and platelets. Blood composition and function. Respiratory System- Transport and exchange of gases between lungs and tissues, Mechanism of blood coagulation. Lung Volumes -Tidal volume, Inspiratory Reserve Volume, Expiratory Reserve Volume.

### **Unit III Cardiac system**

**12 Hour**

Types, functions and physiology of muscle contraction, physiology of cardiac muscle, Structure and function of Heart, cardiac cycle and its regulation, Electrocardiogram and sphygmomanometer

### **Unit IV Nervous System**

**12 Hour**

Organization of the nervous system, concept of central nervous system, peripheral nervous system, Autonomic nervous system, Sympathetic and parasympathetic nervous systems, Structure of neuron, action potential, Propagation of nerve impulses, Structure of synapse, synaptic transmission.

### **Unit V Urogenital and Reproductive System**

**12 Hour**

Structure and functions of kidney, Nephron, Mechanism of urine formation, Renal Transplantation, Dialysis. Structure and function of the male and female reproductive organs, spermatogenesis, menstrual cycle, physiology of pregnancy, parturition and lactation.

### **TEXT BOOKS**

1. Chatterjee C, **Human Physiology**, Medical Allied Agency Calcutta., 13<sup>th</sup> edition, (2010).
2. Muthayya.N.M, **Human Physiology**, Jaypee publications, New Delhi, 5<sup>rd</sup>edi., 2011.
3. Sathyanarayana, U. **Text book of Biochemistry**, Books and Allied Ltd, Kolkatta, 5<sup>nd</sup>edi., 2019.
4. Willam F. Ganong. **Review of medical physiology**(2013), 21<sup>ST</sup> Editon, The MC Graw-Hill companies, India.

### **REFERENCE BOOKS**

1. Guyton, **Text book of Medical Physiology**, W. B. Saunder's Company, 10<sup>th</sup> edition, (2018).
2. Murray, R. K., Granner Mayes and Rod Well, Appleton and Lange, **Harper's Biochemistry**, 32<sup>nd</sup> edition(2018).
3. Barbara A. Gyls Mary Elen Wedding, **Medical Terminology Systems**, Davis plus International. 6<sup>th</sup> edition. 2018.

### **WEB REFERENCES**

1. <https://nptel.ac.in/courses/127/106/127106001/>
2. <https://nptel.ac.in/courses/127/106/127106001/>
3. <https://nptel.ac.in/content/storage2/courses/122103039/pdf/mod3.pdf>
4. <https://www.vedantu.com/biology/human-excretory-system>

## YEAR III – SEMESTER V

### MOLECULAR BIOLOGY

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : CORE VI   | Total Hours | : 60 |
| Hours/Week | : 5         | Exam Hours  | : 03 |
| Credit     | : 5         | Internal    | : 25 |
| Paper Code | : 20U5BCC06 | External    | : 75 |

#### Aim

Molecular Biology deal with the central dogma of life and its regulation.

#### Objective

To make the students understood the synthesis of genetic material, RNA and proteins, gene repair mechanism and gene mutation. To make the students learn about the techniques used in identifying gene mutation.

#### COURSE OUTCOME

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | The course will provide detailed molecular mechanism of DNA replication process                  | K2              |
| CO2       | To understand transcription and post transcriptional modifications of RNA                        | K2              |
| CO3       | To obtain knowledge about the decoding process of mRNA for protein designing principle           | K3              |
| CO4       | Course will advance the knowledge of students on regulation of gene expression and Recombination | K4              |
| CO5       | Categorize the different types of DNA mutation and repair mechanisms                             | K4              |

#### 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 | S   | M   | M   | M   | L   | L   | L   | M   | S   | M    | L    | L    | M    | 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 | M   | L   | S   | M   | M   | L   | L   | S   | M   | M    | L    | M    | M    | L    | L    |

S- Strong; M-Medium; L-Low

**UNIT – I Replication****12 Hours**

Overview of Central dogma. Experimental evidence to prove DNA as genetic material, Types of replication, Meselson & Stahl experiment, bi-directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, mechanism of DNA replication in prokaryotes and Eukaryotes- Initiation, Elongation, Termination, Telomere replication in eukaryotes. inhibitors of DNA replication.

**UNIT – II Transcription****12 Hours**

Basic features of RNA synthesis, E.Coli RNA polymerases, Characteristics of promoter and enhancer sequences. RNA synthesis mechanism in Prokaryotes and Eukaryotes: Initiation, elongation and termination, Inhibitors of transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping, Poly 'A' tail addition, RNA splicing and processing of mRNA.

**UNIT – III Translation****12 Hours**

Introduction to Genetic code- Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, composition of prokaryotic and Eukaryotic ribosomes, mechanism of initiation, elongation and termination of protein synthesis in prokaryotes and eukaryotes, inhibitors of protein synthesis, Posttranslational modifications and its importance.

**UNIT – VI Regulation of gene expression and Recombination****12 Hours**

Hierarchical levels of gene regulation, Prokaryotic gene regulation –lac, trp and arab operon, DNA recombination: Homologous, site specific and transposition.

**UNIT – V DNA damage and Repair****12 Hours**

Types of mutation- Base substitution, insertion, deletion, inversion, duplication, translocation, types of mutagens. DNA Repair mechanisms- thymine dimer, light activation, excision, recombinational, SOS and mismatch repair.

**TEXT BOOKS**

1. Ajoy Paul, (2015). Text book of Cell and Molecular Biology 4<sup>th</sup> Edition, Books and Allied (P) Ltd, Kolkata.
2. Rastogi, S.C. Cell and Molecular Biology, India Binding House, U.P., 2<sup>nd</sup> edi. 2010.

