

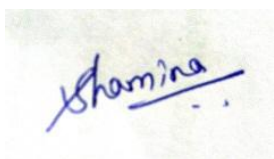
**RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)  
SULUR, COIMBATORE-641402**

**DEPARTMENT OF BIOCHEMISTRY  
B.Sc.,BIOCHEMISTRY**



**Syllabus effective for the students admitted during the academic  
Year 2019 Batch & onwards**

**(2020 - 2023)**



**HOD**



**PRINCIPAL**



**COE**

**PROGRAMME OUTCOMES (POs):**

|     |   |
|-----|---|
| PO1 | Graduates can have strong fundamentals in their specific discipline along with DIGITAL STRATEGIC knowledge.   |
| PO2 | To increase student's ability to communicate effectively with the community /society in verbal /written courage for such as to give or receive clear instruction. |
| PO3 | To enhance their ability to understand and identify the professional and ethical responsibilities.  |
| PO4 | To enrich their personality and character development   |

**PROGRAMME SPECIFIC OUTCOMES: (PSOs)**

Upon completion of Bachelor of Biochemistry Degree, STUDENTS are able to achieve the following outcomes.

|      |  |
|------|--|
| PSO1 | To understand the fundamental concepts and master the pertinent experimental and theoretical techniques in Molecular Gene expression, Proteomics, Pathology, Clinical research and Nano-sciences so as to inflate the understanding of biology.  |
| PSO2 | To transform the way by using sophisticated technologies and thereby gaining insights from clinical data to make cognizant decisions, predictions and to reveal the proficiency in quantitative reasoning and analytical skill within a student. |
| PSO3 | To understand the research oriented learning that develops methodical and integrative problem-   |

|      |  |
|------|--|
|      | solving approaches in the biochemical industries by enabling them to write effective project reports in multidisciplinary environment.   |
| PSO4 | To augment the students in pre-clinical studies and cancer biology enabling them to invent new ideas to develop their entrepreneurial skills, decisive thinking and self-governance. |

### **GRADUATE ATTRIBUTES**

- DISCIPLINEKNOWLEDGE
- PROBLEMANALYSIS
- CRITICALTHINKING
- MODERN TOOLSUSAGE
- SOFTSKILLS
- SELFLEARNING
- LIFE LONGLEARNING
- INDIVIDUAL & TEAMWORK
- PROJECT MANAGEMENT &FINANCE

**PROGRAMME: B.Sc., (Biochemistry)**  
**(Effective from the academic year 2019 - 2022)**  
**Structure, Credits & Marks Distribution**

| Sl No.       | Course Type  | Number of Courses | Credits | Marks       | Total Credits |
|--------------|--|-------------------|---------|-------------|---------------|
| 1            | Multi-Indian/ International Languages (MIL)                                  | 2                 | 4       | 200         | 8             |
| 2            | Ability Enhancement Compulsory Courses (AECC) – (I & II) : Group-I (English) | 2                 | 4       | 200         | 8             |
| 3            | Ability Enhancement Compulsory Courses (AECC) –( II& IV) : Group-II          | 2                 | 1+3     | 200         | 4             |
| 4            | Discipline Specific Courses (DSC)  | 12                | 6       | 1200        | 72            |
| 5            | Discipline Specific Elective Courses (DSE)                                   | 4+1               | 6       | 500         | 30            |
| 6            | Extra Disciplinary Course (EDC) (DSE)  | 1                 | 6       | 100         | 6             |
| 7            | Skill Enhancement Courses (SEC)  | 2+1               | 4       | 200         | 8             |
| 8            | ALCTA– e Learning in MOOC platform   | 1                 | 4*      | Pass        | 4*            |
| 9            | Non Credit Courses – Group I   | 2                 | -       | Grade       | -             |
| 10           | Non Credit Courses – Group II  | 4                 | -       | Completed   | -             |
| <b>Total</b> |  |                   |         | <b>2600</b> | <b>136+4*</b> |

| MULTI-INDIAN/ INTERNATIONAL LANGUAGES (MIL) |              |   |   |   |     |     |            |          |
|---|--------------|---|---|---|-----|-----|------------|----------|
| Course                                      | Course Name  | L | T | P | CIA | ESE | Total      | Credits  |
| <b>Two Courses – Any ONE Group</b>          |              |   |   |   |     |     |            |          |
| <b>Group I</b>                              |              |   |   |   |     |     |            |          |
| MIL   | Tamil I      | 6 | - | - | 25  | 75  | 100        | 4        |
| MIL   | Tamil II     | 6 | - | - | 25  | 75  | 100        | 4        |
| <b>Group II</b>                             |              |   |   |   |     |     |            |          |
| MIL   | Hindi I      | 6 | - | - | 25  | 75  | 100        | 4        |
| MIL   | Hindi II     | 6 | - | - | 25  | 75  | 100        | 4        |
| <b>Group III</b>                            |              |   |   |   |     |     |            |          |
| MIL   | Malayalam I  | 6 | - | - | 25  | 75  | 100        | 4        |
| MIL   | Malayalam II | 6 | - | - | 25  | 75  | 100        | 4        |
| <b>Group IV</b>                             |              |   |   |   |     |     |            |          |
| MIL   | French I     | 6 | - | - | 25  | 75  | 100        | 4        |
| MIL   | French - II  | 6 | - | - | 25  | 75  | 100        | 4        |
| <b>Group V</b>                              |              |   |   |   |     |     |            |          |
| MIL   | Arabic I     | 6 | - | - | 25  | 75  | 100        | 4        |
| MIL   | Arabic II    | 6 | - | - | 25  | 75  | 100        | 4        |
| <b>Total</b>                                |              |   |   |   |     |     | <b>200</b> | <b>8</b> |

| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) - GROUP I : ( I & II SEMESTER) |             |   |   |   |     |     |       |         |
|--|-------------|---|---|---|-----|-----|-------|---------|
| Course   | Course Name | L | T | P | CIA | ESE | Total | Credits |
| AECC – G-I   | English I   | 6 | - | - | 25  | 75  | 100   | 4       |

|              |            |   |   |   |    |    |            |          |
|--------------|------------|---|---|---|----|----|------------|----------|
| AECC – G-I   | English II | 6 | - | - | 25 | 75 | 100        | 4        |
| <b>Total</b> |            |   |   |   |    |    | <b>200</b> | <b>8</b> |

| <b>ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) - GROUP II:(II SEMESTER)</b> |                       |   |   |   |     |     |            |          |
|---|-----------------------|---|---|---|-----|-----|------------|----------|
| Course  | Course Name           | L | T | P | CIA | ESE | Total      | Credits  |
| AECC – G-II - 1   | Environmental Studies | 1 | - | - | 100 | -   | 100        | 1        |
| AECC – G-II - 2   | Aptitude              | 3 | - | - | 25  | 75  | 100        | 3        |
| <b>Total</b>  |                       |   |   |   |     |     | <b>200</b> | <b>4</b> |

| <b>DISCIPLINE SPECIFIC COURSES (DSC)</b> |                                  |   |   |   |     |     |       |         |  |
|--|----------------------------------|---|---|---|-----|-----|-------|---------|--|
| Course                                   | Course Name                      | L | T | P | CIA | ESE | Total | Credits |  |
| DSC - I                                  | Biomolecules                     | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC - II                                 | Allied Chemistry                 | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC - III                                | Instrumentation Techniques       | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC - IV                                 | Cellular Biochemistry            | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC – V                                  | Enzymology                       | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC – VI                                 | Intermediary metabolism          | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC – VII                                | Plant and Microbial Biochemistry | 4 | - | 4 | 25  | 75  | 100   | 6       |  |
|  |                                  |   |   |   | 40  | 60  |       |         |  |
| DSC –VIII                                | Clinical Biochemistry            | 4 | - | 4 | 25  | 75  | 100   | 6       |  |

|              |                          |   |   |   |    |    |             |           |
|--------------|--------------------------|---|---|---|----|----|-------------|-----------|
|              |                          |   |   |   | 40 | 60 |             |           |
| DSC – IX     | Biochemical Pharmacology | 4 | - | 4 | 25 | 75 | 100         | 6         |
| DSC – X      | Immunology               | 4 | - | 4 | 25 | 75 | 100         | 6         |
|              |                          |   |   |   | 40 | 60 |             |           |
| DSC – XI     | Human Physiology         | 4 | - | 4 | 25 | 75 | 100         | 6         |
|              |                          |   |   |   | 40 | 60 |             |           |
| DSC – XII    | Genetic Engineering      | 4 | - | 4 | 25 | 75 | 100         | 6         |
| <b>Total</b> |                          |   |   |   |    |    | <b>1200</b> | <b>72</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) I : (III SEMESTER)</b> |                            |   |   |   |     |     |            |          |
|--|----------------------------|---|---|---|-----|-----|------------|----------|
| Course   | Course Name                | L | T | P | CIA | ESE | Total      | Credits  |
| <b>One Course – From the Group</b>                                   |                            |   |   |   |     |     |            |          |
| DSE - I - 1  | Molecular Biology          | 5 | 1 | - | 25  | 75  | 100        | 6        |
|  |                            |   |   |   | 40  | 60  |            |          |
| DSE - I - 2  | Biomedical Instrumentation | 5 | 1 | - | 25  | 75  | 100        | 6        |
| <b>Total</b>   |                            |   |   |   |     |     | <b>100</b> | <b>6</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) II :(IV SEMESTER)</b> |                     |   |   |   |     |     |            |          |
|---|---------------------|---|---|---|-----|-----|------------|----------|
| Course  | Course Name         | L | T | P | CIA | ESE | Total      | Credits  |
| <b>One Course – From the Group</b>                                  |                     |   |   |   |     |     |            |          |
| DSE - II - 1  | Clinical Research   | 5 | 1 | - | 25  | 75  | 100        | 6        |
| DSE - II - 2  | Marine Biochemistry | 5 | 1 | - | 25  | 75  | 100        | 6        |
| <b>Total</b>  |                     |   |   |   |     |     | <b>100</b> | <b>6</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) III :(V SEMESTER)</b> |             |   |   |   |     |     |       |         |
|---|-------------|---|---|---|-----|-----|-------|---------|
| Course  | Course Name | L | T | P | CIA | ESE | Total | Credits |
| <b>One Course – From the Group</b>                                  |             |   |   |   |     |     |       |         |

|               |                         |   |   |   |    |    |            |          |
|---------------|-------------------------|---|---|---|----|----|------------|----------|
| DSE - III - 1 | Clinical Data Analytics | 5 | 1 | 4 | 25 | 75 | 100        | 6        |
|               |                         |   |   |   | 40 | 60 |            |          |
| DSE - III - 2 | Endocrinology           | 5 | 1 | - | 25 | 75 | 100        | 6        |
| <b>Total</b>  |                         |   |   |   |    |    | <b>100</b> | <b>6</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) IV :(VI SEMESTER)</b> |                            |   |   |   |     |     |            |          |
|---|----------------------------|---|---|---|-----|-----|------------|----------|
| Course  | Course Name                | L | T | P | CIA | ESE | Total      | Credits  |
| <b>One Course – From the Group</b>                                  |                            |   |   |   |     |     |            |          |
| DSE –IV – 1   | Clinical Lab Technology    | 5 | 1 | - | 100 | -   | 100        | 6        |
| DSE – IV - 2  | Environmental Biochemistry | 5 | 1 | - | 100 | -   | 100        | 6        |
| <b>Total</b>  |                            |   |   |   |     |     | <b>100</b> | <b>6</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) V: (V- SEMESTER)</b> |                                   |   |   |   |     |     |       |         |
|--|-----------------------------------|---|---|---|-----|-----|-------|---------|
| <b>DSE – V - EXTRA DISCIPLINARY COURSE :(EDC)</b>                  |                                   |   |   |   |     |     |       |         |
| Course   | Course Name                       | L | T | P | CIA | ESE | Total | Credits |
| <b>One Course – From the Group</b>                                 |                                   |   |   |   |     |     |       |         |
| B.A. English   | Professional Communication        | 5 | 1 | - | 25  | 75  | 100   | 6       |
| BBA  | Entrepreneurship                  | 5 | 1 | - | 25  | 75  | 100   | 6       |
| BBA (CA)   | Project Management                | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.COM  | Insurance and Risk Management     | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.COM (CA)   | Social Media Marketing            | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.COM (IT)   | E-Commerce                        | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.COM (PA)   | Indian Tax System                 | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.COM (BA)   | Digital marketing                 | 5 | 1 | - | 25  | 75  | 100   | 6       |
| BCA  | Responsive Web Design             | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc., (CS)  | Business Analytics                | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc., (IT)  | Big Data Engineering              | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc., CSHM  | Hospitality Management            | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc., ECS   | Fundamentals of Digital Computers | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc.,MATHS  | Computational Mathematics         | 5 | 1 | - | 25  | 75  | 100   | 6       |
| B.Sc., BC  | Health Management                 | 5 | 1 | - | 25  | 75  | 100   | 6       |

