**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 2021 Batch & onwards**

**(2021 - 2024)**

**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

- DISCIPLINE KNOWLEDGE
- PROBLEM ANALYSIS
- CRITICAL THINKING
- MODERN TOOLS USAGE
- SOFT SKILLS
- SELF LEARNING
- LIFE LONG LEARNING
- 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 | - |
| **Total** | | | | **2600** | **136+4*** |

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

| 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 |
| **Total** | | | | | | | **200** | **8** |

| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) - GROUP II : ( II & IV SEMESTER) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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 |
| **Total** | | | | | | | **200** | **4** |

| DISCIPLINE SPECIFIC COURSES (DSC) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course** | **Course Name** | **L** | **T** | **P** | **CIA** | **ESE** | **Total** | **Credits** |
| DSC - I | Biomolecules | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC - II | Allied Chemistry | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC - III | Cellular Biochemistry | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC - VI | Bioinstrumentation Techniques | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC – V | Enzymology | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DSC – VI | Intermediary metabolism | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC – VII | Clinical Biochemistry | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC –VIII | Clinical Lab Technology | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC – IX | Molecular Biology | 5 | 1 | - | 25 | 75 | 100 | 6 |
| DSC – X | Immunology | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC – XI | Biochemical Pharmacology | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSC – XII | Plant Biochemistry and Plant therapeutics | 5 | 1 | - | 25 | 75 | 100 | 6 |
| **Total** | | | | | | | **1200** | **72** |

| **DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) I : (III SEMESTER)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course** | **Course Name** | **L** | **T** | **P** | **CIA** | **ESE** | **Total** | **Credits** |
| **One Course – From the Group** | | | | | | | | |
| DSE - I - 1 | Microbial Physiology | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSE - I - 2 | Environmental Biochemistry | 5 | 1 | - | 25 | 75 | 100 | 6 |
| **Total** | | | | | | | **100** | **6** |

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

| **DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) III : (V SEMESTER)** |
|---|

| Course | Course Name | L | T | P | CIA | ESE | Total | Credits |
|---|---|---|---|---|---|---|---|---|
| **One Course – From the Group** | | | | | | | | |
| DSE - III - 1 | Clinical Data analytics | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| DSE - III - 2 | Stem cells and cancer biology | 5 | 1 | - | 25 | 75 | 100 | 6 |
| **Total** | | | | | | | **100** | **6** |

| DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) IV : (VI SEMESTER) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course** | **Course Name** | **L** | **T** | **P** | **CIA** | **ESE** | **Total** | **Credits** |
| **One Course – From the Group** | | | | | | | | |
| DSE –IV – 1 | Human Physiology and Endocrinology | - | - | - | 100 | - | 100 | 6 |
| DSE – IV - 2 | Nutritional Biochemistry | - | - | - | 100 | - | 100 | 6 |
| **Total** | | | | | | | **100** | **6** |

| DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) V: (V- SEMESTER) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **DSE – V - EXTRA DISCIPLINARY COURSE :(EDC)** | | | | | | | | |
| **Course** | **Course Name** | **L** | **T** | **P** | **CIA** | **ESE** | **Total** | **Credits** |
| **One Course – From the Group** | | | | | | | | |
| 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 |
| **Total** | | | | | | | **100** | **6** |

| **DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE) VI : (VI SEMESTER)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Course** | **Course Name** | **L** | **T** | **P** | **CIA** | **ESE** | **Total** | **Credits** |
| **One Course – From the group** | | | | | | | | |
| DSE – VI - 2 | Project Report – Viva voce | - | - | - | 100 | - | 100 | 6 |
| **Total** | | | | | | | **100** | **6** |

| **SKILL ENHANCEMENT COURSES : GROUP I (III & IV SEMESTER)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **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 |
| **Total** | | | | | | | **100** | **4** |

