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| B.Sc.,  Biochemistry |
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| **SYLLABUS** |
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| **from the academic year**  **2023 – 2024** |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |
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**THE REGULATIONS ON LEARNING OUTCOMES BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE EDUCATION**

**1. Preamble**

Biochemistry is the cross over scientific discipline that integrates the living world and chemistry. It involves the study of the structure of biomolecules and explores the biological processes at molecular level in the living organisms. It is the laboratory science that has several domains like cell biology, molecular biology, clinical biology, enzymology, immunology, physiology, pharmacology etc., It has enlightened many aspects of health and diseases and paved the way for many interdisciplinary technological innovations like metabolomics, genomics and proteomics. There is a continuous demand for biochemists in public and private health care sectors, agriculture, medical and forensic departments. Almost all food, pharmaceuticals, health and beauty care etc required quality control and safety checks for which experts in the field of Biochemistry are always in need. The syllabi for the three year B.Sc., degree programme in Biochemistry was framed in such a way that at the end of the course they could apply the knowledge and expertise in industries, diagnostic laboratories and various research fields

The programme endeavours to provide students a broad based training in biochemistry with a solid background of basic concepts as well as exposing them to the exciting advancements in the field. In addition to theoretical knowledge, significant emphasis has been given to provide hands on experience to the students in the forefront areas of experimental biochemistry. A multidisciplinary approach has been employed to provide the best leverage to students to enable them to move into frontier areas of biological research in the future.

The course defines clearly the objectives and the learning outcomes, enabling students to choose the elective subjects for broadening their skills. The course also offers skills to pursue research in the field of Biological Chemistry and thus would produce best minds to meet the demands of society.

Biochemistry, today is considered as an application oriented integrated basic science. It’s an interdisciplinary science that has emerged by the confluence of principles of Chemistry, Physics and Mathematics to Biology. Advances in Biochemistry have immense positive implications on the understanding of biochemical interactions, cellular communications, hormonal mechanisms and the cross talks between them. The research in Biochemistry has been translational and there is a shift from hypothesis driven research to data dependent research that promises translational, product oriented research. Much of the advancement in Biochemistry is in the advancement of Biotechnology, as a basic science discipline Biochemistry lead to Biotechnological advancement. Considering its pivotal role in biological sciences, it is imperative to strengthen the fundamental concepts of Biochemistry.

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| **TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION** | |
| **Programme:** | **B.Sc Biochemistry** |
| **Programme Code:** |  |
| **Duration:** | **3 years [UG]** |
| **Programme Outcomes:** | **PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study  **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one’s views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.  **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.  **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one’s learning to real life situations.  **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.  **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation  **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team  **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.  **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.  **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.  **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.  **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.  **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one’s life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.  **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.  **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling. |
| **Programme Specific Outcomes:** | **PSO1 – Placement:**  To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.  **PSO 2 - Entrepreneur:**  To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations  **PSO3 – Research and Development:**  Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.  **PSO4 – Contribution to Business World:**  To produce employable, ethical and innovative professionals to sustain in the dynamic business world.  **PSO 5 – Contribution to the Society:**  To contribute to the development of the society by collaborating with stakeholders for mutual benefit |

**PROGRAM OUTCOMES**

|  |  |
| --- | --- |
| **PO1** | Acquire knowledge in Biochemistry and apply the knowledge in their day to day life for betterment of self and society |
| **PO2** | Develop critical ,analytical thinking and problem solving skills |
| **PO3** | Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret and draw conclusion from data |
| **PO4** | Address and develop solutions for societal and environmental needs of local, regional and national development |
| **PO5** | Work independently and engage in lifelong learning and enduring proficient progress |
| **PO6** | Provoke employability and entrepreneurship among students along with ethics and communication skills |

**PROGRAM SPECIFIC OUTCOMES**

|  |  |
| --- | --- |
| **PSO1** | Comprehend the knowledge in the biochemical, analytical, biostatistical and computational areas |
| **PSO2** | Ability to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by human kind |
| **PSO3** | Acquiring analytical and hands on skills to perform research in multidisciplinary environments |
| **PSO4** | Use library search tools and online databases and sources to locate and retrieve scientific information about a topic and techniques related to biochemistry |

**Eligibility for admission**

Candidate for admission to the first year of B.Sc. Degree Course in Bio-Chemistry shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry.