|              |                               |   |   |   |    |    |            |          |
|--------------|-------------------------------|---|---|---|----|----|------------|----------|
| B.Sc., BT    | Forensic Science              | 5 | 1 | - | 25 | 75 | 100        | 6        |
| B.Sc., MB    | Microbes – Health & Disease   | 5 | 1 | - | 25 | 75 | 100        | 6        |
| B.Sc., N&D   | Health & Life Style Disorders | 5 | 1 | - | 25 | 75 | 100        | 6        |
| <b>Total</b> |                               |   |   |   |    |    | <b>100</b> | <b>6</b> |

| <b>DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) VI:(VI SEMESTER)</b> |                            |   |   |   |     |     |            |          |
|--|----------------------------|---|---|---|-----|-----|------------|----------|
| Course   | Course Name                | L | T | P | CIA | ESE | Total      | Credits  |
| <b>One Course – From the group</b>                                 |                            |   |   |   |     |     |            |          |
| DSE – VI   | Project Report – Viva voce | - | - | - | 100 | -   | 100        | 6        |
| <b>Total</b>   |                            |   |   |   |     |     | <b>100</b> | <b>6</b> |

| <b>SKILL ENHANCEMENT COURSES: GROUP I (III &amp; IV SEMESTER)</b> |                         |   |   |   |     |     |            |          |
|---|-------------------------|---|---|---|-----|-----|------------|----------|
| Course  | Course Name             | L | T | P | CIA | ESE | Total      | Credits  |
| SEC – GI-1  | Communicative Skills I  | 2 | - | - | 50  | -   | 50         | 2        |
| SEC – GI-2  | Communicative Skills II | 2 | - | - | 50  | -   | 50         | 2        |
| <b>Total</b>  |                         |   |   |   |     |     | <b>100</b> | <b>4</b> |

| <b>SKILL ENHANCEMENT COURSES : GROUP II (V SEMESTER)</b> |                                     |   |   |   |     |     |            |          |
|--|-------------------------------------|---|---|---|-----|-----|------------|----------|
| Course   | Course Name                         | L | T | P | CIA | ESE | Total      | Credits  |
| <b>Any ONE Group</b>                                     |                                     |   |   |   |     |     |            |          |
| <b>Group A</b>   |                                     |   |   |   |     |     |            |          |
| SEC –GII – A1  | Placement - College to Corporate I  | 2 | - | - | 50  | -   | 50         | 2        |
| SEC –GII – A2  | Placement - College to Corporate II | 2 | - | - | 50  | -   | 50         | 2        |
| <b>Group B</b>   |                                     |   |   |   |     |     |            |          |
| SEC – GII – B  | Industrial Biochemistry             | 4 | - | - | 100 | -   | 100        | 4        |
| <b>Total</b>   |                                     |   |   |   |     |     | <b>100</b> | <b>4</b> |

| <b>NON CREDIT COURSE – GROUP I (III &amp; IV SEMESTER)</b> |                 |                      |  |       |
|--|-----------------|----------------------|--|-------|
| NCC – G1-1   | Career Skills I | RVS Training Academy |  | Grade |



|                             |                  |                      |       |
|-----------------------------|------------------|----------------------|-------|
| (III Semester)              |                  |                      |       |
| NCC – G1-2<br>(IV Semester) | Career Skills II | RVS Training Academy | Grade |

| <b>NON CREDIT COURSE – GROUP II (I - IV SEMESTER)</b> |                                   |                     |            |
|---|-----------------------------------|---------------------|------------|
| <b>Any ONE Course</b>                                 |                                   |                     |            |
| NCC – G II  | National Service Scheme           | NSS                 | Completion |
|   | National Cadet Corps              | NCC                 | Completion |
|   | Sports                            | Physical Education  | Completion |
|   | Literacy & Cultural Club          | Language Department | Completion |
|   | Youth Red Cross / Red Ribbon Club | YRC                 | Completion |
|   | Fine Arts Club                    | Language Department | Completion |

| <b>EXTRA OPTIONAL CREDIT COURSE (ALCTA) I – VI SEMESTER</b> |                             |           |            |
|---|-----------------------------|-----------|------------|
| <b>Any ONE Course with 4 Extra Credits</b>                  |                             |           |            |
| I – VI Semester   | e-Learning in MOOC Platform | 4 Credits | Completion |

**RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS & SCIENCE (Autonomous)**

**Sulur, Coimbatore – 641 402**

**SCHEME OF EXAMINATIONS**

**B. Sc., BIOCHEMISTRY 2020 - 2023 BATCH**

| Semester      | Course Opted             | Course Name  | D  | L | T         | P  | CIA | ESE        | Marks     | Credits |
|---------------|--------------------------|--|----|---|-----------|----|-----|------------|-----------|---------|
| <b>I</b>      | MIL - I                  | Tamil-I/Hindi-I / Malayalam – I / French-I/Arabic- I | 3  | 6 | -         | -  | 25  | 75         | 100       | 4       |
|               | AECC – G I - 1           | English-I  | 3  | 6 | -         | -  | 25  | 75         | 100       | 4       |
|               | DSC – I                  | Biomolecules   | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 3  |   |           |    | 40  | 60         |           |         |
|               | DSC – II                 | Allied Chemistry                                     | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 3  |   |           |    | 40  | 60         |           |         |
|               | NCC – GII                | NCC/NSS/ SPORTS/CULTURALS                            | -  | 1 | -         | -  | -   | -          | -         | -       |
| LIB           | Library                  | -  | 1  | - | -         | -  | -   | -          | -         |         |
| <b>Total</b>  |                          |  |    |   | <b>30</b> |    |     | <b>400</b> | <b>20</b> |         |
| <b>II</b>     | MIL-II                   | Tamil-II/Hindi-II/Malayalam – II/French-II/Arabic-II | 3  | 6 | -         | -  | 25  | 75         | 100       | 4       |
|               | AECC – GI - 2            | English-II   | 3  | 6 | -         | -  | 25  | 75         | 100       | 4       |
|               | DSC – III                | Instrumentation Techniques                           | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 4  |   |           |    | 40  | 60         |           |         |
|               | DSC – IV                 | Cellular Biochemistry                                | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 4  |   |           |    | 40  | 60         |           |         |
|               | AECC – G II - 1          | Environmental Studies                                | 3  | 1 | -         | -  | 100 | -          | 100       | 1       |
|               | NCC – G II               | NCC/NSS/ SPORTS/CULTURALS                            | -  | 1 | -         | -  | -   | -          | -         | -       |
| LIB           | Library                  | -  | 1  | - | -         | -  | -   | -          | -         |         |
| <b>Total</b>  |                          |  |    |   | <b>31</b> |    |     | <b>500</b> | <b>21</b> |         |
| Semester      | Course Opted             | Course Name  | D  | L | T         | P  | CIA | ESE        | Marks     | Credits |
| <b>III</b>    | DSC – V                  | Enzymology   | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 6  |   |           |    | 40  | 60         |           |         |
|               | DSC – VI                 | Intermediary metabolism                              | 3  | 4 | -         | 4  | 25  | 75         | 100       | 6       |
|               |                          |  | 6  |   |           |    | 40  | 60         |           |         |
| DSE - I       | Elective - I             | 3  | 5  | 1 | -         | 25 | 75  | 100        | 6         |         |
|               |                          | 40   | 60 |   |           |    |     |            |           |         |
| SEC – G I – 1 | Communicative Skills - I | 3  | 2  | - | -         | 50 | -   | 50         | 2         |         |

|              |                 |                                  |   |   |           |            |       |    |     |           |
|--------------|-----------------|----------------------------------|---|---|-----------|------------|-------|----|-----|-----------|
|              | NCC – G I -1    | Career Skills - I                | 3 | 2 | -         | -          | Grade |    |     |           |
|              | NCC – G II      | NCC/NSS/<br>SPORTS/CULTURALS     | - | 1 | -         | -          | -     | -  | -   | -         |
| <b>Total</b> |                 |                                  |   |   | <b>27</b> | <b>350</b> |       |    |     | <b>20</b> |
| <b>IV</b>    | DSC – VII       | Plant and Microbial Biochemistry | 3 | 4 | -         | 4          | 25    | 75 | 100 | 6         |
|              |                 |                                  | 6 |   |           |            | 40    | 60 |     |           |
|              | DSC – VIII      | Clinical Biochemistry            | 3 | 4 | -         | 4          | 25    | 75 | 100 | 6         |
|              |                 |                                  | 6 |   |           |            | 40    | 60 |     |           |
|              | DSE - II        | Elective - II                    | 3 | 5 | 1         | -          | 25    | 75 | 100 | 6         |
|              | AECC – G II - 2 | Aptitude                         | 3 | 3 | -         | -          | 25    | 75 | 100 | 3         |
|              | SEC – G I - 2   | Communicative Skills - II        | 3 | 2 | -         | -          | 50    | -  | 50  | 2         |
|              | NCC – G I - 2   | Professional English             | 3 | 2 | -         | -          | Grade |    |     |           |
|              | NCC – G II      | NCC/NSS/<br>SPORTS/CULTURALS     | - | 1 | -         | -          | -     | -  | -   | -         |
| <b>Total</b> |                 |                                  |   |   | <b>30</b> | <b>450</b> |       |    |     | <b>23</b> |

| Semester     | Course Opted         | Course Name                         | D | L | T         | P          | CIA                | ESE | Marks | Credits   |  |
|--------------|----------------------|-------------------------------------|---|---|-----------|------------|--------------------|-----|-------|-----------|--|
| <b>V</b>     | DSC – IX             | Biochemical Pharmacology            | 3 | 4 | -         | 4          | 25                 | 75  | 100   | 6         |  |
|              |                      |                                     | 6 |   |           |            | 40                 | 60  |       |           |  |
|              | DSC – X              | Immunology                          | 3 | 4 | -         | 4          | 25                 | 75  | 100   | 6         |  |
|              |                      |                                     | 6 |   |           |            | 40                 | 60  |       |           |  |
|              | DSE-III              | DSE: Elective-III                   | 3 | 5 | 1         | -          | 25                 | 75  | 100   | 6         |  |
|              | DSE - V              | Elective - V (EDC)                  | 3 | 5 | 1         | -          | 25                 | 75  | 100   | 6         |  |
|              | <b>Any ONE Group</b> |                                     |   |   |           |            |                    |     |       |           |  |
|              | <b>Group A</b>       |                                     |   |   |           |            |                    |     |       |           |  |
|              | SEC – G II – A - 1   | Placement - College to Corporate I  | 3 | 2 | -         | -          | 50                 | -   | 50    | 2         |  |
|              | SEC – GII – A - 2    | Placement - College to Corporate II |   | 2 | -         | -          | 50                 | -   | 50    | 2         |  |
|              | <b>Group B</b>       |                                     |   |   |           |            |                    |     |       |           |  |
|              | SEC – G II – B       | Industrial Biochemistry             | 3 | 4 | -         | -          | 100                | -   | 100   | 4         |  |
|              | NCC – G II           | NCC/NSS/SPORTS/CULTURALS            | - | 1 | -         | -          | Good/ Satisfactory |     |       |           |  |
| <b>Total</b> |                      |                                     |   |   | <b>32</b> | <b>500</b> |                    |     |       | <b>28</b> |  |

|              |   |                          |   |   |           |   |    |    |             |                         |
|--------------|---|--------------------------|---|---|-----------|---|----|----|-------------|-------------------------|
| VI           | DSC – XI                                | Human Physiology         | 3 | 4 | -         | 4 | 25 | 75 | 100         | 6                       |
|              |   |                          | 6 |   |           |   | 40 | 60 |             |                         |
|              | DSC – XII                               | Genetic Engineering      | 3 | 4 | -         | 4 | 25 | 75 | 100         | 6                       |
|              |   |                          | 6 |   |           |   | 40 | 60 |             |                         |
|              | DSE-IV                                  | DSE: Elective-IV         | 3 | 5 | 1         | - | 25 | 75 | 100         | 6                       |
|              | DSE - VI                                | Project Work & Vivo Voce | 3 | 6 | -         | - | 40 | 60 | 100         | 6                       |
|              | ALCTA * ( e-Learning in MOOC Platform ) |                          |   |   |           |   |    |    |             | 4*                      |
| <b>Total</b> |   |                          |   |   | <b>32</b> |   |    |    | <b>400</b>  | <b>24</b>               |
| <b>TOTAL</b> |   |                          |   |   |           |   |    |    | <b>2600</b> | <b>136 +4*<br/>=140</b> |

## ABBREVIATIONS

|         |   |
|---------|---|
| MIL     | - Multi Indian/ International Languages                                 |
| AECC-G1 | - Ability Enhancement Compulsory Courses – I & II: Group - I (English)  |
| AECC-G2 | - Ability Enhancement Compulsory Courses – II & II: Group - II          |
| DSC     | - Discipline Specific Courses   |
| DSE     | - Discipline Specific Elective Courses                                  |
| EDC     | - Extra Disciplinary Course   |
| NCC     | - Non Credit Course   |
| SEC     | - Skill Enhancement Courses (Group-I & II)                              |
| ALCTA   | - Advanced Learners Course in Thrust Areas– e Learning in MOOC platform |