**REFERENCE BOOKS**

1. Freifelder's, Essentials of Molecular Biology, Jones and Bartlett Publications Inc., London 4<sup>th</sup> Edition, , 2015.
2. Gardner, E.J., Simmons, M.J. and Snusted, D.P., Principles of Genetics, John Wiley and Sons, New York, 8<sup>th</sup> ed., 2006.
3. David L. Nelson and Michael Cox, Lehninger Principles of Biochemistry, WH Freeman Publisher, 7th ed. 2017

4. Robert F. Weaver, Molecular Biology , The McGraw – Hill Companies , 5 th Edition 2012
5. Jolcelyn E.Krebs, Elliotts.Goldstein and Stephen T.Killpatrick, Lewins genes XII, Jones and Bartlett Publishers, 12th Revised edition edition, 2017

### **WEB REFERENCES**

1. <https://microbenotes.com/prokaryotic-dna-replication-enzymes-steps-and-significance/>
2. <https://microbenotes.com/rna-splicing/>
3. <https://www.sparknotes.com/biology/molecular/translation/section3/>
4. <https://www.khanacademy.org/science/biology/gene-regulation/gene-regulation-in-bacteria/a/the-trp-operon>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5474181/>

## YEAR III – SEMESTER V

### DRUG BIOCHEMISTRY

Paper : ELECTIVE I  
Hours/Week : 4  
Credit : 3  
Paper Code : 20U5BCE01

Total Hours : 60  
Exam Hours : 03  
Internal : 25  
External : 75

#### Aim

This course presents to focus on the bioactive principles used for drug discovery and it also covers human biology where ever relevant.

#### Objective

The objective of the course is tounderstand the development of the traditional and modern methods used for drug discovery; of how molecules interact.

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | To understand the development of the traditional and modern methods used for drug discovery; of how molecules interact.   | K2              |
| CO2       | Explain the pharmaceutical industry is by far the largest employer of medicine  | K3              |
| CO3       | Analyze the skills in the use of reaction mechanisms and how knowledge of reaction mechanisms can aid in understanding the mode of action of a drug, and the method by which it can be synthesized, and developed | K4              |
| CO4       | Knowledge of reaction mechanisms can aid in understanding the mode of action of a drug  | K6              |
| CO5       | Categorize the learnt method by which it can be synthesized, and developed.   | K5              |

#### 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 Introduction of Drug****12Hours**

Introduction- Definitions, Sources of drugs, dosage forms of drug (Types alone), routes of drug administration, Classification of drugs.

**Unit II Biotransformation, Pharmacokinetics and dynamics****12Hours**

Pharmacokinetics- Absorption and bioavailability of drugs, distribution of drugs, Site of action, half life, C max, T max, factors affecting drug absorption and distribution. Elimination of drugs. Pharmacodynamics- Definition, Drug receptors, drug - receptor interactions, Receptor mediated and non-receptor mediated drug action, Placebo effects, Factors modifying drug action. Biotransformation- Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism.

**Unit III Adverse Drug Reactions and Side Effects****12Hours**

Definition and types. Diseases related to ADRs, Multi Drug Reactions, Drug tolerance & intolerance, Drug addiction, Drug abuses and their effects, management of self-poisoning and drug dependence.

**Unit IV Antibiotics & Chemotherapy****12Hours**

Antibiotics- Types, mode of action and resistance of antibacterial, antiviral and anti-fungal drugs. Chemotherapy- Types, mode of action of chemotherapeutic drugs. Immuno suppressive therapy.

**Unit V Drug discovery and Drugs of plant origin****12Hours**

Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing. Preclinical research, clinical research, overview of DCGI, FDA, ICMR and FSSAI.

Role of Phytochemicals in therapeutics- Alkaloids, Flavonoids and Glycosides.

**TEXT BOOKS**

1. Foye's , 2013 **Principles of Medicinal Chemistry** 7<sup>th</sup> Edition Lippincott Williams and Wilkins publishers. New Delhi
2. Padamaja udayakumar 2017, **Medical pharmacology** 5<sup>TH</sup> Edition ., CBS publishers and distributors pvt.ltd, Newdelhi.
4. A Text book of Pharmaceutical Chemistry by Dr Jayashree Ghosh revised Edition 2014 Chan Publication PVT Ltd

**REFERENCE BOOKS.**

1. Burger's **Medicinal Chemistry and Drug Discovery**: 2021, principles and practice – 8<sup>th</sup> Edition Wolf, John Wiley
2. Nirmala, N., Rege, R.S., Santoskar, S.D. and Bhandarkar (2015), Pharmacology and Pharmacotherapeutics, 24<sup>rd</sup> edition, CBS Publishers and Distributors Pvt. Ltd.
4. Tripathi, K.D. (2013) Essentials of Medical Pharmacology 7<sup>th</sup> dition, Jaypee brothers, Medical publishers, New Delhi

#### **WEB REFERENCES**

1. <https://www.msmanuals.com/professional/clinical-pharmacology/adverse-drug-reactions/adverse-drug-reactions>
2. <https://en.wikipedia.org/wiki/Pharmacodynamics>
3. <https://www.healthline.com/health/chemotherapy>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3560124/>

**YEAR III – SEMESTER V**  
**NUTRITIONAL BIOCHEMISTRY**

Paper : **ELECTIVE II**  
Hours/Week : 5  
Credit : 3  
Paper Code : **20U5BCE02**

Total Hours : 60  
Exam Hours : 03  
Internal : 25  
External : 75

**Aim**

This course presents to focus on the nutritional requirement in physiological and malnutrition status in diseased status. It is an important paper making the students to have placement as nutritionist in hospitals and dietitians.