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

| **NON CREDIT COURSE – GROUP I (III & IV SEMESTER)** | | | |
|---|---|---|---|
| NCC – G1-1 (III Semester) | Professional English - I | RVS Training Academy | Grade |
| NCC – G1-2 (IV Semester) | Professional English - II | RVS Training Academy | Grade |

| NON CREDIT COURSE – GROUP II (I - IV SEMESTER) | | | |
|---|---|---|---|
| **Any ONE Course** | | | |
| 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 |

| EXTRA OPTIONAL CREDIT COURSE (ALCTA) I – VI SEMESTER | | | |
|---|---|---|---|
| **Any ONECourse with 4 Extra Credits** | | | |
| 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 2021 - 2024 BATCH**

| Semester | Course Opted | Course Name | D | L | T | P | CIA | ESE | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 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 | - | - | - | - | - | - |
| | **Total** | | | | **30** | | | | **400** | **20** |
| **II** | 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 | Cellular Biochemistry | 3<br>6 | 4 | - | - | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – IV | Bioinstrumentation Techniques | 3<br>6 | 4 | - | - | 25<br>40 | 75<br>60 | 100 | 6 |
| | AECC – G II - 1 | Environmental Studies | 3 | 1 | - | - | 100 | - | 100 | 1 |
| | NCC – G II | NCC/NSS/ SPORTS/CULTURALS | - | 1 | - | - | - | - | - | - |
| | LIB | Library | - | 1 | - | - | - | - | - | - |
| | **Total** | | | | **34** | | | | **600** | **24** |

| Semester | Course Opted | Course Name | D | L | T | P | CIA | ESE | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| **III** | DSC – V | Enzymology | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – VI | Intermediary metabolism | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSE - I | Elective - I | 3 | 5 | 1 | - | 25<br>40 | 75<br>60 | 100 | 6 |
| | SEC – G I – 1 | Communicative Skills - I | 3 | 2 | - | - | 50 | - | 50 | 2 |
| | NCC – G I -1 | Professional English - I | 3 | 2 | - | - | Grade | | | |
| | NCC – G II | NCC/NSS/ SPORTS/CULTURALS | - | 1 | - | - | - | - | - | - |
| | **Total** | | | | **29** | | | | **450** | **26** |
| **IV** | DSC – VII | Clinical Biochemistry | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – VIII | Clinical Lab Technology | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSE - II | Elective - II | 3 | 5 | **1** | - | 25<br>40 | 75<br>60 | 100 | 6 |
| | AECC – G II - 2 | Aptitude | 3 | 3 | - | - | 25 | 75 | 100 | 3 |

| Semester | Course Opted | Course Name | D | L | T | P | CIA | ESE | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| V | DSC – IX | Molecular Biology | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – X | Immunology | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSE-III | Elective-III | 3 | 5 | 1 | - | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – IX | Elective - V (EDC) | 3 | 5 | 1 | - | 25 | 75 | 100 | 6 |
| | **Any ONE Group** | | | | | | | | | |
| | **Group A** | | | | | | | | | |
| | 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 |
| | **Group B** | | | | | | | | | |
| | SEC – G II – B | Industrial Biochemistry | 3 | 4 | - | - | 100 | - | 100 | 4 |
| | | | | | | | | | | |
| | NCC – G II | NCC/NSS/SPORTS/CULTURALS | - | 1 | - | - | Good/ Satisfactory | | | |
| | **Total** | | | | **32** | | | | **500** | **28** |
| VI | DSC – XI | Biochemical Pharmacology | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | DSC – XII | Plant Biochemistry and Plant therapeutics | 3<br>6 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | 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) | Extra Credits | | | | | | | 4* |
| | **Total** | | | | | | | | **200** | **12** |
| **TOTAL** | | | | | | | | | **2600** | **136 +4* =140** |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SEC – G I - 2 | Communicative Skills - II | 3 | 2 | - | - | 50 | - | 50 | 2 |
| | NCC – G I - 2 | Professional English - II | 3 | 2 | - | - | Grade | | | |
| | NCC – G II | NCC/NSS/ SPORTS/CULTURALS | - | 1 | - | - | - | - | - | - |
| | **Total** | | | | **35** | | | | **450** | **26** |

**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. Microbial Physiology
2. Environmental Biochemistry

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

1. Biostatistics
2. Marine Biochemistry

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

1. Clinical Data analytics
2. Stem cells and cancer biology

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

1. Human Physiology and Endocrinology
2. Nutritional Biochemistry

**NCC - I (Non – Credit course) Group – I (Professional English)**

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.