### DSE I -Discipline Specific Elective Courses I: (III Semester)

1. Molecular Biology
2. Biomedical Instrumentation

### DSE II- Discipline Specific Elective Courses II: (IV Semester)

1. Clinical Research
2. Marine Biochemistry

### DSE III-Discipline Specific Elective Courses III: (V Semester)

1. Clinical Data Analytics
2. Endocrinology

### DSE IV- Discipline Specific Elective Courses IV: (VI Semester)

1. Clinical Lab Technology
2. Environmental Biochemistry

### NCC - I (Non – Credit course) Group – I

The assessment will be done by RVS Training Academy and grade will be given based on internal evaluation in the respective semester

### NCC – II (Non – Credit Course) Group – II

The students shall complete the activities in the concerned semester and completion status will be mentioned in their fifth semester mark statement. However, completing the activities listed in Group – II is mandatory to complete their degrees.

|   |                                 |
|---|---------------------------------|
| Course Title : <b>BIOMOLECULES</b>            | Course Code :                   |
| Semester : <b>I</b>                           | Course Group : <b>DSC-I</b>     |
| Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b> | Credits : <b>4 Credits</b>      |
| Map Code : <b>C(THEORY CONCEPTS)</b>          | Total Contact Hours : <b>48</b> |
| CIA : <b>25 Marks</b>                         | SEE : <b>75 Marks</b>           |
| Programme: <b>BSC-BC</b>                      |                                 |

### Course outcome: (Cos)

| No. | Course Outcome (Cos): After completion of this course, the students will be able to                                   | POs & PSOs | Cl. Ses | CL     |
|-----|---|------------|---------|--------|
| CO1 | Understand the features including structure, function of Carbohydrates  | PSO 1      | 10      | U      |
| CO2 | Understand the various types and properties of lipids   | PSO 2      | 10      | U      |
| CO3 | Recognize the structure and function of amino acids   | PSO 2      | 10      | U & R  |
| CO4 | Derive the structure and the nature of the protein molecules  | PSO 3      | 10      | U & An |
| CO5 | Explain the structure-function relationships for nucleic acids and chromatin  | PSO3       | 4       | U & An |
| CO6 | Identify the components of nucleotide and study the structure and functions of two types of nucleic acids DNA and RNA | PSO 3      | 4       | U & An |

### UNIT-1 (Lecture hours: 10)

Carbohydrates - Introduction (Definition & Classification), Types of Monosaccharides (Introduction & Classification, Stereochemistry, Cyclic structure & Anomeric forms Haworth projection formula), Disaccharides ( Introduction & Classification, chemistry, structure & functions of Sucrose, maltose & lactose), Polysaccharides (Introduction & Classification Storage polysaccharides ), Starch & Glycogen (Structure & Function), Structural polysaccharide (Structure & Function).

### UNIT-2 (Lecture hours: 10)

Lipids – Introduction (Definition & Classification), Simple lipids ( Fats, oils & waxes. Physical properties - Solubility, specific gravity, melting point, color & odor), Chemical properties of fats ( Hydrolysis, Saponification Number, Iodine Number, RM value, Acid Number and Rancidity of fats), Compound lipids (Structure & functions of Phospholipids, Glycolipids and Lipoproteins), Derived lipids (Saturated, Unsaturated & Essential fatty acids) Sterols and Steroids ( Cholesterol and its structure)

### UNIT-3 (Lecture hours: 10)

Amino acid- Introduction (Definition & structure), Classification (Based on functional groups, amino acids as ampholytes), Aliphatic Amino acids (Structure and properties), Aromatic amino acids ( Structure and properties), Peptide bond (Structure & properties), Identification ( N&C terminal residues)

### UNIT-4 (Lecture hours: 8)

Protein - Introduction (Classification & properties), Structure of proteins (Primary, secondary, tertiary & Quaternary

structures), Denaturation & Renaturation of proteins (Physical & chemical agents, coagulation, refolding)

**UNIT-5 (Lecture hours: 10)**

Nucleic acids - Introduction (Definition & Types), Purines (Structure of Adenine, Guanine, Xanthine & Hypoxanthine), Pyrimidines (Structure of Thymine, Uracil & Cytosine), Nucleosides & nucleotides (Structures & Modified Nitrogenous bases),

DNA (DNA double helix - Watson & Crick model, Chargaff's rule), Types (A, B & Z forms), Denaturation & Renaturation (Hyperchromism, Effect of pH & temperature on DNA. Nucleation & zipper reaction), RNA - Types (mRNA, rRNA, tRNA, miRNA, siRNA - Structures and their biological roles)

**Text Books :**

Biochemistry | Edition:5 | W.H. Freeman & Company, New York | LUBERT STRYER (2015)

Essentials of Biochemistry | Edition:2 | Books and Allied (P) Ltd | U.CHAKRAPANI AND U.SATHYANARAYANA (2016)

Fundamentals of Biochemistry | Edition:II | S.Chand & Company | JAIN.J.L.(2015)

Introduction to Practical Biochemistry | Edition:3 | Tata McGraw-Hill Education | David.T. Plummer AND Plummer.(2017)

**Reference Books :**

BIOCHEMICAL METHODS | Edition:2 | New Age International | SADASIVAM.S(2017)

Fundamentals of Biochemistry | Edition:1 | John Wiley & Sons Inc USA | DONALD VOET AND JUDITH G. VOET(2014)

LABORATORY MANUAL IN BIOCHEMISTRY | Edition:2 | NEW AGE INTERNATIONAL PUBLISHER | JAYARAMAN.J (2016)

Lehninger Principles of Biochemistry | Edition:3 | Mac millan Worth Publishers USA | DAVID.L NELSON AND MICHAEL.M.COX(2015)

|                                |                                |                      |                    |
|--------------------------------|--------------------------------|----------------------|--------------------|
| Course Title                   | : <b>BIOMOLECULES</b>          | Course Code          | :                  |
| Semester                       | : <b>I</b>                     | Course Group         | : <b>DSC-I</b>     |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                 | Credits              | : <b>2 Credits</b> |
| Map Code                       | : <b>H (THEORY TECHNOLOGY)</b> | Total Contact Hours: | <b>60</b>          |
| CIA                            | : <b>40 Marks</b>              | SEE                  | : <b>60 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                      |                    |

1. Qualitative Analysis of Monosaccharides - Glucose and Fructose
2. Qualitative Analysis of Disaccharides - Sucrose and Maltose
3. Qualitative Analysis of Polysaccharides - Starch and Dextrin
4. Determination of Acid number of edible oil. -
5. Determination of saponification number of edible oil -
6. Estimation of unsaturated fat by iodine value of oil. -
7. Qualitative Analysis of Non-polar, Aliphatic Aminoacids - Methionine, Leucine
8. Qualitative Analysis of Aromatic Aminoacids - Tyrosine, Tryptophan
9. Qualitative Analysis of Polar, Uncharged Aminoacid - Serine
10. Qualitative Analysis of Charged Aminoacid - Histidine
11. Identification of protein by Biuret method -
12. Denaturation of protein using Egg -
13. Alkali hydrolysis on RNA
14. Effect of Denaturation of DNA

|              |                           |              |                 |
|--------------|---------------------------|--------------|-----------------|
| Course Title | : <b>ALLIED CHEMISTRY</b> | Course Code  | :               |
| Semester     | : <b>I</b>                | Course Group | : <b>DSC-II</b> |

|   |                                 |
|---|---------------------------------|
| Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b> | Credits : <b>4 Credits</b>      |
| Map Code : <b>C(THEORY CONCEPTS)</b>          | Total Contact Hours : <b>48</b> |
| CIA : <b>25 Marks</b>                         | SEE : <b>75 Marks</b>           |
| Programme: <b>BSC-BC</b>                      |                                 |

| No  | Course Outcome (Cos): After completion of this course, the students will be able to                              | Pos & PSOs | Cl. Ses | BLOOM'S TAXONOMY LEVEL |
|-----|--|------------|---------|------------------------|
| CO1 | Understand the basics of thermodynamic laws and principle  | PO1& PS01  | 24      | U                      |
| CO2 | Demonstrate the different aspects of chemical bonding  | PO1& PS01  | 24      | An                     |
| CO3 | Describe the basic rules of organic nomenclature   | PO1& PS01  | 24      | Ap                     |
| CO4 | Demonstrate titrimetry experiments and assessments of important factors that could affect the analytical result. | PO1& PS01  | 24      | Ap                     |
| CO5 | Analyse the concepts of physical chemistry   | PO1& PS01  | 14      | An                     |
| CO6 | Acquire knowledge on Green chemistry   | PO1& PS01  | 10      | U                      |

### UNIT-1 (LECTURE HOURS: 24)

#### Thermodynamics

Thermodynamics - Introduction (Definition, Energy changes and Importance of Thermodynamics), Types of system (Open, Closed and Isolated), Types of process (Reversible, Irreversible and isothermal), Properties (Extensive and intensive), Laws of thermodynamics (First law and Second law, Enthalpy and Entropy), Free energy (Definition, Spontaneity, Gibbs free energy)

### UNIT-2 (LECTURE HOURS: 24)

#### Chemical bonding theory

Structure of atoms and molecules (Introduction), Types of chemical bonds (Ionic, Covalent, and Coordinate), Hybridization (Introduction, Salient Features of Hybridization, Shapes of hybrid orbital), Structure and polarity of water (Hydrogen Bond in Water, Buffer Solutions and Preparations)

### UNIT-3 (LECTURE HOURS: 24)

#### Organic chemistry theory

Organic chemistry (Introduction, Classification, Nomenclature), Isomers and Isomerism (Types and Molecular Formula), Stereoisomerism (Definition and Classification - Optical and Geometric isomerism), Cyclic, Acyclic and Heterocyclic compounds (Introduction, Classification, Structure of Monocyclic, Acyclic and Heterocyclic compounds)

### UNIT-4 (LECTURE HOURS: 24)

#### Volumetric methods theory

Solution (Definition of Ideal and Non-ideal Solutions, Units of Concentration, Molecular Weight, Equivalent Weight, Molarity, Molality, Normality, PPM and Percentage solution), Concepts of volumetric analysis (Introduction, Analysis and Titrant), Principles of acid base titration - (Introduction - Acids, Alkalies, Indicators and Buffers), Titration (Strong acid vs strong base, weak acid vs strong base, weak base vs strong acid), EDTA titration (Introduction, indicators for EDTA titration)

### UNIT-5 (LECTURE HOURS: 124)

#### Physical chemistry theory

Electrochemistry (Definition, Electrolytes, Conductance, Equivalent Conductance, Specific Conductance, Molar conductance), Surface chemistry (Adsorption, Adsorbents, Physisorption and Chemisorption, Colloids, Gels, Emulsions,



Electro Osmosis, Inhibition), Environmental chemistry (Concept and Scope of Environmental Biochemistry)

#### TEXTBOOK

1. B.R. Puri, L.R. Sharma and Madhan S. Pathania, Principles of physical chemistry, (2017), Vishal Publishing Co.
2. B.S. Bahl and Arun Bahl (2014) A textbook of organic chemistry, S. Chand and Co. Ltd.
3. Principles of Inorganic chemistry | Edition: 25 | Shobinlalnagin Chand & Co | Puri & Sharma (2014)
4. Text book of Organic Chemistry | Edition: 28 | Sultan Chand & Sons | H.M. CHAWLA AND P.L. SONI (2014)

#### Reference Books:

1. Industrial chemistry | Edition: 10 | Goel Publishing House Meerut, India | 2. B.K. SHARMA (2007) Chemistry | Edition: 4 | Houghton Mifflin Company New York
2. M. Satake, Y. Hayashi (2003), Colloidal and Surface chemistry, Discovery Publishing House

|                                |                                |                      |                    |
|--------------------------------|--------------------------------|----------------------|--------------------|
| Course Title                   | : <b>ALLIED CHEMISTRY</b>      | Course Code          | :                  |
| Semester                       | : <b>I</b>                     | Course Group         | : <b>DSC-II</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                 | Credits              | : <b>2 Credits</b> |
| Map Code                       | : <b>H (THEORY TECHNOLOGY)</b> | Total Contact Hours: | <b>48</b>          |
| CIA                            | : <b>40 Marks</b>              | SEE                  | : <b>60 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                      |                    |

1. Demonstration of Thermodynamics - Enthalpy and Entropy
2. Preparation of buffer solutions – phosphate buffer and citrate buffer at different pH
3. Estimation of hardness of water
4. Qualitative Analysis of Aromatic compounds - Toluene and Naphthalene
5. Qualitative Analysis of Aliphatic compounds – Glucose, Fructose
6. Qualitative Analysis of Functional group-Carboxylic acid and tryptophan
7. Titration for Acid-Base - Strong Acid vs Strong Base, HCl Vs NaOH  
Strong base Vs weak acid, NaOH Vs CH<sub>3</sub>COOH (acetic acid)  
Weak base Vs strong acid, Ammonia (NH<sub>3</sub>) Vs H<sub>2</sub>SO<sub>4</sub>
8. Determination of alkalinity in water
9. COD (chemical oxygen demand)-Measure of wastewater quality.