**3.Highlights of the Revamped Curriculum**

* The curriculum is created to improve the relationship between business and academia
* Every semester,practicals based on the course taken that semester will aid students in applying what they have learned
* Students will benefit from the introduction of skill based elective courses including Bioinformatics,Nanobiotechnology,Therapeutic nutrition, and Medical Laboratorytechnology as they keep up withtechnological advancements in their fields of study
* The fourth semester internship will give students a chance to apply what they have learned in class to a real world working experiment
* Skill enhancement courses help students venture new platforms in career.
* Equip students with employability skills,generate self employment and small scale entrepreneurs.

**4.Value additions in the Revamped Curriculum:**

|  |  |  |
| --- | --- | --- |
| **Semester** | **Newly introduced Components** | **Outcome / Benefits** |
| **I** | **Foundation Course**  It depicts the overview of entry education and makes the students assimilate with the biochemistry course. This course will inculcate knowledge of the academic skills, laboratory skills and research | It gives a strong determination to undergo the course.Be committed and interested in learning the subject |
| **I, II, III, IV** | **Skill Enhancement papers (Discipline centric / Generic / Entrepreneurial)** | Improve employabilityDevelop the skill as Laboratory Analyst  To make students compete with industrial expectations. |
| Incorporating the interest on health, diet, lifestyle diseases will enable the students gain knowledge to get exposed themselves in medical field |
| Biomedical Instrumentation skills will aid the students gain knowledge on the various instruments used in the field of medical laboratory and research. |
| Entrepreneurial skill training will increase the chance to build their career independently.Learning this skills will encourage the students to enhance creativity, innovation and collaboration |
| Discipline /subject specific skill will serve as a route for employability |
| **V & VI** | **Elective papers-**  An open choice of topics categorized under Generic and Discipline Centric | It reinforces additional knowledge inputs along with core course.Students are familiarized with multi-disciplinary,crossdisciplinary and inter disciplinary subjects.  It broadens the knowledge on immunological aspects, pharmacology and research.  Additional Employability skills are facilitated through computational biology and Bioentrepreneurship. |
| **V semester Vacation activity** | **Internship/ Industrial visit/Field visit** | Hand on training in Medical Labs/ Industry/ Research centres enable the students to explore the practical aspects in career path. They gain confident to fix their career. |
| **VI Semester** | **Project with Viva – voce** | Self-learning is enhanced·It serves as a platform to express their innovative ideas in a practical way, which serves as a pathway to enter in the field of research. |
| **VI Semester** | **Introduction of**  **Professional Competency skill** | The revamped curriculum caters the education to all category of learners; Learning multidisciplinary papers, updated in the curriculum will help the students to fix their career in the fields of Medical, pharmaceutical, forensic, nutritional, diagnostic coding ,etc  ·Students are trained in the field of research to bring out the progress in the field of Medical, Agriculture ,Nutrition ,etc which will be a back bone for health and wealth creation and improve the quality of life |
| **Extra Credits:**  **For Advanced Learners / Honours degree** | | ETo cater to the needs of peer learners / research aspirants |
| **Skills acquired from the Courses** | | Analytical, Laboratory operating, Predicting, Experimenting, Critical thinking, Problem solving, Communication, Interpersonal, Time management and Multi-tasking Skills |