**Objective**

To acquire detailed knowledge regarding the biological basis of nutrition and the mechanisms by which diet can influence health. This includes a basic understanding of metabolism, physiology, molecular genetics, epidemiology and biostatistics.

**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 Introduction of food****12 Hours**

Definition and Units of energy-Kilocalories,Respiratory quotients of foodstuffs, specific dynamic action. Estimation of energy requirement and Energy values of food, Basal Metabolic rate- Measurement of BMR and factors influencing BMR.Regulation of Body Temperature and Energy needs, Total energy requirement for various activities

**UNIT – II Balance of Diet****12 Hours**

Definition,Dietary requirements, recommended dietary allowances for infants, children and adolescent, pregnant and lactating women. Role of dietary fat, fiber, antioxidants . Carbohydrates in nutrition

**UNIT – III Proteins****12 Hours**

Essential and non-essential aminoacids, Protein content of diets various ages in Indians.Quality and Quantitative aspects of protein - Protein nutritional Nitrogen balance, Protein calorific malnutrition – marasmus and kwashiorkor- Aetiology, symptoms and management.

**UNIT – IV Mineral And Vitamin Nutrition****12 Hours**

Vitamins- Definition, classification, sources, distribution, abnormalities, minimum requirements and optimum allowances, Deficiency and excess. Minerals - Nutritional significance of dietary micro and macro-minerals. minimum requirements and optimum allowances, disorders related to the deficiency of minerals.

**UNIT- V Nutrition And Body Defenses****12 Hours**

Nutritional therapy- stress, anemia, obesity, diabetes mellitus and allergy, Role of diet and nutrition in the prevention and management. Effect of drugs on nutrients, food production, storage and management.

**TEXT BOOKS**

1. Nutrition: Science and Applications, 3rd Edn. Lori A. Smolin, Mary B. Grosvenor, Wiley (2013).
2. Introduction to Human Nutrition, 2nd Edn. Michael J. Gibney, Susan A. Lanham-New, Aedin Cassidy, Hester H. Vorster, Wiley-Blackwell (2009).
3. Swaminathan, M. (2010) Essentials of Food and Nutrition, Volume I and II Ganesh and Co., Madras

## **REFERENCE BOOKS**

1. Introduction to Human Nutrition, 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK, (2012).
2. Srilakshmi. E .(2016) Nutrition Science, New Age International Publishers
3. Gopalan, C., Ramasastry, B.V and Balasubramanian, S. (2007). Nutritive Value of Indian Foods, National Institute of Nutrition, Hyderabad.

## **WEB REFERENCES**

- 1.[https://onlinecourses.swayam2.ac.in/nce20\\_sc01/preview](https://onlinecourses.swayam2.ac.in/nce20_sc01/preview)
- 2.[https://nptel.ac.in/content/syllabus\\_pdf/126104004.pdf](https://nptel.ac.in/content/syllabus_pdf/126104004.pdf)
- 3.[https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumptionbmi?qid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from\\_search=4](https://www.slideshare.net/DrSubirKumar/food-nutrition-nutrients-diet-energy-consumptionbmi?qid=28af04db-ca98-4c07-bc56-abec1a9dcd27&v=&b=&from_search=4)
- 4.[https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1\\_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf](https://nptel.ac.in/content/storage2/courses/126104004/LectureNotes/Week-1_01-Relationship%20between%20Food,%20Nutrition%20and%20Health%201-A.pdf)

## YEAR III – SEMESTER V

### GENETIC ENGINEERING

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : SBEC III  | Total Hours | : 30 |
| Hours/Week | : 2         | Exam Hours  | : 03 |
| Credit     | : 2         | Internal    | : 25 |
| Paper Code | : 20U5BCS03 | External    | : 75 |

#### Aim

Genetic Engineering deal with the basis of gene cloning, vectors, genetic engineering techniques and large scale production.

#### Objective

The objective of the course is to learn about the basics, vectors, methods of gene cloning. Techniques and application of gene technology.

#### COURSE OUTCOMES

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | Course material will help to remember the basic principles of gene cloning and about uses of restriction endonucleases in rDNA technology | K1              |
| CO2       | Understanding of construction of vectors and hybridization techniques   | K2              |
| CO3       | Understand suitable methods for isolation and purification of DNA and the mechanism of various gene transfer methods                      | K2              |
| CO4       | Apply the knowledge gained about gene amplification and advances in sequencing techniques   | K3              |
| CO5       | Explore recombinant DNA technology in the field of medicine, agriculture, industry and environment  | K4              |

#### Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

**UNIT – I Introduction to genetic engineering****06 Hours**

Basic steps of gene cloning, enzymes used in genetic engineering. Basis of gene cloning; Restriction endonucleases – Types and Features; Ligations; Linkers and Adaptors.

**UNIT – II Cloning and vectors****06 Hours**

Plasmids, Cosmids, Phages, Phagemids, Yeast vectors, Shuttle vectors, Ti Plasmids and Ri plasmids. Hybridization probes- Southern, Northern and Western blotting techniques.

**UNIT – III Methods of gene transfer****06 Hours**

Definition of gene transfer. Isolation and purification of cellular and plasmid DNA. Transformation, transfection and conjugation – Synthesis of genes- chemical synthesis of tRNA genes, gene synthesis machine.