|                                |                                     |                     |                    |
|--------------------------------|-------------------------------------|---------------------|--------------------|
| Course Title                   | : <b>INSTRUMENTATION TECHNIQUES</b> | Course Code         | :                  |
| Semester                       | : <b>II</b>                         | Course Group        | : <b>DSC-III</b>   |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:0:0</b>                      | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>         | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>                   | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                     |                     |                    |

| No. | <u>Course Outcome</u>  | <u>POs &amp; PSOs</u> | <u>Cl. Ses</u> | <u>CL</u> |
|-----|--|-----------------------|----------------|-----------|
| CO1 | Understand the terms like pH, pOH, acidic, basic, neutral solutions and universal indicator and acquire the practical skill. | PSO 1                 | 10             | U         |
| CO2 | Explore the use of suitable chromatographic or electrophoretic techniques for actual analytical problems.                    | PSO 2                 | 10             | Ap        |
| CO3 | Motivating the students in handling the basic apparatus and instruments.   | PSO 2                 | 10             | Ap        |
| CO4 | Identifying the separation of proteins/peptides by selecting appropriate separation techniques .                             | PSO 2                 | 8              | R         |
| CO5 | Understand the theoretical principles of radioactivity and appreciate the uses of radioisotopes.                             | PSO 1                 | 10             | R         |

**UNIT – I**  
**(LECTURE HOURS: 10)**

pH - Introduction (Definition and applications), Determination of pH (using indicators and pH meter), Electrode - Types (calomel electrode, silver-silver chloride electrode and standard hydrogen electrode), Henderson's Hasselbach equation (Relationship between pKa & pH)  
Buffer - Acids & Bases (Buffer system, Bicarbonate Buffer system, Hb Buffer system)

**UNIT – II**  
**(LECTURE HOURS: 10)**

Chromatography - Definition and its types, Paper Chromatography (Principle, Technique & applications), Thin Layer chromatography (Principle, Technique & applications), Gas Liquid chromatography (Principle, Technique & applications), Ion exchange chromatography (Principle, Technique & applications), HPLC (Principle, Technique & applications), Affinity Chromatography (Principle, Technique & applications), Molecular sieve Chromatography (Principle, Technique & applications)

**UNIT – III**  
**(LECTURE HOURS: 10)**

Electrophoresis – Introduction(types and Factors affecting electrophoretic mobility),Agarose Gel Electrophoresis(Principle, technique and applications),SDS – PAGE(Principle, technique and applications),Immuno-electrophoresis(Principle, technique and applications),Centrifugation(Introduction, types of centrifugation and Rotor types),Ultra centrifugation(Working, applications and its types.)

**UNIT – IV**

**(LECTURE HOURS: 10)**

COLORIMETRY - Introduction (colour and absorption ),Beer - Lambert’s law(Principle & Laws),Working of a single cell photoelectric colorimeter (Principle instrumentation & applications), Spectrophotometry(Principle, Instrumentation and applications),Flourimetry(Principle, Instrumentation and applications)

**UNIT – V**

**(LECTURE HOURS: 8)**

ISOTOPES AND RADIOACTIVITY – Introduction(Tracer techniques),Radioactive decay and units of radio activity(Curie, Bequerel, specific activity),Detection and measurement of radio activity(GM counter, Scintillation counting, Autoradiography),Applications of radioisotopes, Biological and Medical sciences

**Text Books :**

Biophysical Chemistry | Edition:4 | Himalaya Pub. House | UpadhyayNath(2009)

Practical Biochemistry | Edition:3 | Tata McGraw-Hill Education | David Plummer(1988)

**Reference Books :**

Analytical Biochemistry | Edition:4 | Longman | David James Holme(1997)

|                                |   |                      |                    |
|--------------------------------|---|----------------------|--------------------|
| Course Title                   | : <b>INSTRUMENTATION<br/>TECHNIQUES</b> | Course Code          | :                  |
| Semester                       | : <b>II</b>                             | Course Group         | : <b>DSC-III</b>   |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                          | Credits              | : <b>2 Credits</b> |
| Map Code                       | : <b>H (THEORY TECHNOLOGY)</b>          | Total Contact Hours: | <b>48</b>          |
| CIA                            | : <b>40 Marks</b>                       | SEE                  | : <b>60 Marks</b>  |
| Programme: <b>BSC-BC</b>       |   |                      |                    |

1. Determination of pH
2. Preparation of Buffers
3. Paper Chromatography – Circular

4. Thin Layer Chromatography.
5. Separation of compounds using centrifuge.
6. SDS-gel Electrophoresis – Demonstration
7. Estimation of Protein by FOLIN - CIOCALTEAU method
8. Estimation of Urea by DAM-TSC method
9. Industrial visit to learn techniques in radioactivity

|                                |                                |                     |                    |
|--------------------------------|--------------------------------|---------------------|--------------------|
| Course Title                   | : <b>CELLULAR BIOCHEMISTRY</b> | Course Code         | :                  |
| Semester                       | : <b>II</b>                    | Course Group        | : <b>DSC-IV</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:0:0</b>                 | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>    | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>              | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                     |                    |

#### **OBJECTIVES :**

- CO1 Recall the history of cytology and draw the structure of cell organelles and locate its parts along with functions
- CO2 Design the model of a cell.
- CO3 Distinguish the structure of prokaryotic and eukaryotic cell.
- CO4 Explain the organization of Genes and chromosomes, chromosome morphology and its aberrations
- CO5 Distinguish the types and mechanism of mutations.
- CO6 Compare and contrast the events of cell cycle and its regulation

#### **UNIT - 1 (LECTURE HOURS: 20)**

##### Cell biology

Cell membrane (Structure and functions- Fluid mosaic model, Unit membrane model), Membrane transport (Active and Passive transport-Endocytosis and Exocytosis-Pinocytosis and Phagocytosis), Cell structure (cytoplasm -structure – composition), Cellular organelles ( Nucleus-Mitochondria-Golgi bodies-Lysosomes- Endoplasmic reticulum-Peroxisomes- Plastids- Vacuoles-Ribosomes), Cytoskeleton (structure and function)

#### **UNIT - 2 (LECTURE HOURS: 16)**

##### Cell division and cell growth

Cell division (Mitosis and Meiosis ,reductive division), Cell cycle (Phases of cell cycle -cell cycle regulation, cell cycle check points)

#### **UNIT - 3 (LECTURE HOURS: 20)**

##### Cell communication and signaling

Cell cell interaction ( Cell communications - electric and chemical-signaling mechanisms - cell surface receptors), Basic aspects of intercellular communication ( Intracrine, autocrine, paracrine, endocrine & neuronal, endocrine communications)

UNIT - 4 (LECTURE HOURS: 20)

Biochemical energetics

Biological oxidation( High energy compounds-Redox potential),ETC ( electron transport chain-oxidative phosphorylation-inhibition of electron transport chain).

UNIT - 5 (LECTURE HOURS: 20)

Regulation of cell growth

Cell death ( apoptosis-necrosis),Tumor (Types-causes and invasion-mutation-viral infection-tumor viruses- DNA and RNA viruses-life cycle of virus and its regulation-senescence-proliferation control)

Text Books :

Cell and Molecular Biology | Edition:8 | Lippincott Williams and Wilkins, Philadelphia | De Robertis, E.D.P. AND De Robertis, E.M.F. (2010) The Cell: A Molecular Approach | Edition:5 | Sunderland, Mass. Sinauer Associates, Inc. | Cooper, G.M AND Hausman, R.E(2009)

Reference Books :

Cell and Molecular Biology: Concepts and Experiments | Edition:6 | John | Karp, G(2010) Essential Cell Biology | Edition:4 | Garland Science | Bruce Alberts AND Dennis Bray (2013)

|                                |                                |                     |                    |
|--------------------------------|--------------------------------|---------------------|--------------------|
| Course Title                   | : <b>CELLULAR BIOCHEMISTRY</b> | Course Code         | :                  |
| Semester                       | : <b>II</b>                    | Course Group        | : <b>DSC-IV</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                 | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>    | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>              | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                     |                    |

1. Microscopic view of prokaryotic cells using staining techniques. - Simple staining
2. Microscopic view of prokaryotic cells using staining techniques - Gram staining
3. Mitotic cell division by using - onion root tip
4. Extraction of protein - Total cellular protein
5. Separation of nucleic acid bases - By paper chromatography.
6. Preparation of cell culture media - Preparation of cell culture media
7. Cellular separation by using centrifugation technique. - Cellular separation by using centrifugation technique.

|  |                             |                    |                   |
|--|-----------------------------|--------------------|-------------------|
| Course Title                           | : <b>ENZYMOLGY</b>          | CourseCode         | :                 |
| Semester                               | : <b>III</b>                | CourseGroup        | : <b>DSC-V</b>    |
| Teaching Scheme in Hrs (L:T:P)         | : <b>4:0:0</b>              | Credits            | : <b>6Credits</b> |
| MapCode                                | : <b>C(THEORY CONCEPTS)</b> | TotalContact Hours | <b>60</b>         |
| CIA                                    | : <b>25 Marks</b>           | SEE                | : <b>75Marks</b>  |
| Programme: <b>BSC-BC- BIOCHEMISTRY</b> |                             |                    |                   |

**Course outcome: (Cos)**

| No. | Course Outcome (Cos): After completion of this course, the students will be able to | POs & PSOs | Cl. Ses | CL |
|-----|---|------------|---------|----|
|-----|---|------------|---------|----|

|     |  |       |    |   |
|-----|--|-------|----|---|
| CO1 | Describe the Nomenclature and Classification of enzymes according to International Union of Biochemistry (IUB) | PSO 1 | 10 | A |
| CO2 | Illustrate the enzyme kinetics and enzyme inhibition in enzyme catalytic reaction.                             | PSO 2 | 10 | R |
| CO3 | Discuss the structure and functions of Coenzymes and role of coenzymes in various metabolic reaction.          | PSO 2 | 10 | U |
| CO4 | Describe the methods of Immobilizations and its applications in various Industrial aspects.                    | PSO 3 | 10 | U |
| CO5 | Discuss the Biosensor, various types and its application in clinical aspects.                                  | PSO3  | 4  | R |
| CO6 | Describe the role of enzymes in Medicine , Food and Textile industry.  | PSO3  | 4  | U |

## **UNIT- I (Lecture Hours: 24)**

### **ENZYME :INTRODUCTION AND CLASSIFICATION:**

Enzyme: Introduction – (Properties and History) & Nomenclature - According to IUB system. Digit number, Suffix “ase” Classification - Six main classes, (Definition & suitable examples) Active site-(Introduction & Mode of action) - Salient features of active site residues. Binding sites and catalytic sites. Lock and Key model – (Definition, mechanism & diagrammatic presentation) Induced fit model – (Definition, mechanism & diagrammatic presentation)

## **UNIT –II(Lecture Hours: 24)**

### **ENZYME KINETICS:**

Steady state theory – (Introduction, Rate of formation of ES, Graph) Michaelis-Menton equation,  $K_m$  - Michaelis constant.- (Introduction and Derivation.) LB Plot - LB Plot Graph. Hanes plot - Based on the MM equation. (Introduction & Derivation) Enzyme inhibition & factors affecting enzyme activity – (Introduction and Mechanism) Reversible inhibitors, Irreversible inhibitors. Competitive, Non-competitive & Uncompetitive inhibition – (Mechanism with examples) Effect of various factors affecting enzyme activity - Vital role in metabolic regulation. (Substrate, enzyme, temperature & PH, Saturation point,  $V_{max}$ ,  $K_m$ , Optimum PH & Temperature)

## **UNIT –III (Lecture Hours: 24)**

### **CO ENZYME :**

Coenzyme :(Introduction and Properties) Nicotinamide coenzymes -  $NAD^+$  and  $NADP^+$ - (Structure and Function) .Flavin nucleotides - FMN and FAD- (Structure and Function) TPP – Thiamine Pyro Phosphate- (Structure and Function). PP- Pyridoxal Phosphate- (Structure and function) Biotin- (Structure and Function) Folic acid- (Structure and Function) Isoenzymes- (Introduction and properties) Multienzyme complex – (Definition & examples) Pyruvate dehydrogenase – (Mechanism & reactions)

## **UNIT- IV(Lecture Hours: 24)**

### **ENZYME IMMOBILIZATION**

Enzyme Immobilization (Introduction – Definition.) Methods of immobilization – (Principle and Types) Adsorption, Covalent bonding, Cross linking. Encapsulation, Entrapment, Advantage of immobilization process – (Advantage in immobilization techniques in industry aspects ) Applications of immobilized enzymes – (Components of analytical systems, continuously operated process)

## **UNIT – V (Lecture Hours:24)**

### **ENZYME SENSOR**

Enzyme Biosensor: Introduction – (Definition and Principle) Types and Applications - Colorimetric, Optical & immunosensor. (Principle and application) Enzyme in Industrial aspects – (Role in Food & Textile industry) Role of enzyme in medicine - Treatment of various diseases (Asparaginase, Collagenase, Urokinase, Streptokinase) Food and drink industries – (Baking of bread, brewing industries.)Other industries – (Washing powders, Immobilized glutamate dehydrogenase linked to alcohol dehydrogenase) Role of enzymes in Free Radical Scavenging – (SOD, GSH Reductase, Catalase, Etc.)

### **Text Books :**

T1 - Fundamentals of Enzymology | Edition:2 | Oxford Science Publications, Newyork. | Nicholas c. price, Lewis stevens 2010



T2 - Enzymes - Biochemistry, Biotechnology, Clinical chemistry. | Edition:3 | East west Press Pvt Ltd, New Delhi. | Trevor palmer. and Philip bonner (2014)

Reference Books :

R1 – Lehninger Principles of Biochemistry, David. L.Nelson, Michael M. Cox . Eight edition ,2021.