**SEMESTER I**

| Semester | Course Opted | Course Name | D | L | T | P | CIA | ESE | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 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<br>3 | 4 | - | 4 | 25<br>40 | 75<br>60 | 100 | 6 |
| | NCC – GII | NCC/NSS/ SPORTS/CULTURALS | - | 1 | - | - | - | - | - | - |
| | LIB | Library | - | 1 | - | - | - | - | - | - |
| | **Total** | | | | **30** | | | | **400** | **20** |

| | | | |
|---|---|---|---|
| Course Title | : **BIOMOLECULES (T)** | Course Code | : 13A |
| Semester | : **I** | Course Group | : **DSC-I** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:0** | | Credits | : **4** |
| Map Code | : **C(THEORY CONCEPTS)** | Total Contact Hours | : 60 |
| CIA | : **25 Marks** | SEE | : **75 Marks** |
| Programme: **BSC-BC** | | | |

**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 | 12 | U |
| CO2 | Understand the various types and properties of lipids | PSO 2 | 12 | U |
| CO3 | Recognize the structure and function of amino acids | PSO 2 | 12 | U & R |
| CO4 | Derive the structure and the nature of the protein molecules | PSO 3 | 12 | U & An |
| CO5 | Explain the structure-function relationships for nucleic acids and chromatin | PSO3 | 6 | 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 | 6 | U & An |

UNIT-1 (Lecture hours: 12)
CARBOHYDRATES THEORY
Introduction - Definition & Classification
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
UNIT-2 (Lecture hours: 12)
LIPIDS THEORY
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: 12)

AMINOACID THEORY
Introduction - Definition & structure
Classification - Based on functional groups, amino acids as ampholytes
Aliphatic Aminoacids - Structure and properties
Aromatic aminoacids - Structure and properties
Peptide bond - Structure & properties
Identification - N&C terminal residues
UNIT-4 (Lecture hours: 12)
PROTEIN THEORY
Introduction - Classification & properties
Structure of proteins - Primary, secondary, tertiary & Quaternary structures
Denaturation & Renaturation of proteins - Physical & chemical agents, coagulation, refolding
UNIT-5 (Lecture hours: 12)
NUCLEIC ACIDS THEORY
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 & zippering reaction
RNA - Types - mRNA, rRNA, tRNA,miRNA, Si RNA -Structures and their biological roles
Practicals

**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)

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|---|---|
| Course Title : **BIOMOLECULES (P)** | Course Code : 13P |
| Semester : **I** | Course Group : **DSC-I** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:0** | Credits : **4** |
| Map Code : **H(PRACTICAL EXPERIMENTS)** | Total Contact Hours : 60 |
| CIA : **40 Marks** | SEE : **60 Marks** |
| Programme: **BSC-BC** | |

List of Experiments:

Qualitative Analysis of Monosaccharides- Glucose and Fructose
Qualitative Analysis of Disaccharides - Sucrose and Maltose
Qualitative Analysis of Polysaccharides - Starch and Dextrin
Determination of Acid number of edible oil.
Determination of saponification number of edible oil
Estimation of unsaturated fat by iodine value of oil.
Qualitative Analysis of Non-polar, Aliphatic Aminoacids- Methionine, Leucine
Qualitative Analysis of Aromatic Aminoacids- Tyrosine, Tryptophan
Qualitative Analysis of Polar, Uncharged Aminoacid- Serine
Qualitative Analysis of Charged Aminoacid- Histidine
Identification of protein by Biuret method
Denaturation of protein using Egg
Isolation of protein from different organic sources
Identification of sulfhydryl group of isolated proteins
Quantify the amount of casein present in milk samples
Alkali hydrolysis on RNA
Effect of Denaturation of DNA