**UNIT – IV Molecular techniques****06 Hours**

Amplification of DNA by PCR technique and applications, RT PCR- Principles, Techniques and applications, DNA sequencing – Maxam and Gilbert's method and Sanger's method – DNA chip and Microarray

**UNIT – V Gene therapy and application****06 Hours**

Applications of gene technology- Recombinant insulin and Recombinant growth hormones production, Gene therapy- Methods and applications, oligonucleotides PNA, LNA applications.

**TEXT BOOKS**

1. R.W. Old & S.B. Primrose, Principles of Gene manipulation: An Introduction to Genetic Engineering, Blackwell scientific publications, 5<sup>th</sup> ed., 1994
2. Sandy B. Primrose, Richard Twyman, Principles of Gene manipulation & Genomics, Wiley-Blackwell publisher, 7<sup>th</sup> ed., 2013

**REFERENCE BOOKS**

1. T.A. Brown, Gene cloning and DNA Analysis- An introduction, Chapman and Hall, 2016, 7<sup>th</sup> Edition.
2. Glick.R, Bernard and Pasternak.J, Jack, Molecular Biotechnology, Asm press, Washington D.C, 3<sup>rd</sup> Edition 2002.
3. Glazier. N. Alexander, Hiroshnikaido, Microbial Biotechnology, W.H. Freeman & co., New York, 2<sup>nd</sup> Edition 2007.
4. Molecular Cloning: A Laboratory Manual (3 Volume Set): 4<sup>th</sup> Edition – 2013 by Michael R Green, Joseph Sambrook; Publisher: Viva Books Private Limited.

## **WEB REFERENCES**

1. <http://www.hixonparvo.info/Gene%20Cloning.pdf>
2. <https://thebiologynotes.com/vectors-characteristics-classification-features-types/>
3. <https://geneticeducation.co.in/gene-transfer-techniques-horizontal-vertical-physical-and-chemical/>
4. <https://microbenotes.com/polymerase-chain-reaction-pcr-principle-steps-applications/>
5. [https://en.wikipedia.org/wiki/Gene\\_therapy](https://en.wikipedia.org/wiki/Gene_therapy)

**YEAR III – SEMESTER V**  
**CORE - BIOCHEMISTRY PRACTICAL – V**

|            |                    |             |      |
|------------|--------------------|-------------|------|
| Paper      | : Core Practical V | Total Hours | : 75 |
| Hours/Week | :5                 | Exam Hours  | : 06 |
| Credit     | : 3                | Internal    | : 40 |
| Paper Code | : 20U5BCCP05       | External    | : 60 |

**COURSE OUTCOME**

| Course No  | Course Outcome  | Knowledge Level |
|------------|---|-----------------|
| <b>CO1</b> | Learn and understand the Qualitative analysis of secondary phytochemicals in medicinal plants | K1 & K2         |
| <b>CO2</b> | Estimate the amount of Total Alkaloids, flavonoids  | K1 & K2         |
| <b>CO3</b> | Learn the Ash content from the plant sources  | 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

1. Qualitative analysis of secondary phytochemicals in medicinal plants
2. Extraction and confirmation
  - a. Pectin from orange peel
  - b. Caffeine from tea
  - c. Solanine from potato
3. Estimation of total alkaloids
4. Estimation of total flavonoids
5. Estimation of chlorophyll in leaves
6. Determination of Ash content from plant source
7. Determination of H<sub>2</sub>O<sub>2</sub> radical scavenging assay.

## **TEXT BOOKS**

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

## **REFERENCES**

1. **Laboratory Manual in Biochemistry.** Pattabiraman, T.N. (1998). 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.

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

3. **Biochemical Methods.** Sadasivam S and Manickam P. (2004) 2<sup>nd</sup> Edition. New Age

## YEAR III – SEMESTER V

### CORE - BIOCHEMISTRY PRACTICAL – VI

|            |                     |             |      |
|------------|---------------------|-------------|------|
| Paper      | : Core Practical VI | Total Hours | : 75 |
| Hours/Week | : 5                 | Exam Hours  | : 06 |
| Credit     | : 3                 | Internal    | : 40 |
| Paper Code | : <b>20U5BCCP06</b> | External    | : 60 |

#### COURSE OUTCOME

| Course No  | Course Outcome   | Knowledge Level |
|------------|--|-----------------|
| <b>CO1</b> | Isolation and identification of genomic DNA from animal and plant tissue | K1 & K2         |
| <b>CO2</b> | Learn about Bacterial Transformation method                              | K1 & K2         |
| <b>CO3</b> | 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

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



## **TEXT BOOKS**

1. **An Introduction to Practical Biochemistry**. David, T. Plummer, (1988). 3<sup>rd</sup> 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.

## YEAR III – SEMESTER VI

### IMMUNOLOGY AND IMMUNOTECHNIQUES

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | : CORE VII  | Total Hours | : 60 |
| Hours/Week | : 5         | Exam Hours  | : 03 |
| Credit     | : 5         | Internal    | : 25 |
| Paper Code | : 20U6BCC07 | External    | : 75 |

#### Aim

Immunology deals with the immune system and it is an important branch in medical sciences. The immune system protects us from infection through various lines of defense. The immunotechnology is a technology based on applications of cells and molecules of the immune system.

#### Objective

To make the students understood the overview of immune system in our body. To make the student learn about antigen and antibody reactions and techniques related to it. To make the students to describe the roles of the immune system in both maintaining health and in diseased condition.