R2- Harper’s Illustrated Biochemistry, Victor Rodwell, David Bender, Kathleen Botham and Peter Kennelly, Thirty First Edition -May-2018.

**R2- Enzyme Chemistry: Impact and Applications, 3<sup>rd</sup> Edition by Colin J Suckling and Gibson Colin .L -2010**

|  |                                   |                     |                    |
|--|-----------------------------------|---------------------|--------------------|
| Course Title                           | : <b>ENZYMOLOGY</b>               | Course Code         | : 43Q              |
| Semester                               | : <b>III</b>                      | Course Group        | : <b>DSC-V</b>     |
| Teaching Scheme in Hrs (L:T:P)         | : <b>0:0:4</b>                    | Credits             | : <b>2 Credits</b> |
| Map Code                               | : <b>H(PRACTICAL EXPERIMENTS)</b> | Total Contact Hours | <b>60</b>          |
| CIA                                    | : <b>40 Marks</b>                 | SEE                 | : <b>60 Marks</b>  |
| Programme: <b>BSC-BC- BIOCHEMISTRY</b> |                                   |                     |                    |

## **ENZYMOLOGY – PRACTICAL**

### **Course Content:**

- 1.Determine the pH on the activity of Salivary Amylase
2. Determine the Temperature on the activity of Salivary Amylase
3. Determine the pH on the activity of Alkaline Phosphatse

4. Determine the Temperature on the activity of Alkaline Phosphatase
5. Determine the pH on the activity of Catalase
6. Determine the Temperature on the activity of catalase
7. Determine the pH on the activity of Acid Phosphatase
8. Determine the Temperature on the activity Acid Phosphatase
9. Determine the SOD Enzyme activity
10. Determination of GSH Reductase activity

|                                |                                  |                     |                    |
|--------------------------------|----------------------------------|---------------------|--------------------|
| Course Title                   | : <b>INTERMEDIARY METABOLISM</b> | Course Code         | :                  |
| Semester                       | : <b>III</b>                     | Course Group        | : <b>DSC-VI</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:4:0</b>                   | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>      | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>                | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                  |                     |                    |

| No. | Course Outcome   | POs & PSOs | Cl. Ses | CL     |
|-----|--|------------|---------|--------|
| CO1 | Discuss the general design of metabolic pathways based on bioenergetic principle.                    | PSO 1      | 10      | U      |
| CO2 | Describe the process involved in carbohydrate metabolism, Glycolysis, Glycogenesis & Glycogenolysis. | PSO 2      | 9       | U & An |
| CO3 | Understanding the mechanisms involved in Electron Transport Chain.                                   | PSO 2      | 10      | R & U  |
| CO4 | Illustrate the process of Biosynthesis of fatty acid oxidation in lipid metabolism                   | PSO 2      | 10      | U & An |

|     |  |       |   |        |
|-----|--|-------|---|--------|
| CO5 | Describe the process involved in the metabolism of protein.                | PSO 3 | 5 | U & An |
| CO6 | Describe the Synthesis & Degradation of Purine and Pyrimidine nucleotides. | PSO 2 | 4 | U & An |

### **Pedagogy**

The teaching methodology is through lectures and PowerPoint presentation.

### **UNIT-I (LECTURE HOURS: 20)**

Metabolism –(Metabolism- Concepts of anabolism and catabolism)

Carbohydrate metabolism -Glycolysis (Pathway and Energetics). TCA cycle – (Pathway and Energetics).Glycogenolysis-(Reactions of Glycogen phosphorylase, Glucan transferase and Glucose phosphatase).Glycogenesis –(Reactions of Glucokinase, Formation of UDPG glucose, Glycogen synthase). Gluconeogenesis- (Reactions of Transamination, Deamination, Propionate metabolism).HMP shunt – (Oxidative and non oxidative phase reactions).

### **UNIT-II(LECTURE HOURS: 20)**

Biological Oxidation –(Biological oxidation(Reactions, Redox potential, High energy compounds).Electron Transport Chain – (Electron carrier, sites of ATP production, inhibitors of ETC).Oxidative phosphorylation – (Structure of ATPase complex, Chemiosmotic theory, inhibitors).

### **UNIT-III (LECTURE HOURS: 18)**

Lipid Metabolism - (Oxidation of fatty acids – alpha, beta and omega oxidation).

Biosynthesis of Saturated and Unsaturated fatty acids – (Reactions of Acetyl ACP, Fatty acid synthase)

Biosynthesis of Phospholipids – (Phosphotidyl choline, ethanolamine and serine).

Metabolism of Cholesterol – (Conversion of acetate to mevalonate to isoprene to squalene to cholesterol).

### **UNIT-IV(LECTURE HOURS: 18)**

**Protein Metabolism –(General reactions of amino acid - Deamination, Transamination, Decarboxylation).****Urea cycle** – (Reactions and intermediates of urea cycle).Catabolism of carbon skeleton of aminoacids- (Glycogenic and ketogenic).Integration of metabolism – (Interrelation between Carbohydrate, Fat and Protein metabolism).

### **UNIT-V (LECTURE HOURS: 20)**

**Nucleic acids (Introduction - Nucleosides & Nucleotides).****Metabolism of Purines**

**(Biosynthesis of purine nucleotides Denovo synthesis - Synthesis of purines AMP & GMP from ribose 5 phosphate).**

**Biosynthesis of purine nucleotides salvage pathways – (Conversion of purines their nucleosides & their deoxyribonucleotides into mononucleotides).**

**Metabolism of pyrimidines –(Biosynthesis of pyrimidine nucleotides- Denovo synthesis).**

**Biosynthesis of pyrimidine nucleotides-( salvage pathways -**

Deoxyribonucleosides of uracil & cytosine are salvaged).

### **Text books:**

1. Fundamentals of Biochemistry, 2017 J.L.Jain, S.Chand publications.
2. Principles of Biochemistry, 2011 Nelson, David.I and Cox, M.M.Macmillian worth, NY.
3. Textbook of Biochemistry, 1995 Lubert Stryer, 4<sup>th</sup> Edition, W.H.Freeman & Co. (New edition)
4. Biochemical Methods 2014, Sadasivam and A. Manickam, Second Edition. (New edition)
5. Laboratory Manual in Biochemistry 2013, J.Jayaraman

### Reference books

1. Textbook of Biochemistry, Harper, Robert K.Murray, Daryl k.Graner, Peter A.Mayes Rodwell,2018, Rev edition.
2. Principles of Biochemistry, Zubay Geoffrey, McGraw publishers, 2017, 5<sup>th</sup> edition.
3. Textbook of Biochemistry, 2016 Lubert Stryer, 4<sup>th</sup>Edition, W.H.Freeman & co.

|   |                                |
|---|--------------------------------|
| Course Title : <b>INTERMEDIARY METABOLISM</b> | Course Code :                  |
| Semester : <b>III</b>                         | Course Group : <b>DSC-VI</b>   |
| Teaching Scheme in Hrs (L:T:P) : <b>0:0:4</b> | Credits : <b>2 Credits</b>     |
| Map Code : <b>H (THEORY TECHNOLOGY)</b>       | Total Contact Hours: <b>48</b> |
| CIA : <b>40 Marks</b>                         | SEE : <b>60 Marks</b>          |
| Programme: <b>BSC-BC</b>                      |                                |

1. Estimation of Total Carbohydrates by Anthrone method.
2. Estimation of Glycogen by Anthrone method.
3. Estimation of Iron by Wong's method.
4. Estimation of Hydrogen peroxide by colorimetric method.
5. Determination of Total cholesterol from blood sample by KIT method.
6. Extraction of lecithin from egg yolk.
7. Separation of Glycine, Methionine by TLC method.
8. Estimation of Urea by DAM – TSC method.
9. Separation of DNA by Agarose Gel Electrophoresis.
10. Estimation of RNA by Orcinol method.

|   |                                |
|---|--------------------------------|
| Course Title : <b>MOLECULAR BIOLOGY</b>   | Course Code :                  |
| Semester : <b>III</b>                     | Course Group : <b>DSE - I</b>  |
| Teaching Scheme in Hrs (L:T) : <b>5:1</b> | Credits : <b>4 Credits</b>     |
| Map Code: <b>C(THEORY )</b>               | Total Contact Hours: <b>72</b> |
| CIA: <b>25 Marks</b>                      | SEE # : <b>75 Marks</b>        |
| Programme: <b>BSC-BC</b>                  | # - <b>Semester End Exam</b>   |

| No  | Course Outcome (Cos): After completion of this course, the students will be able to | Pos & PSOs | Cl.Ses | BLOOM'S TAXONOMY LEVEL |
|-----|---|------------|--------|------------------------|
| CO1 | Explain the basic concepts of replication in DNA.                                   | PO1& PS01  | 12     | U                      |
| CO2 | Explore the DNA repair mechanism and types of DNA damage.                           | PO1& PS01  | 12     | R                      |
| CO3 | Describe the use of Prokaryotic transcription and its regulation.                   | PO1& PS01  | 14     | U                      |
| CO4 | Explain about eukaryotic transcription and post transcriptional processing.         | PO1& PS01  | 14     | R                      |
| CO5 | Understand the concepts of both prokaryotic and eukaryotic translation.             | PO1& PS01  | 12     | U                      |
| CO6 | Explain about Genetic code and its clinical significance.                           | PO1& PS01  | 10     | R                      |

## UNIT-I

### REPLICATION

DNA Replication -Types of replication (Semiconservative, Conservative, Dispersive) Meselson and Stahl experiment (E.coli, heavy isotope, N<sup>15</sup>, N<sup>14</sup>). Replications in circular chromosomes - Plasmid replication (Initiation, Elongation, Termination). Rolling circle model (Initiation, helicase enzyme, Topoisomerase Single strand binding proteins, Elongation, Eukaryotes, Prokaryotes, Termination, ligase enzyme, circular plasmid molecule). Theta model (unwinding replication, Lagging strand, Leading strand). Replication of mitochondrial DNA (Nuclear DNA, mitochondrial DNA, Replication of mt- DNA with diagram).

DNA replication in prokaryotes (Initiation, Enzymes and proteins involved in replication -helicase enzyme, Topoisomerase, Single strand DNA binding Proteins, DNA polymerase IV, V, Elongation, DNA polymerase I, II, III, Leading strand, Ladding strand, Okazaki fragment, Termination, Terminus sequence). Inhibitors of replication (Novobiocin, Nalidixic acid, Ciprofloxacin, Etoposide and Adriamycin).

Eukaryotic replication – ( Initiation, ORC, G1 phase, Pre – S phase, SPhase, Elongation, DNA polymerase alpha, epsilon, delta, Termination, Telomerase enzyme).

### UNIT-II

DNA Repair and Recombination Mutations

DNA damage – (Dependent on various factors- cell type, age of the cell, extracellular environment, sources of

damage). Types of DNA damage (Types- oxidative damage, Hydrolytic damage, DNA strand breaks).DNA repair mechanism –DNA repair (Definition, Mechanism - Nucleotide excision repair- distort the DNA double helix). Base excision repair- (changes to DNA bases, Glycosylases DNA polymerase, DNA ligase). Mismatch repair (Mut S, Mut L, Mut H, Enzymes). Recombination repair (Homologous, Site- specific and Transposition). Double stranded break repair (Homologous,non-homologous). SOS response- (Rec- A Protein, Lex- A repressor, error – prone repair system). Recombination – Homologous recombination (Holliday model). Site specific recombination (Lysogenic cycle, integrative mechanism) .

### **UNIT-III**

Prokaryotic transcription and regulation – Transcription (Definition, Gene structure, Promoter region, RNA coding sequence, Terminator region, Initiation, Elongation, Termination).

Termination of transcription - Rho dependent (Definition, type 1 terminator, Hair pin loop). Rho independent termination (Definition, type 2 terminator, RNA polymerase).

Regulation of transcription in prokaryotes – lac operon( Definition, operon model, lac Z, lac Y, lac a, positive and negative regulation). Arabinose operon (Three structural genes, enzymes arabinose model, positive and negative regulation). Tryptophan operon (trp E, trp D, trpC, trp B and trp A, structure of trp operon, Negative control).

### **UNIT-IV**

Eukaryotic transcription and regulation-(Eukaryotic gene control and RNA polymerases, regulatory sequence in eukaryotes, activators and repressors of transcription, transcriptional factors, Transcription initiation by RNA polymerase I, II and III, Elongation, RNA polymerase, Termination).Transcriptional regulation in eukaryotes – (Types- hormonal steroid hormone receptors, phosphorylation - Stat proteins). Post transcriptional processing – (Definition, mRNA, rRNA and tRNA, Alternative splicing, RNA editing).

### **UNIT-V**

Translation and Genetic code - Genetic code (salient features of genetic code, Wobble hypothesis).Components of protein synthesis –( mRNA, ribosomes and tRNA).