**Credit Distribution for UG Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sem I** | **Credit** | **H** | **Sem II** | **Credit** | **H** | **Sem III** | **Credit** | **H** | **Sem IV** | **Credit** | **H** | **Sem V** | **Credit** | **H** | **Sem VI** | **Credit** | **H** |
| Part 1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | Part..1. Language – Tamil | 3 | 6 | 5.1 Core Course –\CC IX | 4 | 5 | 6.1 Core Course –  CC XIII | 4 | 6 |
| Part.2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | Part..2 English | 3 | 6 | 5.2 Core Course – CC X | 4 | 5 | 6.2 Core Course –  CC XIV | 4 | 6 |
| 1.3 Core Course – CC I | 5 | 5 | 2..3 Core Course – CC III | 5 | 5 | 3.3 Core Course – CC V | 5 | 5 | 4.3 Core Course – CC VII  Core Industry Module | 5 | 5 | 5. 3.Core Course CC -XI | 4 | 5 | 6.3 Core Course –  CC XV | 4 | 6 |
| 1.4 Core Course – CC II | 5 | 5 | 2.4 Core Course – CC IV | 5 | 5 | 3.4 Core Course – CC VI | 5 | 5 | 4.4 Core Course –  CC VIII | 5 | 5 | 5. 4.Core Course –/ Project with viva- voce  CC -XII | 4 | 5 | 6.4 Elective -VII Generic/ Discipline Specific | 3 | 5 |
| 1.5 Elective I Generic/ Discipline Specific | 3 | 4 | 2.5 Elective II Generic/ Discipline Specific | 3 | 4 | 3.5 Elective III Generic/ Discipline Specific | 3 | 4 | 4.5 Elective IV Generic/ Discipline Specific | 3 | 3 | 5.5 Elective V Generic/ Discipline Specific | 3 | 4 | 6.5 Elective VIII  Generic/ Discipline Specific | 3 | 5 |
| 1.6 Skill Enhancement Course SEC-1 | 2 | 2 | 2.6 Skill Enhancement Course SEC-2 | 2 | 2 | 3.6 Skill Enhancement Course SEC-4,  (Entrepreneurial Skill) | 1 | 1 | 4.6 Skill Enhancement Course SEC-6 | 2 | 2 | 5.6 Elective VI Generic/ Discipline Specific | 3 | 4 | 6.6 Extension Activity | 1 | - |
| 1.7 Skill Enhancement -(Foundation Course) | 2 | 2 | 2.7 Skill Enhancement Course –SEC-3 | 2 | 2 | 3.7 Skill Enhancement Course SEC-5 | 2 | 2 | 4.7 Skill Enhancement Course SEC-7 | 2 | 2 | 5.7 Value Education | 2 | 2 | 6.7 Professional Competency Skill | 2 | 2 |
|  |  |  |  |  |  | 3.8 E.V.S. | - | 1 | 4.8 E.V.S | 2 | 1 | 5.8 Summer Internship /Industrial Training | 2 |  |  |  |  |
|  | **23** | **30** |  | **23** | **30** |  | **22** | **30** |  | **25** | **30** |  | **26** | **30** |  | **21** | **30** |
| **Total – 140 Credits** | | | | | | | | | | | | | | | | | |

**Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System**

**for all UG courses including Lab Hours**

**First Year – Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course SEC-1 | 2 | 2 |
| Foundation Course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language – Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-2 | 2 | 2 |
| Skill Enhancement Course -SEC-3 (Discipline / Subject Specific) | 2 | 2 |
|  |  | **23** | **30** |

**Second Year – Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 14 |
| Part-4 | Skill Enhancement Course -SEC-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | - | 1 |
|  |  | **22** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| Part-1 | Language - Tamil | 3 | 6 |
| Part-2 | English | 3 | 6 |
| Part-3 | Core Courses & Elective Courses including laboratory [in Total] | 13 | 13 |
| Part-4 | Skill Enhancement Course -SEC-6 (Discipline / Subject Specific) | 2 | 2 |
| Skill Enhancement Course -SEC-7 (Discipline / Subject Specific) | 2 | 2 |
| E.V.S | 2 | 1 |
|  |  | **25** | **30** |

**Third Year**

**Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based | 22 | 26 |
| **Part-4** | Value Education | 2 | 2 |
| Internship / Industrial Visit / Field Visit | 2 | 2 |
|  |  | **26** | **30** |

**Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **No. of Hours** |
| **Part-3** | Core Courses including Project / Elective Based & LAB | 18 | 28 |
| **Part-4** | Extension Activity | 1 | - |
| Professional Competency Skill | 2 | 2 |
|  |  | **21** | **30** |

**Consolidated Semester wise and Component wise Credit distribution**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parts** | **Sem I** | **Sem II** | **Sem III** | **Sem IV** | **Sem V** | **Sem VI** | **Total Credits** |
| **Part I** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part II** | 3 | 3 | 3 | 3 | - | - | 12 |
| **Part III** | 13 | 13 | 13 | 13 | 22 | 18 | 92 |
| **Part IV** | 4 | 4 | 3 | 6 | 4 | 1 | 22 |
| **Part V** | - | - | - | - | - | 2 | 2 |
| **Total** | 23 | 23 | 22 | 25 | 26 | 21 | **140** |