#### COURSE OUTCOME

| Course No | Course Outcome  | Knowledge Level |
|-----------|---|-----------------|
| CO1       | The course will provide detail about overview of immune system and about the cells and organs of immune system                                | K2              |
| CO2       | To understand about the antigens and antibodies and its classification  | K2              |
| CO3       | To obtain knowledge about the interaction between antigen and antibody and techniques about its detection in physiological and diseased state | K3              |
| CO4       | The next level of understanding of cell mediate responses and cytotoxicity responses was dealt and predicted                                  | K4              |
| CO5       | Regulation of immunity, immunosuppressive chemical messengers was covered Immunity during diseased state was discussed and analysed           | K4              |

#### Mapping with Programme Outcomes

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

|     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| co4 | S | L | S | M | S | L | L | S | M | M | L | M | M | L | L |
| co5 | M | L | S | M | M | L | L | S | M | M | L | M | M | L | L |

S- Strong; M-Medium; L-Low

**UNIT-I Overview and Cells and organs of immune system** **12 Hours**

Overview of immune system, Immunity, types, mechanism of immunity, immune response, phagocytosis, hematopoiesis, Cells and its functions – T and B cells, mononuclear phagocytes, granulocytes, Organs of immune system – primary, secondary and cutaneous associated lymphoid tissue.

**UNIT-II Antigens And Antibody** **12 Hours**

Definition -Antigens and Antibody, immunogenicity and antigenicity, Antigens - Properties, Specificity, Immunogenicity, antigenic determinants, haptens, adjuvants. Epitopes, Antibodies - Properties, Structure, Classes Immunoglobins, functions of antibodies, Monoclonal antibodies - Production and functions-.

**UNIT-III Immunotechniques** **12 Hours**

Strength of Antigen –antibody interaction, Agglutination, Precipitation, Complement fixation, and Neutralization, Opsonization. Immunofluorescence, ELISA and RIA. Immuno electrophoresis and electroimmunodiffusion, flow cytometry, western blotting.

**UNIT-IV Immune effector mechanisms** **12 Hours**

MHC, Cell mediated response – effector T cells, cytotoxic T cells, natural killer cells, antibody dependent cell mediated cytotoxicity, inflammatory process and anti-inflammatory agents, Complement component. Cytokines and their functions.

**UNIT- Immune system in health and disease** **12 Hours**

Immune response to viral infections, Vaccines: whole organism vaccine, purified macromolecules as vaccines, DNA vaccines, Hypersensitivity I, II, III, IV, Autoimmunity: organ specific, systemic type, treatment. Immunologic tolerance. Transplantation – Basis of graft rejection, immunosuppressive therapy, oncogenes and cancer induction, tumour antigens, cancer immunotherapy

**TEXT BOOKS**

1. Rastogi (2016). Razdan .M.K (2018). **Elements of Immunology**. 3<sup>rd</sup> Edition, CBS Publishers & Distributors Pvt Ltd.

2. Janeway Jr. Paul., (2001). The immune System in Health and Disease. Travels and Co.,

**REFERENCE BOOKS**

1. JenniPunt, SharonStranford, Patricia Jones and Judy Owen. Kuby Immunology. 8<sup>th</sup> Edition. Macmillan Publications, NY.

2. David Male, Jonathan Brostoff, David Roth and Ivan Roitt.(2013). Immunology. 8<sup>th</sup> Edition. Elsevier Saunders. house, U.P., 2<sup>nd</sup>edi. 2010.

3. Ian R. Tizard. (1994). Immunology: An Introduction. 4<sup>th</sup> Edition. Books/Cole Publishers

**WEB REFERENCES**

1. <https://www.msdmanuals.com/en-in/professional/immunology-allergic-disorders/biology-of-the-immune-system/overview-of-the-immune-system>

2. <https://www.sinobiological.com/resource/antibody-technical/antibody-structure-function>
3. [https://link.springer.com/protocol/10.1007/978-1-0716-0134-1\\_7](https://link.springer.com/protocol/10.1007/978-1-0716-0134-1_7)
4. <https://medcraveonline.com/MOJI/cytokines-and-their-role-in-health-and-disease-a-brief-overview.html>
5. <https://courses.lumenlearning.com/microbiology/chapter/autoimmune-disorders/>

**YEAR III – SEMESTER VI**  
**CLINICAL BIOCHEMISTRY**

|            |             |             |      |
|------------|-------------|-------------|------|
| Paper      | CORE VIII   | Total Hours | : 60 |
| Hours/Week | : 4         | Exam Hours  | : 03 |
| Credit     | : 3         | Internal    | : 25 |
| Paper Code | : 20U6BCC08 | External    | : 75 |

**Aim**

This module aims to detailed knowledge and understanding of the clinical disorders of major organ function, along with the biochemical laboratory methods used in diagnosis and management.

**Objective**

Advanced Clinical Biochemistry deal withthe diagnostic importance of various metabolic disorders and to know the clinical aspects of various metabolic disorders.

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Recognize the disorder of carbohydrate metabolism and its disease                                  | K1 & K2         |
| CO2       | Execute disorders of protein metabolism and its disease  | K3              |
| CO3       | Distinguish about disorders of lipid and nucleic acid metabolism                                   | K4              |
| CO4       | Interpret the Renal function test, Liver function test, Gastric function test, Cerebrospinal fluid | K3 & K4         |
| CO5       | Catagorize clinically imporatnat enzymes- Significant of marker enzymes                            | K4 & K6         |

**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 | S   | L   | M   | S   | S   | S   | L   | M   | M   | M    | S    | L    | M    | S    | M    |
| CO3 | S   | 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 | S   | M   | L   | M   | L   | M   | S   | L   | S   | S    | M    | M    | L    | L    | L    |

S- Strong; M-Medium; L-Low

### **UNIT-I Disorders in carbohydrate metabolism**

**12 Hours**

Introduction, Homeostasis and its disorder-Hypo and hyperglycaemia, Renal threshold value, GTT, Galactosemia, Fructosuria, Diabetes mellitus - Types, Clinical features, metabolic effects, complications, Glycogen storage diseases.