Protein synthesis in bacteria and eukaryotes –(initiation, elongation, termination).Post-translational modifications ( prokaryotes and eukaryotes). Inhibitors of protein synthesis-(Protein targeting - signal sequence hypothesis, targeting of proteins to different compartment of mitochondria, ER, plasma membrane, lysosomes, peroxisomes and chloroplast).Molecular basis of mutation- Types of mutation (missense, nonsense, silent, point and Frameshift mutation)

### **Text Books**

1. Molecular biology of the Gene, James Watson, 7<sup>th</sup> Edition, 2017.
2. Principles of Molecular biology, VeeraBalaRastogi, 2<sup>nd</sup> Edition (Rev) 2016.
3. Freifelder's Essentials of Molecular biology, Malacinski, Jones and Bartlett, 4<sup>th</sup> Edition, 2015.
4. Molecular biology, W.H.Freeman and Co. Weaver, R.F. 2015.

### **Reference Books**

1. Karp's Cell & Molecular biology , Gerald Karp, Janet Iwasa, Wallace Marshall, 9<sup>th</sup> Edition, 2019.
2. Molecular Cell Biology, Harvey Lodish, 8<sup>th</sup> Edition, 2018.
3. Molecular biology of the Gene, Watson, Steitz, Hopkins,Roberts, 4<sup>th</sup> Edition , 2016.

|  |                                 |
|--|---------------------------------|
| Course Title : <b>PLANT AND MICROBIAL BIOCHEMISTRY</b> | Course Code :                   |
| Semester : <b>IV</b>                                   | Course Group : <b>DSC-VI</b>    |
| Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b>          | Credits : <b>4 Credits</b>      |
| Map Code : <b>C(THEORY CONCEPTS)</b>                   | Total Contact Hours : <b>48</b> |
| CIA : <b>25 Marks</b>                                  | SEE : <b>75 Marks</b>           |
| Programme: <b>BSC-BC</b>                               |                                 |

CO1: To increase your awareness and appreciation for plants in your environment, as well as to understand their diverse physiological functions.

CO2: Understand the mechanisms of nitrogen fixation and its importance in agricultural production and economics

CO3: To help you develop the knowledge and confidence to pursue advanced courses in plant biology, and to conduct your own plant physiology research.

CO4: Elucidate the growth and growth factors of micro-organisms

CO5: Provide knowledge about the metabolic pathways and helps to acquire knowledge about anaerobic respiration of microorganisms.

#### **UNIT: 1**

##### **PHOTOSYNTHESIS AND TRANSPORT SYSTEM IN PLANT**

**PHOTOSYNTHESIS** – Definition, Structure of Chloroplast, Pigments of Photosynthesis, Role of Carotenoids, Factors Affecting Photosynthesis

**PHOTOSYNTHETIC APPARATUS** - Photosystems I and II, their location; Hill reaction, Photosynthetic Electron Transport and Generation of NADPH & ATP, Cyclic and Non-cyclic photo phosphorylations, CAM cycle, C<sub>3</sub> and C<sub>4</sub> cycle.

**TRANSPIRATION** – Definition, Mechanisms of Stomatal Opening, Factors Affecting Transpiration.

#### **UNIT: 2**

##### **NITROGEN METABOLISM IN PLANTS**

**NITROGEN FIXATION** -Basic concepts, Potential scope in crop improvement, Nitrate and Ammonia assimilation.

**NITROGEN CYCLE** - Symbiotic and Non-symbiotic nitrogen fixation, Nitrate release of sulfur from organic compounds, nif genes.

**AMMONIFICATION, NITRIFICATION AND DENITRIFICATION** – Introduction.

#### **UNIT : 3**

##### **PLANT TISSUE CULTURE AND REGULATORS**

**GERMINATION** -Seed Germination , Concept of Totipotency

**INVITRO CULTURE** - types of *in vitro* culture – Meristem culture, Organ culture, Protoplast culture and Protoplast fusion, Embryo culture and Embryo rescue, Initiation and maintenance of *in vitro* cultures (callus and organ cultures). Embryogenesis and Organogenesis, Micropropagation, Application of organ culture for Secondary Metabolite Production.

**GROWTH REGULATORS** – Auxins, Gibberellins, Cytokinins, Abscicic acid, Ethylene, Structure, Synthesis and Function of growth regulators.

#### **UNIT: 4**

##### **MICROBIAL GROWTH AND ITS FACTORS**

**MICROBIAL GROWTH:** Definition of growth, balanced and unbalanced growth, growth curve, growth-generation time, specific growth rate, batch and continuous culture.

**FACTORS INFLUENCING MICROBIAL GROWTH:** Temperature pH-classification based on pH ranges and

adaptations, solutes and water activity, oxygen concentration, radiation and pressure.

#### **UNIT: 5**

### **MICROBIAL METABOLISM AND ANAEROBIC RESPIRATION**

#### **MICROBIAL METABOLISM**

Metabolism, EMP, HMP shunt, TCA cycle

#### **ANAEROBIC RESPIRATION:**

Compounds involved in anaerobic respiration, fermentation, fermentation of alcohol, acid fermentation and lactic acid fermentation.

#### **References:**

1. Fundamentals of plant physiology, V.K. Jain ( 2004) edition :11<sup>th</sup> ,S.Chand &Company Ltd
2. Buchanan, B.B., Gruissem,W. and Jones, R.L., (2002); Biochemistry and Molecular Biology of Plants; ISBN: 978-0-943088-39-6; American Society of Plant Physiologists, 2nd Indian Reprint (2007), I.K. International Pvt. Ltd. N. Delhi.
3. Lincoln Taiz, Eduardo Zeiger, (2010); Plant Physiology: International Edition (5thEdition); ISBN-13: 978-0123849861, Elsevier Academic Press Publication, USA
4. Sathyanarayana, B.N (2007); Plant Tissue Culture : Practices and New Experimental Protocols; I.K.International Pvt. Ltd.
5. Microbiology, Pelczar J RKrieg R( 1986) edition 1,McGraw Hill Book Company.
- 6.Prescott's Microbiology ,Joanne Willey (2013) ,edition 7 , McGraw Hill Book Company.



|                                |   |                     |                    |
|--------------------------------|---|---------------------|--------------------|
| Course Title                   | : <b>PLANT AND MICROBIAL<br/>BIOCHEMISTRY</b> | Course Code         | :                  |
| Semester                       | : <b>IV</b>                                   | Course Group        | : <b>DSC-VI</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                                | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>                   | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>                             | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |   |                     |                    |

1. Determination of microbial growth – Turbidity method
2. Isolation and purification of bacteria – serial dilution method
3. Enumeration of bacteria from soil, water and air
4. Plating techniques- Spread plate, pour plate and streak plate culture and media preparation
5. Principles of tissue culture and media preparation
6. Green synthesis of Silver Nanoparticles.
7. Estimation of chlorophyll content in plants

|                                |                                |                     |                    |
|--------------------------------|--------------------------------|---------------------|--------------------|
| Course Title                   | : <b>CLINICAL BIOCHEMISTRY</b> | Course Code         | :                  |
| Semester                       | : <b>IV</b>                    | Course Group        | : <b>DSC-VI</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:0:0</b>                 | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>    | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>              | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                     |                    |

#### OBJECTIVES :

CO1: Understanding the pathophysiology and of the most prevalent diseases.

CO2 Discuss the fundamental biochemistry knowledge related to health

CO3 Evaluate the abnormalities which commonly occur in the clinical field

CO4: Discuss the fundamental biochemistry knowledge related to lipid metabolism

CO5; To understand the basic functional test

#### UNIT I

Basic concepts of clinical Biochemistry

Specimen collection and processing (blood ,urine and feaces), anti-coagulant and preservatives for blood and urine. Transport of specimens)Hematology (Total and differential counting of leukocytes). RBC counting. Prothrombin time and hematocrit Types of anaemias, hemophilias.

Practical1. Separation of serum and plasma from blood2. Estimation of haemeoglobin concentration in blood

#### UNIT II

DISORDERS OF CARBOHYDRATE METABOLISM

Homeostasis( Regulation of blood sugar) Diabetes mellitus and Diabetes insipidus (hypoglycemia, hyperglycemia fasting blood glucose and post pandrial glucose level). Ketonuria, ketosis.Galactosemia (causes, symptoms and treatment) Glycosuria (types of glycosuria) Glycogen storage disease ( introduction, types, clinical manifestation, symptoms and treatment)

Practicals;Estimation of Glucose by anthrone method 2. Estimation of Glycogen by anthrone method

#### UNIT III

DISORDERS OF AMINOACIDS AND NUCLEIC ACID METABOLISM

Phenyl ketonuria Cystinuria, alkaptonuria, and tyrosinemia ( Etiology and clinical manifestation) Maple syrup urine disease (MSUD) (Etiology and clinical manifestation and treatment) Hartnup disease (Etiology and clinical manifestation and treatment) Fanconi's syndrome, (Etiology and clinical manifestation and treatment) Albinism,( Etiology and clinical manifestation)

DISORDER OF PURINE METABOLISM (Hypo and Hyperuricemia (Etiology and clinical manifestation) Gout (types clinical manifestation and treatment). DISORDER OF PYRIMINDINE METABOLISM Orotic acid uria (Etiology and clinical manifestation and treatment)

Practicals.Estimation of urea by TSC DAM method method 2.Estimation of RNA by orcinol method

#### UNIT IV

Diseses related to lipid metabolism:

Disorder associated with lipoproteins Hyperlipoproteinemia & hypo protein lipoproteinemia(Introdcuton, clinical manifestation and treatment)

Atherosclerosis(Introduction, clinical manifestation and treatment) Fatty liver( Introduction, clinical manifestation and treatment) Lipid storage disease Tayssach's disease (Introduction, clinical manifestation and treatment) Niemann - Pick diseases( Introduction, clinical manifestation and treatment)  
Practical  
Estimation of the total amount of lipids by colorimetry method 2.Estimation of triglyceride

## UNIT V

Liver Function tests

(PT, jaundice-types, clinical features and test based on bile pigments level in blood and urine, plasma changes)

Gastric function tests

(Collection of gastric contents, examination of gastric residium, FTM, stimulation tests, tubeless gastric analysis)

Renal function tests

(Clearance tests-urea, creatinine, inulin, PAH test, concentration and dilution tests).

## Reference book

- 1.M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Brothers Medical Publisher (P) Ltd. 6th edition (2006).
2. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.
3. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7thEd, 2010.
- 4.Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry, 5th edition, 2013. 3. Graham Basten, Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2 nd edition, 2011.

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|--------------------------------|--------------------------------|---------------------|--------------------|
| Course Title                   | : <b>CLINICAL BIOCHEMISTRY</b> | Course Code         | :                  |
| Semester                       | : <b>IV</b>                    | Course Group        | : <b>DSC-VI</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>                 | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>    | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>              | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                |                     |                    |

Separation of serum and plasma from blood  
 Estimation of haemeoglobin concentration in blood  
 Estimation of Glucose by anthrone method  
 Estimation of Glycogen by anthrone method  
 Estimation of urea by TSC DAM method method.  
 Estimation of RNA by orcinol method  
 Estimation of the total amount of lipids by colorimetry method  
 Estimation of triglyceride

|   |                                 |
|---|---------------------------------|
| Course Title : <b>CLINICAL RESEARCH</b>       | Course Code :                   |
| Semester : <b>IV</b>                          | Course Group : <b>DSE-II</b>    |
| Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b> | Credits : <b>4 Credits</b>      |
| Map Code : <b>D(THEORY CONCEPTS)</b>          | Total Contact Hours : <b>48</b> |
| CIA : <b>25 Marks</b>                         | SEE : <b>75 Marks</b>           |
| Programme: <b>BSC-BC</b>                      |                                 |

| S.No | Course Outcome  |            |
|------|---|------------|
| CO1  | To understand the basic concept of Clinical research                                    | Understand |
| CO2  | To remember the drug development process specially the phases of clinical trials.       | Remember   |
| CO3  | To learn the students on conceptualizing, designing, conducting, managing and reporting | Understand |
| CO4  | To understand the ethical requirement for conducting clinical trials                    | Understand |
| CO5  | To know how to protect the rights, safety and wellbeing of trial subjects               | Analyse    |

## UNIT-I

### INTRODUCTION TO CLINICAL RESEARCH:

Historical Perspective

Nuremberg Code, Thalidomide study, Nazis Trials, Tuskegee Syphilis Study, The Belmont Report

The declaration of Helsinki

Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines

### **Definition**

Types and Design of clinical trials –

Prevention trials, diagnostic trials, treatment trials.

Randomized trials and uncontrolled trials, Crossover and factorial designs, Equivalence, non-inferiority and superiority trials

### **UNIT-II**

**PHASES OF CLINICAL TRIALS-** Phase 1, Phase 2, Phase 3, Phase 4

**PRINCIPLES OF CONTROLLED CLINICAL TRIALS-** Clinical trial design (observational and interventional) protocol, consent in clinical trials, placebo, bias and methods to prevent bias

### **UNIT-III**

#### **CLINICAL RESEARCH MANAGEMENT**

**Clinical data management (CDM)-** handling of data/ information, clinical trial management systems, Data safety monitoring board and Committees

**Clinical Trial Monitoring-** various types of monitoring plans and monitoring visits, Investigators, Study Coordinator, Sponsor, Monitor, Contract Research Organization

Project management Documentation, Monitoring, Audits and Inspections

### **UNIT-IV**

#### **ETHICS IN CLINICAL RESEARCH**

Developing clinical trial protocols

Institutional Review Board/ Independent Ethics committee-formation and working procedures

Declaration of Helsinki and Informed consent-process and procedures

HIPAA- A new requirement to clinical study process.