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|---|---|---|---|
| Course Title | :**ALLIED CHEMISTRY (T)** | Course Code | : 13B |
| Semester | : **I** | Course Group | : **DSC** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:4** | | Credits | : **4 Credits** |
| Map Code | : C(THEORY – APPLICATION) | Total Contact Hours | : **60** |
| CIA | : **25 Marks** | SEE # | : **75 Marks** |
| Programme | : **BSC-BC** | **# - 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 |
|---|---|---|---|---|
| CO1 | Understand the basics of thermodynamic laws and principle | PO1& PS01 | 12 | U |
| CO2 | Demonstrate the different aspects of chemical bonding | PO1& PS01 | 12 | An |
| CO3 | Describe the basic rules of organic nomenclature | PO1& PS01 | 12 | Ap |
| CO4 | Demonstrate titrimetry experiments and assessments of important factors that could affect the analytical result. | PO1& PS01 | 12 | Ap |
| CO5 | Analyse the concepts of physical chemistry | PO1& PS01 | 6 | An |
| CO6 | Acquire knowledge on Green chemistry | PO1& PS01 | 6 | U |

**UNIT-1 (LECTURE HOURS: 12)**

**THERMODYNAMICS THEORY**

**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:12)**

**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: 12)**

**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: 12)**

**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: 12)

### 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

### Text Books:

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 miftin company new york

2. M.Satake,Y.Hayashi(2003),Colloidal and Surface chemistry,Discovery publishing house

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|---|---|---|---|
| Course Title | :**ALLIED CHEMISTRY ((P)** | Course Code | : 13Q |
| Semester | : **I** | Course Group | : **DSC** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:4** | | Credits | : **4 Credits** |
| Map Code | : **H(PRACTICAL EXPERIMENTS)** | Total Contact Hours | : **120** |
| CIA | : **25 Marks** | SEE # | : **75 Marks** |
| Programme | : **BSC-BC** | **# - Semester End Exam** | |

List of Experiments:

**Demonstration of Thermodynamics** - Enthalpy and Entropy

Preparation of buffer solutions – phosphate buffer and citrate buffer at different pH
Estimation of hardness of water
Qualitative Analysis of Aromatic compounds - Toluene and Naphthalene
Qualitative Analysis of Aliphatic compounds – Glucose, Fructose
Qualitative Analysis of Functional group-Carboxylic acid and tryptophan
**Titration for Acid-Base** - Strong Acid vs Strong Base, HCl Vs NaOH
Strong base Vs weak acid,NaOH Vs $CH_3COOH$( acetic acid)
Weak base Vs strong acid,Ammonia ($NH_3$) Vs $H_2SO_4$
Determination of alkalinity in water
COD (chemical oxygen demand)-Measure of wastewater quality.

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|---|---|
| Course Title : **BIOINSTRUMENTATION TECHNIQUES** | Course Code : 23A |
| Semester : **II** | Course Group : **DSC-III** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:0** | Credits : **4 Credits** |
| Map Code : **C(THEORY CONCEPTS)** | Total Contact Hours : **48** |
| CIA : **25 Marks** | SEE : **75 Marks** |
| Programme: **BSC-BC** | |

| No. | Course Outcome | POs & PSOs | Cl. Ses | CL |
|---|---|---|---|---|
| **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 INSTRUMENTATION TECHNIQUES THEORY (LECTURE HOURS: 24)**

pH- Introduction - Definition, 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 - Buffer solutions - Acids and bases
Buffer system - Bicarbonate Buffer system, Hb Buffer system
INSTRUMENTATION TECHNIQUES PRACTICAL
Determination of pH -
Preparation of Buffers – calibration buffer 4.1, 7.0, 9.18