### **UNIT- II Disorders in protein metabolism**

**12 Hours**

Introduction, etiology and clinical features of Aromatic aminoacid-Phenylketonuria, Alkaptonuria, Albinism and Tyrosinemia. Clinical significance of non – protein nitrogen (NPN) – urea, uric acid and creatinine. Metabolism of bilirubin and its disorder- jaundice and their clinical features.

### **UNIT- III Disorders in lipid and nucleic acid metabolism**

**12 Hours**

Introduction, Hypertriglyceridemia, Atherosclerosis – aetiology, clinical features and complication. Lipid storage diseases, fatty liver. Disorders of Uric acid metabolism-Gout, types, aetiology and clinical features.

### **UNIT IV Organ function tests**

**12 Hours**

Liver function test, Renal function test, Gastric function test - Collection of gastric contents, examination of gastric residuum, FTM, stimulation test, tubeless gastric analysis.

### **UNIT V Clinically Important enzymes**

**12 Hours**

Mechanism responsible for abnormal level in serum. Enzyme level on the onset of myocardial infarction and hepatobiliary diseases. Marker Enzymes and its clinical significance of SGOT, SGPT, ALP and ACP,.

### **TEXT BOOKS**

1. N.W. Teitz, (1994). *Textbook of Clinical Chemistry and Molecular Diagnostics* Fifth Edition W.B. Saunders company
2. Harold Varley (1988). **Practical Clinical Biochemistry**, Volume I and II 4<sup>th</sup> Edition, CBS Publishers New Delhi
3. Foye, O.W., Lemke, J.L. and William D.A. (1995). **Medicinal Chemistry**, B.I. Waverly Pvt. Ltd., New Delhi.
4. Praful B. Godkar, Darshan P. Godkar (2014) Textbook of Medical Laboratory Technology Clinical Laboratory Science and Molecular Diagnosis 3<sup>rd</sup> Edition, **Bhalani Publishing House**

## **REFERENCE BOOKS**

1. Philip. D. Mayne (1994). **Clinical Biochemistry in Diagnosis and Treatment** 6<sup>th</sup> Edition  
ELBS Publication
2. William J. Marshall and Stephen K. Bangert, (1995). **Clinical Biochemistry** – Metabolic and  
clinical aspects, Pearson Professional Ltd

## **WEB REFERENCE**

1. [www.medicinenet.com](http://www.medicinenet.com) › ... › diabetes az list › diabetes mellitus index
2. [www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...](http://www.mayoclinic.org/diseases-conditions/diabetes/basics/.../con-2003309...)
3. [www.niams.nih.gov](http://www.niams.nih.gov) ›
4. [www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf](http://www.nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf)
5. [www.arup.utah.edu/education/automation.php](http://www.arup.utah.edu/education/automation.php)

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR III – SEMESTER VI**  
**BIOCHEMISTRY OF HORMONES**

|            |                |             |      |
|------------|----------------|-------------|------|
| Paper      | : ELECTIVE III | Total Hours | : 60 |
| Hours/Week | : 5            | Exam Hours  | : 03 |
| Credit     | : 5            | Internal    | : 25 |
| Paper Code | : 20U6BCE03    | External    | : 75 |

**Aim**

This module aims to detailed knowledge and understanding of the mechanisms and actions of vital organs

**Objective**

On successful completion of the course the students should haven understood clearly on various parts of human body.

**COURSE OUTCOME**

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Remember about the hormones, hormone secretion; understand the mechanism of hormone action I and II and also communication between the endocrine glands and target organs. | K1 & K2         |
| CO2       | Illustrate the thyroid and parathyroid gland, type of hormones, physiological response and pathophysiology of gland.   | K1 & K2         |
| CO3       | Understand and remember the hormonal actions of pancreas and GIT   | K1, K2 & k3     |
| CO4       | Apply the knowledge of hormonal synthesis, chemistry and action of supra renal gland.  | K1 & K2         |
| CO5       | Illustrate the male and female reproductive system, synthesis of hormones, significance and pathophysiology of gonads.   | 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   | 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 Outline of Hormones**

**12 Hours**

Introduction, classification of hormones. Role of second messengers in hormonal action. Cyclic AMP, Role of G-proteins. Calcium, calmodulin. Mechanism of action of Group I and Group II hormones. Hormones of the hypothalamus Anterior Pituitary hormone (Tropic hormone)-Posterior Pituitary (Oxytocin, Vasopressin)

**UNIT – II Thyroid gland and hormones**

**12 Hours**

Hormones of the thyroid and parathyroid-chemical nature, secretion, function & disorders of thyroid and parathyroid hormones. Calcitriol biosynthesis and functions. Hyper and hypoparathyroidism, Paget's disease, Ricket's and osteomalacia.

**UNIT – III Pancreatic and Gastrointestinal tract**

**12 Hours**

Pancreatic and G.I. Tract hormones Chemical nature and functions of Insulin, Glucagon. Secretion, release, chemical nature and functions of Gastrin, Enterogastin, Secretin & Cholecystokinin.

**UNIT – IV Adrenal gland and hormones**

**12 Hours**

Hormones of the Adrenal gland – chemical nature & functions of Adrenal medullary & Cortex hormones. Adrenal Corticoid hormones- Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Adrenal medullary hormones-Catecholamines: biosynthesis and biological effects.