**\*Part I. II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.**

|  |  |  |
| --- | --- | --- |
| **MethodsofEvaluation** | | |
| **InternalEvaluation** | ContinuousInternalAssessmentTest | 25 Marks |
| Assignments |
| Seminars |
| AttendanceandClassParticipation |
| **ExternalEvaluation** | EndSemesterExamination | 75 Marks |
|  | Total | 100 Marks |
| **MethodsofAssessment** | | |
| **Recall(K1)** | Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions | |
| **Understand/Comprehend(K2)** | MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryor  overview | |
| **Application (K3)** | Suggestidea/conceptwithexamples,Suggestformulae, Solveproblems,  Observe,Explain | |
| **Analyze(K4)** | Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate | |
|  | betweenvariousideas,Mapknowledge | |
| **Evaluate(K5)** | Longer essay/Evaluationessay,Critiqueorjustifywithprosandcons | |
| **Create(K6)** | Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor  Presentations | |

**8.Illustration for B.Sc Biochemistry Curriculum Design**

**First Year**

**Semester-I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week (L/T/P)** |
| Part-I | Language –Tamil | 3 | 6 |
| Part-II | English | 3 | 6 |
| Part-III | Nutritional Biochemistry | 5 | 5 |
| Chemistry I | 5 | 5 |
| Allied Chemistry Practical –I | 3 | 4 |
| Part-IV | Skill Enhancement Course (Non Major Elective) | 2 | 2 |
| Foundation Course FC Bridge course | 2 | 2 |
|  |  | **23** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week(L/T/P)** |
| Part-I | Language - Tamil | 3 | 6 |
| Part-II | English | 3 | 6 |
| Part-III | Cell Biology | 5 | 5 |
| Allied Chemistry- II | 3 | 4 |
| Core Practical II -Cell Biology | 5 | 5 |
| Part-IV | Data Analytic Skill | 2 | 2 |
| Skill Enhancement Course (Discipline / Subject Specific) – Computational Mathematics | 2 | 2 |
|  |  | **23** | **30** |

**Second Year :Semester-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week(L/T/P)** |
| Part-I | Language -Tamil | 3 | 6 |
| Part-II | English | 3 | 6 |
| Part-III | Biomolecules | 5 | 5 |
| Allied Paper III | 3 | 4 |
| Core Practical III Biomolecules | 5 | 5 |
| Part-IV | Skill Enhancement Course-4 (Entrepreneurial Based) | 1 | 1 |
| Skill Enhancement Course -SEC-5 | 2 | 2 |
| Environmental Studies | - | 1 |
|  |  | **22** | **30** |

**Second Year :Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week (L/T/P)** |
| Part-I | Language - Tamil | 3 | 6 |
| Part-II | English | 3 | 6 |
| Part-III | Biochemical techniques | 5 | 5 |
| Allied Paper IV | 3 | 3 |
| Core Practical IV -Biochemical Techniques | 5 | 5 |
| Part-IV | Skill Enhancement Course -6 | 2 | 2 |
| Skill Enhancement Course - 7 | 2 | 2 |
| Environmental Studies | 2 | 1 |
|  |  | **25** | **30** |

**Third Year :Semester-V**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week (L/T/P)** |
| Part-III | Enzymes | 4 | 5 |
| Intermediary Metabolism | 4 | 5 |
| Clinical Biochemistry | 4 | 5 |
| \*Elective Paper 1 | 3 | 4 |
| Core Practical V -Clinical Biochemistry | 4 | 5 |
| Part-IV | Value Education | 2 | 2 |
| Internship / Industrial Training  (Summer vacation at the end of IV semester activity) | 2 |  |
|  |  | **26** | **30** |

**Third Year :Semester-VI**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credit** | **Hours per week (L/T/P)** |
| Part-III | Molecular Biology | 4 | 6 |
| Human Physiology | 4 | 6 |
| Plant Biochemistry & Plant therapeutics | 4 | 6 |
| \*Elective paper 2 | 3 | 5 |
| Core Project | 4 | 6 |
| Part-IV | Professional Competency Skill | 2 | 2 |
| Part -V | Extension Activity | 1 |  |
|  |  | **23** | **30** |