Pharmacovigilance-safety monitoring in clinical trials.

### **UNIT-V**

#### **Regulations Governing Clinical Trials**

**ICH –GCP guidelines**

**Clinical Research regulations in India – CDSCO guidelines**

**Clinical trial application requirements in India-** IND, ANDA, AADA and NDA

**USFDA regulations to conduct drug studies**

**Clinical Research regulations in UK – Medicines and Healthcare Products Regulatory**

Agency (MHRA)

**Clinical Research regulations in Europe (EMA)**

### **REFERENCES**

1. Handbook of clinical research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone c.
2. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
3. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, March 2005, John Wiley and Sons.
4. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
5. Clinical trial of drugs and biopharmaceuticals | Edition:- | CRC Press | CHI-JEN LEELUCIA H LEE(2006)

|                                |                                   |                     |                    |
|--------------------------------|-----------------------------------|---------------------|--------------------|
| Course Title                   | : <b>BIOCHEMICAL PHARMACOLOGY</b> | Course Code         | :                  |
| Semester                       | : <b>V</b>                        | Course Group        | : <b>DSC-IX</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:0:0</b>                    | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b>       | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>                 | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                                   |                     |                    |

| No. | Course Outcome   | POs & PSOs | Cl. Ses | CL |
|-----|--|------------|---------|----|
| CO1 | To understand the basic concepts of pharmacology   | PSO 1      | 600     | U  |
| CO2 | To explain the principle of absorption, distribution, metabolism and excretion of drugs                    | PSO 2      | 600     | Ap |
| CO3 | To understand the mode of action of a drug, and the method by which it can be synthesized                  | PSO 2      | 600     | Ap |
| CO4 | To remember the causes of disease and effects of existing drugs and development of new modes of treatment. | PSO 2      | 480     | R  |
| CO5 | To understand the mechanism of drug abuse  | PSO 1      | 600     | R  |

#### UNIT - I

##### DRUGS

Introduction to drugs: Pharmacodynamics, Pharmacokinetics, Pharmacognosy, Pharmacy, The nature of drugs: stimulants, depressants, painkillers and hallucinogens Sources of drugs - Plants, Animals, Mineral, Synthetic, Semi-synthetic sources, Microbiological sources, Genetic engineering. (rDNA technology) Routes of drug administration - Oral, Injections, (Subcutaneous, Intramuscular, Intradermal, Intravenous, Intra-arterial, Intrathecal, Intraperitoneal) Subcutaneous, Transmucosal) Subcutaneous Cell surface receptors - Ion channels, G protein coupled receptors, Tyrosine kinases. Drug receptor interaction - Agonist, Antagonist, Inverse agonist, partial agonist.

#### UNIT - II

##### ADME

Absorption - Passive Diffusion, (Facilitated passive diffusion of lipid soluble substances) Active transport (water soluble substances), pinocytosis (fluid or particles are engulfed by a cell). Distribution - Plasma, (blood and tissue binding proteins, pH, and perfusion) Interstitial fluid compartment, transcellular fluid compartment, cellular fluid compartment (Volume of Distribution). Metabolism - (Site of action, cytochrome P450) Phase I - (Oxidation, reduction and hydrolysis Mixed function oxidases - Epoxidation, hydroxylation, O, N and S-Dealkylation, N-Dealkylation). Phase II. - (Sulphation, methylation, Amino acid conjugation and glutathione conjugation). Elimination - Renal system (Passive glomerular filtration and Active Tubular secretion).

#### UNIT - III (LECTURE HOURS: 20)

##### CHEMOTHERAPY

Introduction - Definition and history. Antibacterial - Sulphonamides, Penicillin, Streptomycin, tetracycline. (source, structure, mechanism of action, therapeutic uses and adverse effects) Antiviral - Hydroxychloroquine and Ivermectin (source, structure, mechanism of action, therapeutic uses and adverse effects) Antimalarial - Life cycle of malaria, Quinine and chloroquine (source, structure, mechanism of action, therapeutic uses and adverse effects) Anti-Tuberculosis - Isonicotinic acid hydrazide and Rifampicin (source, structure, mechanism of action, therapeutic uses and adverse effects) Anticancer - Cyclophosphamide and methotrexate. (source, structure, mechanism of action, therapeutic uses and adverse effects)

#### UNIT - IV

##### DRUGS ACTING ON VARIOUS DISEASES

Central nervous system - Introduction, Structure and mode of action of barbiturates and salicylates. Cardiovascular system - Introduction, Structure and mode of action of Cardiac glycosides. Hepatic diseases (Liver enzymes and fatty

liver) Renal diseases (Kidney stones)

UNIT - V

### DRUGS OF PLANT ORIGIN

Primary and Secondary metabolites -Drug Dependence and Abuse Types – (Psychic dependence and physical dependence), Factors which facilitate abuse - Availability of drugs, peer group pressure, socioculture Principles of Treatment - Hospitalization, drug therapy, substitution therapy.

Text Books :

Pharmaceutical Pharmacology | Edition:4 | New age International publishers | S C Metha AshutoshKar, (2011)

Pharmacology and Pharmacotherapeutics | Edition:23 | Prakasam Pvt. Ltd, Mumbai | BhandarkarS.D AND SatoskarR.S(2013)

Reference Books :

Essentials of Medical Pharmacology | Edition:Seventh Edition | Jay Pee Brothers Medical Publishers, New Delhi. | Tripathi,K.D(2010)

Pharmacology | Edition:5 | Lippincott Williams & Wilkins publishers | ChampeP.C AND HarveyR.A AND MycekM.J(2010)

|                                |                             |                     |                    |
|--------------------------------|-----------------------------|---------------------|--------------------|
| Course Title                   | : <b>IMMUNOLOGY</b>         | Course Code         | :                  |
| Semester                       | : <b>V</b>                  | Course Group        | : <b>DSC-IX</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>4:0:0</b>              | Credits             | : <b>4 Credits</b> |
| Map Code                       | : <b>C(THEORY CONCEPTS)</b> | Total Contact Hours | : <b>48</b>        |
| CIA                            | : <b>25 Marks</b>           | SEE                 | : <b>75 Marks</b>  |
| Programme: <b>BSC-BC</b>       |                             |                     |                    |

CO1 To understand the concept immune system for protection against diseases

CO2 To remember the antigen and antibody structure, types, function and immunological reactions.

CO3 To apply immune techniques to understand know the measurement of antigen and antibody interaction .

CO4 To explain the different types of hypersensitivity and various immunological disorders .

CO5 To understand the significance of different vaccines .

CO6 To study the important organs transplantation and its impact of rejection

### UNIT-I (LECTURE HOURS: 20)

#### Immunology

Introduction to Immunology (Definition and general principles of Immunology),Innate immunity and Acquired immunity (Physiological, genetic, anatomic and inflammatory Live and attenuated vaccines, Active and Passive), Antibody mediated immune response (Primary and secondary immune response),Cell mediated immune response (Lymphocytes),Primary lymphoid organs (Thymus and Bone Marrow), Secondary lymphoid organs (Spleen, Lymph node),Cells of immune system (RBC,WBC, NK CELLS),Structure and function (Neutrophils, eosinophils, basophils, macrophages and phagocytes)

### UNIT-II (LECTURE HOURS: 20)



## Antigen

Introduction ( Definition and Types Properties, Specificity, cross reactivity, antigenicity, immunogenicity Chemical nature Epitope, haptens, adjuvant, super antigen Introduction ( Definition and properties)  
Structure and function (Light Chain, Heavy Chain, Hinge region, Disulphide bonds), Class and subclass (Ig G, Ig A, Ig M, Ig E & Ig D), Clonal selection theory (Response of B cells to antigen)  
antigen- antibody reactions (Primary, Secondary and Tertiary - Precipitation and agglutination experiments).  
complement system Introduction (Definition and mechanism of formation), Complement pathway (Components and pathway)

### UNIT-III (LECTURE HOURS: 20)

Measurement of antigen and antibody combination

Introduction (Introduction of diffusion and agglutination methods) , Immunodiffusion (Types Radial immuno diffusion, double immuno diffusion). Immuno electrophoresis (Principles and techniques), agglutination (Types Slide and Table agglutination), Widal test (Method)

immunological test Application RIA, ELISA, monoclonal antibodies

### UNIT-IV (LECTURE HOURS: 20)

Allergy and hypersensitivity

Types I & II ( Mechanism and clinical manifestation), Types III & IV (Mechanism and clinical manifestation)  
immunological disorders Autoimmune diseases (Rheumatoid Arthritis and Myasthenia Gravis), Immuno-deficiency disease (AIDS)

### UNIT-V (LECTURE HOURS: 16)

Transplantation immunology

Introduction (Allograft rejection and Graft vs Host diseases), Allograft rejection ( Mechanism of graft rejection), Rejection to tumors ( tumors rejection)

Vaccination Types of immunization ( Active and Passive immunization), Types of vaccines (Recombinant DNA vaccines and Edible vaccine), Effects ( Benefits and adverse effects of vaccination)

### Text Books :

Immunology | Edition:2 | Lippincott Williams & Wilkins | Melvold, Roger AND Doan, Thao AND Viselli, Susan(2012)

Kuby Immunology | Edition:8 | W.H. Freeman Publishers | Jenni Punt AND Judy Owen AND Patricia Jones AND Sharon Stranford(2019)

### Reference Books :

Immunology | Edition:4 | Elsevier publishers | David B Roth Ivan Roitt AND David Male AND Jonathan Brostoff(2012)

|                                |                     |              |                    |
|--------------------------------|---------------------|--------------|--------------------|
| Course Title                   | : <b>IMMUNOLOGY</b> | Course Code  | :                  |
| Semester                       | : <b>V</b>          | Course Group | : <b>DSC-IX</b>    |
| Teaching Scheme in Hrs (L:T:P) | : <b>0:0:4</b>      | Credits      | : <b>4 Credits</b> |

|                          |                             |                     |                   |
|--------------------------|-----------------------------|---------------------|-------------------|
| Map Code                 | : <b>C(THEORY CONCEPTS)</b> | Total Contact Hours | : <b>48</b>       |
| CIA                      | : <b>25 Marks</b>           | SEE                 | : <b>75 Marks</b> |
| Programme: <b>BSC-BC</b> |                             |                     |                   |

Separation of serum and plasma from blood sample

Estimation of WBC

ASO latex test

RA test

Rocket immunoelectrophoresis

Widal test

Estimation of uric acid

ELISA test

Visit to vaccination center

|                                |                                 |                       |             |
|--------------------------------|---------------------------------|-----------------------|-------------|
| Course Title                   | : <b>ClinicalData Analytics</b> | Course Code           | :           |
| Semester                       | : V                             | Course Group          | :           |
| Teaching Scheme in Hrs (L:T:P) | : 4:0:0                         | Credits               | : 4 Credits |
| Map Code                       | : Theory                        | Total Contact Hours:  | 48          |
| CIA                            | : 25 Marks                      | SEE                   | : 75 Marks  |
| Programme: B.Sc Biochemistry   |                                 | # - Semester End Exam |             |

|                                |                         |                       |             |
|--------------------------------|-------------------------|-----------------------|-------------|
| Course Title                   | : <b>Data Analytics</b> | Course Code           | :           |
| Semester                       | : V                     | Course Group          | :           |
| Teaching Scheme in Hrs (L:T:P) | : 0:0:4                 | Credits               | : 2 Credits |
| Map Code                       | : Practical             | Total Contact Hours:  | 48          |
| CIA                            | : 40 Marks              | SEE                   | : 60 Marks  |
| Programme: B.Sc Biochemistry   |                         | # - Semester End Exam |             |

| No. | Course Outcome  | POs & PSOs       | Cl. Ses   | CL |
|-----|---|------------------|-----------|----|
| CO1 | Interpret data to inform business decisions                               | PO1, PSO1 & PSO4 | 10L + 10P | U  |
| CO2 | Recognize trends, detect outliers, and summarize data sets                | PO1, PSO1 & PSO4 | 10L+10P   | Ap |
| CO3 | Analyze relationships between variables                                   | PO1, PSO1 & PSO4 | 5L+5P     | Ap |
| CO4 | Develop and test hypotheses   | PO1, PSO1 & PSO4 | 4L + 4P   | Ap |
| CO5 | Craft sound survey questions and draw conclusions from population samples | PO1, PSO1 & PSO4 | 10L+10P   | Ap |
| CO6 | Implement regression analysis and other analytical techniques in Excel    | PO1, PSO1 & PSO4 | 9L+9P     | Ap |