**UNIT – V Sexual organs and hormones**

**12 Hours**

Gonadal hormones- Androgens and estrogens. Hormones of the testes and ovaries – chemical nature & functions of Androgens, Estrogens and Progesterone.

**TEXT BOOKS**

1. Murray, K.R., Granner, K.D., Mayes, P.A. and Rodwell, W.V. (2009) **Harper's Biochemistry**, 28<sup>th</sup> Ed, Appleton & Lange Stamford, Connecticut.
2. Guyton, A.C. and Hall, J.E (2006), **Textbook of Medical Physiology**, 11<sup>th</sup> Edition, Saunders Co. Pennsylvania.
3. Donald Voet , Judith G. Voet , Charlott W. Pratt , **Fundamentals of Biochemistry** upgrade edition John Willey & Sons. Inc,
4. Francis Sreenspan , Gordon J. 1997–**Basic & Clinical Endrocrinology** 5<sup>th</sup> Ed., Stewler Prentice – Hall International Inc.

## **REFERENCE BOOKS**

1. Foye, O.W., Lemke, J.L. and William D.A. (1995), **Medicinal Chemistry**, B.I. Waverly Pvt. Ltd., New Delhi.

2. West, E.S., Todd, W.R., Mason, H.S. and Van Brugge, T.J. (1966), **Biochemistry**. 4<sup>th</sup> Edition, The Macmillan Company, London.

### **WEB OF RESOURCE:**

[https://en.wikipedia.org/wiki/Endocrine\\_system](https://en.wikipedia.org/wiki/Endocrine_system)

[www.medicinenet.com](http://www.medicinenet.com) > ... > thyroid az list > medterms medical dictionary az list

[www.btf-thyroid.org](http://www.btf-thyroid.org) > Info

[www.healthline.com/human-body-maps/pituitary-gland](http://www.healthline.com/human-body-maps/pituitary-gland)

### **PEDOGOGY: CHALK and Talk , PPT**

## YEAR III – SEMESTER VI

### CELL BIOLOGY

Paper : **ELECTIVE IV**  
Hours/Week : 4  
Credit : 3  
Paper Code : **20U6BCE04**

Total Hours : 60  
Exam Hours : 03  
Internal : 25  
External : 75

#### Aim

This course presents to focus on the different cellular organelles and organization its biochemistry.

#### Objective

The objective of the course is to understand the relationship between cellular organelles and molecules signaling in research.

#### COURSE OUTCOME

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Discuss the cell organization and the cell structures  | K2              |
| CO2       | Illustrate the cell organelles structure and functions such as nucleus, chloroplast, mitochondria, endoplasmic reticulum and ribosome lysosome etc., | K3              |
| CO3       | Apply the knowledge chromosome organization and its types  | K4              |
| CO4       | Evaluate the stages of cell cycle and its regulation of cells  | K5              |
| CO5       | Describes the critical based knowledge of cell -cell interactions and their molecules  | K6              |

#### Mapping with Programme Outcomes

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

S- Strong; M-Medium; L-Low

**UNIT I: Cell Organization****12 Hours**

Introduction, cell theory, types of cell – Prokaryotic and eukaryotic cell structure, difference between plant and animal cell.

**UNIT II: Cell Organelles****12 Hours**

Structure and functions of nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, peroxisomes and cytoskeleton.

**UNIT III: Chromosome Organization****12 Hours**

Structure of chromatin, types of euchromatin and heterochromatin, structure of chromosome, Chromosome aberrations, special types of chromosome-Prokaryotic Nucleoids Polytene Chromosomes, Lampbrush Chromosomes

**UNIT IV: Cell Cycle****12 Hours**

Stages of cell cycle, cell division - various stages and significance of mitosis and meiosis, difference between mitosis and meiosis

**UNIT V : Cell – Cell Interactions****12 Hours**

ECM- collagen, elastin, fibronectin, laminins, Cell- ECM interactions- integrins, focal adhesions, hemidesmosomes. Cell-cell interactions- cadherins, IgSF, selectins; Intracellular junctions- gap junctions, tight junctions, adherens junction and desmosomes.

**TEXT BOOK**

1. Cell Biology by T. Devasena, 2012, Oxford University press.
2. VK Agarwal and PS Varma Cytology (Cell Biology and Molecular Biology), 2000 4/e S Chand & Company, New Delhi.
3. Cell and Molecular Biology by Prakash S Lohar, 2007, MJP publishers.
4. The Cell, a molecular approach by Geoffrey M Cooper, 5 th Edition, 2009, ASM press, Washington.

**REFERENCE BOOK**

1. **Bruce Albert *et al.***, *Molecular biology of the cell*, Garland publications, New York & London, 3<sup>rd</sup> edition, 1994.
2. **lodish.h, baltimore, bert.a *et.al.***, *molecular cell biology*, 3<sup>rd</sup> edition. 1995.

**WEB OF RESOURCE:**

[https://en.wikipedia.org/wiki/Endocrine\\_system](https://en.wikipedia.org/wiki/Endocrine_system)

[www.medicinenet.com](http://www.medicinenet.com) › ... › thyroid az list › medterms medical dictionary az list

[www.btf-thyroid.org](http://www.btf-thyroid.org) › Info

[www.healthline.com/human-body-maps/pituitary-gland](http://www.healthline.com/human-body-maps/pituitary-gland)

**PEDOGOGY: CHALK and Talk , PPT**

**YEAR III – SEMESTER VI**  
**BIOCHEMISTRY IN DIAGNOSTIC MEDICINE**

|            |                    |             |      |
|------------|--------------------|-------------|------|
| Paper      | : SBEC             | Total Hours | : 30 |
| Hours/Week | :2                 | Exam Hours  | : 03 |
| Credit     | : 2                | Internal    | : 25 |
| Paper Code | : <b>20U6BCS04</b> | External    | : 75 |

**Aim**

This module aims to detailed knowledge and understanding of the clinical disorders of major organ function, along with the biochemical laboratory methods used in diagnosis and management.