**Total Credits : 140**

**9.Suggestive Topics in Core Component**

* Nutritional Biochemistry
* Cell Biology
* Biomolecules
* Biochemical techniques
* Enzymes
* Intermediary metabolism
* Clinical Biochemistry
* Molecular Biology
* Human Physiology
* Plant Biochemistry and Plant therapeutics

**10.Suggestive Topics in skill enhancement courses (NME))**

**Group I**

* Medicinal Diet
* Lifestyle Diseases
* Health and Nutriton

**11.Suggestive Elective Courses (Discipline-centric )**

**Group II**

* + Immunology
  + Biochemical pharmacology
  + Research methodology
  + Bioentrepreneurship
  + Bioinformatics
  + Biotechnology

**12.Suggestive Topics in Skill Enhancement Courses (SEC)**

**Group III –**

* Biomedical Instrumentation
* First Aid
* Basics of forensic science
* Medical Laboratory technology
* Tissue culture
* Medical coding
* Microbial techniques

**FIRST YEAR :SEMESTER I**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Over**  **all Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** | **CIA** | **ESE** | **Total** |
| Part –1 |  | Language –Tamil - I | 2 | 1 | 0 | 0 | 3 | 6 | 25 | 75 | 100 |
| Part –2 |  | English –I | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Part -3 | Core Paper 1 | Nutritional Biochemistry | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Allied Paper 1 | Chemistry I | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Core Paper 2 | Core Practical I -Nutritional Biochemistry | 0 | 0 | 3 | 0 | 3 | 3 | 40 | 60 | 100 |
| Allied Practical 1 | Chemistry Practical –I | 0 | 0 | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| Part -4 | Skill Enhancement Course SEC-1 | NME I | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Foundation Course | Bridge course | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Ability Enhancement Compulsory Course(AECC) | Soft Skill – I | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| **Total** | | | | | | | **23** | **30** |  |  |  |

**FIRST YEAR :SEMESTER II**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Overall Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** | **CIA** | **ESE** | **Total** |
| Part –1 |  | Language –Tamil - II | 2 | 1 | 0 | 0 | 3 | 6 | 25 | 75 | 100 |
| Part –2 |  | English –II | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Part -3 | Core Paper 3 | Cell Biology | 3 | 1 | 0 | 0 | 4 | 4 | 25 | 75 | 100 |
| Allied Paper 2 | Chemistry- II | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Core Paper 4 | Core Practical II -Cell Biology | 0 | 0 | 3 | 0 | 3 | 3 | 40 | 60 | 100 |
| Allied Practical 2 | Chemistry Practical II | 0 | 0 | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| Part -4 | Skill Enhancement  Course SEC-2 | NMEII | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Skill Enhancement Course -SEC-3 | Discipline/Subject specific) | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Ability Enhancement Compulsory Course(AECC) | Soft Skill – II | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| **Total** | | | | | | | **24** | **30** |  |  |  |

**\*Skill Enhancement Course (NME/Discipline/Subspecific)– ( Basket of Courses)**

**Second YEAR :SEMESTER III**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Overall Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** | **CIA** | **ESE** | **Total** |
| Part –1 |  | Language –Tamil –III | 2 | 1 | 0 | 0 | 3 | 6 | 25 | 75 | 100 |
| Part –2 |  | English –III | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Part -3 | Core Paper 5 | Biomolecules | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Allied Paper 3 | Allied Paper III | 2 | 1 | 0 | 0 | 3 | 3 | 25 | 75 | 100 |
| Core paper 6 | Core Practical III Biomolecules | 0 | 0 | 3 | 0 | 3 | 3 | 40 | 60 | 100 |
| Allied Practical 3 | Allied Practical –III | 0 | 0 | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| Part-4 | Skill EnhancementCourse SEC-4 | Entrepreneurial Based | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Skill Enhancement Course -SEC-5 | Discipline/  subject specific) | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Ability Enhancement Compulsory Course(AECC) | Soft skill 3 | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| EVS |  |  |  |  |  | - | 1 | 25 | 75 | 100 |
| **Total** | | | | | | | **23** | **30** |  |  |  |