**UNIT : I (LECTURE HOURS: 10 + PRACTICAL HOURS:10 = 20)**

| TOPIC(S)                        | SUB TOPIC(S)                        | MINUTES | KEY POINT(S)   | HOURS |
|---------------------------------|-------------------------------------|---------|--|-------|
| Describing and Summarizing Data | Introduction                        | 120     | Analyzing Box office Revenues  | 2     |
|                                 | Visualizing Data                    | 120     | Recognizing patterns, Histograms, Outliers   | 2     |
|                                 | Descriptive Statistics              | 180     | Central values for data, conditional means, percentiles, variability, Descriptive statistics in excel, coefficient of variation. | 3     |
|                                 | Relationships Between Two Variables | 180     | Scatter plots, correlation, hidden variables, time series  | 3     |
|                                 | Hands on Practice                   | 600     | Practice Problems  | 10    |

**UNIT :II (LECTURE HOURS: 10+ PRACTICAL HOURS:10 = 20)**

|                         |  |     |   |    |
|-------------------------|--|-----|---|----|
| Sampling and Estimation | Introduction                                 | 60  | Sampling at Amazon  | 1  |
|                         | Creating Representative and Unbiased Samples | 120 | Samples Vs Population, Sample size, Avoiding Bias   | 2  |
|                         | The Normal Distribution                      | 120 | Rules of thumb, The Normal function NORM.DIST, The Normal function NORM.INV, The central limit theorem                      | 2  |
|                         | Confidence Intervals                         | 180 | Estimating the population mean, Large samples, small samples, Choosing a sample size, Estimating the population proportion, | 3  |
|                         | Amazon's Inventory Sampling                  | 120 | Amazon's inventory sampling   | 2  |
|                         | Hands on Practice                            | 600 | Practice Problems   | 10 |

**UNIT :III (LECTURE HOURS: 9+ PRACTICAL HOURS:9 = 18)**

|                    |   |     |  |   |
|--------------------|---|-----|--|---|
| Hypothesis Testing | Introduction                              | 120 | Amazon's use of Hypothesis Testing   | 2 |
|                    | Designing and Performing Hypothesis Tests | 240 | Developing Hypothesis, Constructing a range of likely sample means, using p-values, Type I and Type II Errors, One | 4 |

|  |                                   |     |   |   |
|--|-----------------------------------|-----|---|---|
|  |                                   |     | sided testing, Comparing two populations                              |   |
|  | Improving the Customer Experience | 180 | The shopping cart A/B test, The arrow A/B test, The magazine A/B test | 3 |
|  | Hands on Practice                 | 540 | Practice Problems   | 9 |

**UNIT :IV (LECTURE HOURS: 10+ PRACTICAL HOURS:10= 20)**

|                                   |                                    |     |  |    |
|-----------------------------------|------------------------------------|-----|--|----|
| Single Variable Linear Regression | Introduction                       | 60  | Regression at Disney Studios   | 1  |
|                                   | Regression Line                    | 60  | Visualizing the Relationship, The best fit line, The structure of the Regression line                        | 1  |
|                                   | Forecasting                        | 120 | Point Forecasts, Prediction intervals  | 2  |
|                                   | Interpreting the regression output | 120 | Quantifying predictive power, testing for a significant relationship, R-square vs p-value, Residual analysis | 2  |
|                                   | Performing Regression Analysis     | 120 | Regression Analysis in excel, Using dummy variables  | 2  |
|                                   | Forecasting Home Video Units       | 120 | The Disney Studio Model, Just a starting point   | 2  |
|                                   | Hands on Practice                  | 600 | Practice Problems  | 10 |

**UNIT :V (LECTURE HOURS: 9+ PRACTICAL HOURS:9= 18)**

|                     |  |     |   |   |
|---------------------|--|-----|---|---|
| Multiple Regression | Introduction                             | 60  | Multiple Regression at Caesars  | 1 |
|                     | Multiple Regression equation             | 60  | Single Vs Multiple Regression, Interpreting the multiple regression equation, forecasting | 1 |
|                     | Adapting concepts from single regression | 60  | Adjusted R-square, Residual Analysis, Testing for Significance of Variables,              | 1 |
|                     | Performing Multiple Regression Analysis  | 120 | Multiple Regression Analysis in Excel   | 2 |
|                     | New Concepts in Multiple Regression      | 120 | MutiCollinearity, Dummy variables, lagged variables                                       | 2 |

|  |                              |     |  |   |
|--|------------------------------|-----|--|---|
|  | The Caesars Staffing Problem | 120 | Developing the model, Analyzing the results, Improving the model | 2 |
|  | Hands on Practice            | 540 | Practical Problems   | 9 |

**REFERENCES:**

- 1.Open Intro Statistics (Third Edition) by David M Diez , Christopher D Barr, Mine Cetinkaya - Rund | Edition:3 | Open Intro Statistics | Christopher D Barr AND David M Diez AND Mine Cetinkaya (2017)
- 2.An Introduction to Statistical Learning with Applications | Edition:1 | Springer | Daniela Witten AND Gareth James AND Robert Tibshirani AND Trevor Hastie(2013)
- 3.Business Analytics | Edition: | Harvard Business School | Janice Hammond(2017 )

|              |                          |             |                      |
|--------------|--------------------------|-------------|----------------------|
| Course Title | :INDUSTRIAL BIOCHEMISTRY | CourseCode  | : *                  |
| Semester     | : <b>V</b>               | CourseGroup | : <b>SEC – G2 –B</b> |

|   |                                 |
|---|---------------------------------|
| Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b> | Credits : <b>4 Credits</b>      |
| Map Code: <b>C (THEORY - CONCEPTS)</b>        | Total Contact Hours : <b>60</b> |
| CIA : <b>25 Marks</b>                         | SEE# : <b>75 Marks</b>          |
| Programme : <b>B.SC., BC</b>                  | # - <b>Semester End Exam</b>    |

| No. | Course Outcome(Cos):<br>After completion of this course, the students will be able to | POs & PSOs | Cl. Ses | CL |
|-----|---|------------|---------|----|
| CO1 | Understand fermentation process used in the Industrial production of various products | PO1 & PSO3 | 12      | U  |
| CO2 | Describe the biochemical changes in nutrients during preservation.                    | PO1 & PSO3 | 12      | U  |
| CO3 | Illustrate the applications of enzymes in <i>various Industries</i>                   | PO1 & PSO3 | 12      | U  |
| CO4 | Develop skills of performing basic biochemical tests in Environmental aspects         | PO1 & PSO3 | 12      | U  |
| CO5 | Extend the knowledge on patents   | PO1 & PSO3 | 12      | R  |

### UNIT I (Lectuer Hours: 12)

#### **Introduction to fermentation technology:**

**Isolation and screening of industrially important microbes-**, Inoculum preparation, strain improvement for better yield. Fermentation-Submerged and solid state fermentation, Fermentor design, Downstream processing.

**Industrial production of alcohol, alcoholic beverages and bioactive compounds** – Wine, Beer and Dairy Industry. Industrial Production of Lactic acid, Citric acid, Penicillin and streptomycin.

### UNIT II:(Lectuer Hours: 12)

#### **Biochemistry of Food Spoilage**

**Factors causing food spoilage** - Food Preservation General principles of food preservation Preservation by use of high and low temperatures, drying, radiations, chemical preservatives, inert gases, mechanical preservation techniques (vacuum packaging, tetra packs).

**Adulteration & Determination of shelf** – Food Adulteration – Common food adulterants, their harmful effects and physical and chemical methods for their detection. Milk adulteration and adulteration in edible oils. Class I and II preservatives.

Food safety regulations

**Role of ISI, Agmark, FDA & Food Safety and Standards Authority of India (FSSAI), Food and Agricultural Organization (FAO) in food industry.**

### UNIT III:(Lectuer Hours: 12)

**Enzyme- Production** Amylase; Production of Amylase; Microbial Enzyme- cellulase, Cellulose- Producing Microorganisms, Fermentation Production of Cellulase; Microbial Enzyme- Pectinase, Microbial enzyme- Protease; **Application, Advantages, Disadvantages;** Mechanism of Action; Production of Vitamin B<sub>12</sub>, Synthesis and Industrial Production; Riboflavin.

### UNIT IV1:(Lectuer Hours: 12)

#### **Environmental biochemistry**

**Bioremediation:** Introduction and types of bioremediations, bioremediation of surface soil and sludge, bioremediation of subsurface material, In situ and Ex-situ technologies, Phytoremediation. Chemical toxicology: Biochemical effects of heavy metals (Pb, As, Hg, Cd), pesticides, insecticides, herbicides, weedicides, larvicides.

Biomining and bioleaching.

**Wastewater treatment** – BOD, COD, aerobic, anaerobic, suspended and attached growth systems.

**UNIT V(Lectuer Hours: 12)**

**Intellectual property right**

**IPR: and Scope** of IPR, Recent developments in Registration of inventions and protections of IPR, WIPO and its role, World Trade Organization regimes, GATT agreement and its impact on agriculture and biotechnology. WTO and Agreement on Agriculture (AoA). **Trade Related Aspects of Intellectual Property Rights (TRIPS)**. History of IPRs. Categories of IPRs- Copyrights, Patents, Trademark, Geographical Indications. Industrial Designs,. Recent amendments in Indian acts and regulations related to IPR. Patent filing-opposition-retrieval. Recent developments, advances in IPR.

**Reference books**

1. Peter stanbuy, Allan Whitaker, stephen j. Hall. Principles of Fermentation third Edition 2016.
2. Food Processing: Principles and Applications” by J Scott Smith and Y H Hui 2019. Second edition
3. Biotechnology of Microbial Enzymes: Production, Biocatalysis and IndustrialApplications 1st Edition, Kindle Edition by Goutam Brahmachari (Author), Arnold L Demain (Editor), Jose L Adrio (Editor) 2016
4. Textbook of Environmental Biochemistry 1 January 2018 by Harender K. Gaur (Author)
5. Indian Patent Law (English, Paperback, Kalyan C. Kankanala)Publisher: OXFORD UNIVERSITY PRESS- NEW DELHI ISBN: 9780198089605, 0198089600 Edition: 2012

|                                |                              |                       |                   |
|--------------------------------|------------------------------|-----------------------|-------------------|
| Course Title                   | : <b>HEALTH MANAGEMENT</b>   | CourseCode            | :                 |
| Semester                       | : <b>V</b>                   | CourseGroup           | : <b>EDC</b>      |
| Teaching Scheme in Hrs (L:T:P) | : <b>5:1:0</b>               | Credits               | : <b>6Credits</b> |
| Map Code                       | : <b>C (THEORY CONCEPTS)</b> | Total Contact Hours   | : <b>90</b>       |
| CIA                            | : <b>25 Marks</b>            | SEE#                  | : <b>75 Marks</b> |
| Programme                      | : <b>B.SC., BIOCHEMISTRY</b> | # - Semester End Exam |                   |



| No   | Course Outcome (COs): After completion of this course, the students will be able to | Pos & PSOs | Cl.Ses | BLOOM'S TAXONOMY LEVEL |
|------|---|------------|--------|------------------------|
| CO 1 | Understand the equity in health, to reduce health risk and to promote lifestyle.    | PO1 & PS01 | 18     | U                      |
| CO 2 | Explain the impact of diabetes in our community                                     | PO1 & PS01 | 18     | U                      |
| CO 3 | Summarize the pathology and prevention of cardiovascular diseases.                  | PO1 & PS01 | 18     | U                      |
| CO 4 | Interpret the formation of kidney stones and to overcome through diet.              | PO1 & PS01 | 18     | U                      |
| CO 5 | Analyze private sector participation in the provision of health care policy         | PO1 & PS01 | 18     | U                      |

#### UNIT I (LECTURE HOURS: 18)

##### Health

**Concept of health** - Definition, Quality of life, and Hygiene.

**Food factors** - For human being and their requirements Calorific value of food - Values of different nutrients.

**Obesity related diseases** - Definition and classification, genetic and environmental factor leading to obesity & Management of obesity

#### UNIT II (LECTURE HOURS: 18)

##### Diabetes

**Diabetes** - Definition,

**Types of diabetes** - IDDM, NIDDM, Gestational Diabetes and blood sugar level

**Insulin and glucagon** - Definition, effect of hormone levels in diabetes

**Etiology and pathogenesis** - Occurrence and symptoms Management of diabetes - Diet and medicine

#### UNIT III (LECTURE HOURS: 18)

##### Cardiovascular disease

**Cardiovascular disease** - Normal level of cholesterol and lipoprotein

**Cardiac arrest and myocardial infarction** - Signs, symptoms and risk factors

**Management of heart disease** - Diet, medicine and exercise

#### UNIT IV (LECTURE HOURS: 18)

##### Renal Disease

**Kidney stones** - Diet and prevention

**Food habits** - food habits and preventive measures

**Cancer** - Definition and types

#### UNIT V (LECTURE HOURS: 18)

##### Health Insurance

**Health Insurance** - Individual mediclaim policy Domiciliary hospitalization - Procedures **Cancer** - Cancer insurance

**Group mediclaim policy** - Rules and regulations of family mediclaim policy

##### Text Books :

Practical clinical biochemistry

Varley, Harold; Gowenlock, Alan H; McMurray, Janet R; McLauchlan, Donald M; Varley, Harold. | Edition:-5 | - 2015

**Reference Books :**

Clinical chemistry-Principles and techniques | Edition:- 5| - | Michael L. Bishop -(2013)

Clinical laboratory diagnosis | Edition:-12 | - | Richard A. McPherson - (2016)