**Objective**

This course presents about the techniques, diagnostic values and significance and the interpretation of various enzymes, bio-chemical parameters, hormones and immunoglobulins.

**COURSE OUTCOME**

| Course No | Course Outcome   | Knowledge Level |
|-----------|--|-----------------|
| CO1       | Remember the approaches to clinical quality control, accuracy, collection and preservation of biological samples such as blood, urine and fluids                 | K1 & K2         |
| CO2       | Understand the blood cell and explain the different cell count such as PVC, ESR, RBC and WBC   | K1 & K2         |
| CO3       | Apply the knowledge on abnormal constituents of urine such as protein, keton bodies, bile pigments and their clinical interpretation                             | K1, K2 & k3     |
| CO4       | Analyse and describe the to know about the critical based stool collection, preservation, and analyse the abnormal constituent of stools and microscopy studies. | K1 & K2         |
| CO5       | Evaluate and discuss clinical significance of the biochemical GTT, SGOT, SGPT and LDH etc  | 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 Approaches to clinical biochemistry**

**06 Hours**

Quality control- Concepts of accuracy, precision, sensitivity and reproducibility, Collection of clinical specimens, preservatives for blood and urine, transport of biological samples. First aid equipment in laboratory accident- Precautions and first aid equipmentsensitivity, linearity, calibration , Biomedical waste disposals

### **UNIT – II Hematology**

**06 Hours**

Composition and functions of blood, Haemoglobin, Differential count-PCV, ESR, RBC, WBC and Platelet count. Fully automated and semi automated analysers.

### **UNIT – III Physical and chemical examination in urine**

**06 Hours**

Physical examination- Volume, colour, odour, appearance, specific gravity and pH. Chemical examination -Qualitative tests for Reducing sugar, protein, ketone bodies, Bile pigment, bile salt, Urobilinogen, and mucin. Microscopic Examination of urine.

### **UNIT – IV Stool examination**

**06 Hours**

Collection of fecal specimen, preservation, physical examination:- volume, colour, odour and appearance. Chemical examination:- reducing sugar, occult blood test, detection of steatorrhea. Microscopic examination of stool.

### **UNIT – V Blood and clinical assays**

**06 Hours**

Estimation of Biochemical components in Blood, Glucose, GTT, Glycosylated haemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of enzyme activity: SGOT, SGPT and LDH.

### **TEXT BOOK**

1. Practical Clinical Biochemistry, Harold Varley, 4th edition, CBS Publication and Distributors, New Delhi.
2. Medical Biochemistry by MN Chatterjee, Rana Shinde, 8th edition, 2013, Jaypee publications.
3. Sabitri Sanyal, Clinical pathology, B.I.Churchill Livingstone(P)Ltd, New Delhi.2000.

3. Tietz Fundamentals of Clinical Chemistry- (5th edition) C.A. Burtis, E.R. Ashwood (eds) Saunders WB Co.

### **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://onlinelibrary.wiley.com/doi/abs/10.1002/0470869526.ch3>

2. <http://fblt.cz/en/skripta/v-krev-a-organy-imunitniho-systemu/1-slozeni-krve/>

3. [https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinanalysis\\_microscopic\\_exam](https://www.urmc.rochester.edu/encyclopedia/content.aspx?contenttypeid=167&contentid=urinanalysis_microscopic_exam)

4. <https://www.webmd.com/a-to-z-guides/what-is-a-stool-culture#1>

5. <https://www.webmd.com/diabetes/guide/glycated-hemoglobin-test-hba1c>

**PEDOGOGY: CHALK and Talk , PPT**



## YEAR III – SEMESTER VI

### CORE - BIOCHEMISTRY PRACTICAL – VII

|            |                      |             |      |
|------------|----------------------|-------------|------|
| Paper      | : Core Practical VII | Total Hours | : 75 |
| Hours/Week | : 5                  | Exam Hours  | : 06 |
| Credit     | : 3                  | Internal    | : 40 |
| Paper Code | : 20U6BCCP07         | 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 by Alkali-Picrate method
3. Estimation of Uric acid by 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 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). 3<sup>rd</sup> Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. **Laboratory Manual in Biochemistry**. Pattabiraman, T.N. (1998). 3<sup>rd</sup> Edition. All India Publishers and Distributors. Chennai.
3. **Laboratory Manual in Biochemistry**. Jayaraman, S. (2003). 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi
4. **Biochemical Methods**. Sadasivam S and Manickam P. (2004) 2<sup>nd</sup> Edition. New Age International (P) Limited. New Delhi.

## YEAR III – SEMESTER VI

### CORE - BIOCHEMISTRY PRACTICAL – VIII

|            |                       |             |      |
|------------|-----------------------|-------------|------|
| Paper      | : Core Practical VIII | Total Hours | : 45 |
| Hours/Week | :5                    | Exam Hours  | : 03 |
| Credit     | : 3                   | Internal    | : 40 |
| Paper Code | : <b>20U6BCCP08</b>   | External    | : 60 |

#### 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. Isolation and purification of IgG serum by column chromatography techniques
8. Dissection and identification of thymus, spleen and lymph node from rat.
9. Antigen Antibody reaction- Pregnancy and WIDAL Test.

#### REFERENCES

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