**Second :SEMESTER IV**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Overall Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** | **CIA** | **ESE** | **Total** |
| Part –1 |  | Language –Tamil –III | 2 | 1 | 0 | 0 | 3 | 6 | 25 | 75 | 100 |
| Part –2 |  | English –III | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |
| Part 3 | Core Paper 7 | Biochemical techniques | 2 | 1 | 0 | 0 | 3 | 3 | 25 | 75 | 100 |
| Allied Paper 4 | Allied Paper IV | 2 | 1 | 0 | 0 | 3 | 3 | 25 | 75 | 100 |
| Core paper 8 | Core Practical IV-Biochemical Techniques | 0 | 0 | 3 | 0 | 3 | 3 | 40 | 60 | 100 |
| Allied Practical 4 | Allied Practical –IV | 0 | 0 | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| Part -4 | Skill Enhancement  Course SEC-6 | Discipline/  subject specific) | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Skill Enhancement Course -SEC-7 | Discipline/  subject specific | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Ability Enhancement Compulsory Course(AECC) | Soft skill 4 | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| EVS |  | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| **Total** | | | | | | | **25** | **30** |  |  |  |

**third year :SEMESTER V**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Overall Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** |  |  | **CIA** | **ESE** | **Total** |
| Part 3 | Core Paper 9 | Enzymes | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| CorePaper 10 | Intermediary  Metabolism | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| Core Paper 11 | Clinical Biochemistry | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| \*Elective Paper 1 | 1AImmunology  1B Biochemical pharmacology  1C Research methodology | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| Core paper 12 | Core Practical V -Clinical Biochemistry | 0 | 0 | 4 | 0 | 4 | 6 | 40 | 60 | 100 |
| Part 4 | Value Education |  | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |
| Internship/ Industrial visit/Field visit |  | 0 | 1 | 1 | 0 | 2 | 2 | 25 | 75 | 100 |
| **Total** | | | | | | | **24** | **30** |  |  |  |

**third year :SEMESTER VI**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Course Category** | **Course** | **Credit Distribution** | | | | **Overall Credits** | **Total Contact hours** | **Marks** | | |
| **L** | **T** | **P** | **S** | **CIA** | **ESE** | **Total** |
| Part 3 | Core Paper 13 | Molecular Biology | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| Core Paper 14 | Human Physiology | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| Core Paper 15 | Plant Biochemistry & Plant therapeutics | 3 | 1 | 0 | 0 | 4 | 5 | 25 | 75 | 100 |
| \*Elective paper 2 | 2ABiotechnology  2B Bioinformatics  2CBioentrepreneu-rship | 2 | 1 | 0 | 0 | 3 | 5 | 25 | 75 | 100 |
| Core paper  16 | Core Project | 0 | 1 | 2 | 0 | 3 | 8 | 40 | 60 | 100 |
| Part 4 | Extension activity |  |  |  |  |  | 1 | - |  |  |  |
| Professional Competeny Skill |  |  |  |  |  | 2 | 2 |  |  |  |
| **Total** | | | | | | | **21** | **30** |  |  |  |

**Remarks:** EnglishSoft Skill - **2 hours** will be handled by English Teachers.(4+2=6)

**IYEAR :SEMESTER I**

**NUTRITIONAL BIOCHEMISTRY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Core Paper1- Nutritional Biochemistry** | Core | 2 | 1 | 0 | 0 | 3 | 4 | 25 | 75 | 100 |

**Learning Objectives**

The objectives of this course are to

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

**Module I** : Concepts of food and nutrition. Basic food groups-energy yielding, body building and functional foods.Modules of energy.Calorific and nutritive value of foods.Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height,Weight, chest and waist circumference BMI. 12 Hrs

**Module II:** Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, , Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkar and Marasmus, Obesity-Types and preventive measures.12 Hrs

**Module III** : Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects .12 Hrs

**Module IV** : Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.12 Hrs

**Module V** : Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants– carotenoids, anthocyanins and its benefits. 12 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value | PO1,PO5 |
| CO2 | Identify and explain nutrients in foods and the specific functions in maintaining health. | PO1 |
| CO3 | Classify the food groups and its significance | PO1,PO2 |
| CO4 | Understand the effect of food additives | PO1,PO2 |
| CO5 | Describe the importance of nutraceuticals and pigments | PO1,PO5,PO6 |

**Text books**

1.Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.

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

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

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

Churchill Livingstone.