**UNIT II**
**INSTRUMENTATION TECHNIQUES THEORY (LECTURE HOURS: 24)**
CHROMATOGRAPHY - Definition and its types
Paper Chromatography –Working Principle, Instrumentation & applications.
Thin Layer chromatography - Working Principle, Instrumentation & applications
Column chromatography -basic principle, Working Principle, Instrumentation & applications (
Gas Liquid chromatography, Ion exchange chromatography, HPLC, Affinity Chromatography, Molecular sieve)
INSTRUMENTATION TECHNIQUES PRACTICAL
Paper Chromatography - Circular
Thin Layer Chromatography
**UNIT III (LECTURE HOURS: 24)**
**INSTRUMENTATION TECHNIQUES THEORY**
Centrifugation - Introduction, types of centrifugation and Rotor types
Ultra centrifugation - Working, applications and its types.
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
INSTRUMENTATION TECHNIQUES PRACTICAL
Separation of sub- cellular components using centrifuge.
Separation Technique SDS-gel Electrophoresis – Demonstration

**1 Horizontal and Vertical Gel Electrophoresis**
**2 Polyacrylamide Gel Electrophoresis**

**UNIT IV INSTRUMENTATION TECHNIQUES THEORY (LECTURE HOURS: 24)**
COLORIMETRY - Introduction, colour and absorption spectrum
Beer-Lambert's law - Principle and laws
Working of a single cell photoelectric colorimeter - Principle instrumentation & applications
SPECTROPHOTOMETRY AND FLOURIMETRY - Principle, Instrumentation and applications.
INSTRUMENTATION TECHNIQUES PRACTICAL
Estimation of Protein by FOLIN - CIOCALTEAU method
Estimation of Urea by DAM-TSC method
Estimation of carbohydrate by colorimetric method

**UNIT V INSTRUMENTATION TECHNIQUES THEORY (LECTURE HOURS: 24)**
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
INSTRUMENTATION TECHNIQUES PRACTICAL
Practical: Industrial visit to learn techniques in radioactivity
**Text Books :**

1.Boyer, R.F. (2000). Modern Experimental Biochemistry (3rded.). Pearson Publishers, London, United Kingdom.
2. Chatwal, G.R.&Anand, S.K. (2014). Instrumental Methods of Chemical Analysis (5thed.). Himalaya Publishing House,Mumbai, India.
3. Hofmann, A. &Clokie, S. (2018). Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology (8thed.).Cambridge University Press, Cambridge, United Kingdom. .
4. Sawhney, S.K.& Singh, R. (2005). Introductory Practical Biochemistry (2nded.).Alpha Science International Ltd. Publishers, Oxford, United Kingdom.
5. Sharma, B.K. (2011). Instrumental Methods of Chemical Analysis (1sted.).Krishna Prakashan Media Publishers, Meerut, India.
6. Veerakumari, L. (2009). Bioinstrumentation. MJP Publishers, Chennai, India
7. Wilson, K., and Walker, J., (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th Low Price Edition, Cambridge University Press, India.

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|---|---|---|---|
| Course Title | : **BIOINSTRUMENTATION TECHNIQUES** | Course Code | : 23P |
| Semester | : **II** | Course Group | : **DSC-III** |
| Teaching Scheme in Hrs (L:T:P) : **0:0:4** | | Credits | : **2 Credits** |
| Map Code : H (THEORY TECHNOLOGY) | | Total Contact Hours: **48** | |
| CIA | : **40 Marks** | SEE | : **60 Marks** |
| Programme: **BSC-BC** | | | |

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

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|---|---|---|---|
| Course Title | : **CELLULAR BIOCHEMISTRY** | Course Code | : 23B |
| Semester | : **II** | Course Group | : **DSC-IV** |
| Teaching Scheme in Hrs (L:T:P) : **4:0:0** | | Credits | : **4 Credits** |
| Map Code | : **C(THEORY CONCEPTS)** | Total Contact Hours | : **48** |
| CIA | : **25 Marks** | SEE | : **75 Marks** |
| Programme: **BSC-BC** | | | |

| No. | Course Outcome | POs & PSOs | Cl. Ses | CL |
|---|---|---|---|---|
| **CO1** | Recall the history of cytology and draw the structure of cell organelles and locate its parts along with functions. | **PSO 1** | **10** | **U** |
| **CO2** | Design the model of a cell. | **PSO 2** | **10** | **Ap** |
| **CO3** | Distinguish the structure of prokaryotic and eukaryotic cell | **PSO 2** | **10** | **Ap** |
| **CO4** | Explain the organization of Genes and chromosomes morphology and its aberrations. | **PSO 2** | **8** | **R** |
| **CO5** | Distinguish the types and mechanism of mutations. | **PSO 1** | **5** | **R** |
| **CO6** | Compare and contrast the events of cell cycle and its regulation. | **PSO 1 & PSO 2** | **5** | **R & Ap** |

**UNIT-I (LECTUREHOURS:24)**

**Cell biology**

Cell Structure (Cytoplasm- Structure- Composition), Cellular organelles (Nucleus- Mitochondria – Golgi bodies- Lysosomes- Endoplasmic reticulum- Peroxisomes- Plastids- Vacoules- Ribosomes), Cytoskeleton (Structure and Function).

Cell membrane ((Structure and Functions- Fluid mosaic model, Unit membrane model)

Membrane Transport (Active and Passive Transport- Endocytosis and exocytosis- Pinocytosis and Phagocytosis).

1. Microscopic view of prokaryotic cells using staining techniques.- Simple staining
2. Microscopic view of prokaryotic cells using staining techniques.- Gram staining

**UNIT-II (LECTUR EHOURS:24)**

**Cell division and cell growth**

Cell division (Mitosis and Meiosis, reductive division), Cell cycle (Phases of cell cycle-S phase, G phase, M phase) cell cycle regulation and, cell cycle checkpoints)

1. Mitotic cell division by using-onion root tip

**UNIT III (LECTURE HOURS:24)**

**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)

1. Extraction of protein-Total cellular protein

**UNIT-IV (LECTUREHOURS:24)**

**Biochemical energetics**

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

1. Separation of nucleic acid bases - By TLC
2. Preparation of cell culture media-Preparation of cell culture media

**UNIT V (LECTUREHOURS:24)**

**Regulation of cell growth**

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

1. Cellular separation by using centrifugation technique.
2. Isolation of genomic DNA in liver samples
3. Isolation of genomic RNA in liver samples.

**TextBooks:**

Cell and Molecular biology, Edition 8th, Lipppincott Williams and Wilkins, Phila delphia, De Robertis, E.D.P and De Robertis, E.M.F. (2010)

The Cell : A Molecular Biology, Editon 7th, Sunderland, Mass. Sinauer Associates, Inc.Cooper, G.M and Hausman, R.E. (2018)

Cell Biology | Edition:3rd edition | Himalaya Publishing House Pvt. Ltd | Powar C B(2017)

**ReferenceBooks:**

Cell and Molecular Biology: Concepts and Experiments, Edition 6th, John Karp, G (2019)

Essential Cell biology : Edition 6th, Garlan dSciecne, Bruce Alberts and Dennis Bray (2018)

Cell Biology | Edition: 6 | John Wiley and Sons, Inc., Hoboken, NJ Gerald Karp (2010)
Cell Biology | Edition: 5 | Universities Press (Isndia) Pvt. Ltd.Channarayappa (2014)

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|---|---|---|---|
| Course Title | : **CELLULAR BIOCHEMISTRY** | Course Code | : 23Q |
| Semester | : **II** | Course Group | : **DSC-IV** |
| Teaching Scheme in Hrs (L:T:P) : **0:0:4** | | Credits | : **4 Credits** |
| Map Code | : **C(THEORY CONCEPTS)** | Total Contact Hours | : **48** |
| CIA | : **25 Marks** | SEE | : **75 Marks** |
| Programme: **BSC-BC** | | | |

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