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

**Reference Books**

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

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

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

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

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

**Web resources**

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

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

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  | 2 |  | 3 | 3 | 3 | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 3** | 3 | 2 |  |  |  |  | 3 | 1 |  | 3 |
| **CO 4** | 3 | 2 |  |  |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 |  |  |  | 2 | 2 | 3 | 3 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**IYEAR : SEMESTER I**

**PRACTICAL I -NUTRITIONAL BIOCHEMISTRY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Core paper 2Practical 1- Nutritional Biochemistry** | Core | 0 | 0 | 3 | 0 | 3 | 3 | 25 | 75 | 100 |

**Learningobjectives**

The objectives of this course are to

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

**TITRIMETRY20hrs**

1. Estimation of ascorbic acid in a citrus fruit.

2. Estimation of calcium in milk .

3. Estimation of glucose by Benedict’s method in honey.

4. Estimation of phosphorous (Plant source)

**BIOCHEMICAL PREPARATIONS 15 Hrs**

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.

6. Starch from potato.

7. Casein and Lactalbumin from milk.

**GROUP EXPERIMENT 10Hrs**

8.Determination of ash content and moisture content in food sample

9.Extraction of lipid by Soxhlet’s method.

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Estimate the important biochemical constituents in the food samples. | PO1,PO3 |
| CO2 | Prepare the macronutrients from the rich sources. | PO1,PO3 |
| CO3 | Determine the ash and moisturecontent of the food samples | PO1,PO3 |
| CO4 | Extract oil from its sources | PO1,PO3,PO6 |

**Text books**

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

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

Hill Publishing Company Limited, 2001.

**Reference books**

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016

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

3Bowman and Robert M. 2006. Present Knowledge in Nutrition.9th edition, International Life Sciences Publishers.

4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.

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

**Web resources**

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

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

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

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 3 |  | 3 |  |  | 3 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**FIRST YEAR :SEMESTER II**

**CELL BIOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 3: Cell Biology** | Core | 2 | 1 | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Provide basic understanding of architecture of cells and its organelles.
* Understand the organization of prokaryotic and eukaryotic genome.
* Educate on the structural organization of bio membrane and transportmechanism
* Impart knowledge on cellcycle, cell division and basics of cells
* Familiarize the concept of mechanism of cell-cell interactions.

**Module I:** Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions 12 Hrs

**Module II:** Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome -prokaryotic, and eukaryotic genome. Organization of chromatin – histones, nucleosomeconcept, formation of chromatin structure.Special types of chromosomes – lamp brush chromosomes, polytene chromosomes. 12 Hrs

**Module III:**Biomembranes-Structuralorganizationofbilipidlayermodelandbasicfunctions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.12Hrs

**Module IV:** Cellcycle-DefinitionandPhasesofCellcycle-Celldivision-MitosisandMeiosis and its significance, Cancer cells- definition, types andcharacteristics of cancer cells. 12 Hrs

**Module V:** Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions- Types-gap junctions, tight junctions and Desmosomes 12 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Explainthestructureandfunctions ofbasiccomponentsofprokaryotic  and eukaryotic cells, especially the organelles. | PO1 |
| CO2 | Familiarize the cytoskeleton and chromatin | PO1,PO2 |
| CO3 | Illustrate thestructure,composition and functionsofcellmembranerelated to membrane transport | PO1,PO2 |
| CO4 | Elaborate thephasesofcellcycle and cell division-mitosisandmeiosis and characteristics of cancer cells. | PO1, PO2 |
| CO5 | Relatethestructureandbiologicalroleofextracellularmatrix in cellular interactions | PO1,PO2 |

**Text books**

1.Arumugam.N,Cellbiology.Saraspublication(10ed, paperback), 2019

2. Devasena.T.CellBiology.OxfordUniversityPressIndia-ISBN:9780198075516, 0198075510, 2012

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

**Referencebooks**

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

2.Cooper,G.A.TheCell:AMolecularApproach.SinauerAssociates,Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013

3...E.M.F.,D.R,CellandMolecularBiology.LippincottWilliams&WilkinsPhiladelphia - ISBN: 0781734932 9780781734936, 2006

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

**Web resources**

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

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

https://biologydictionary.net /cell

**Mapping with Program Outcome**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 | 3 |  |  |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**FIRST YEAR :SEMESTER II**

**PRACTICAL II CELL BIOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 4 practical II: Cell Biology** | Core practical | - | - | 3 | - | 3 | 3 | 40 | 60 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Learn the parts of microscope
* Investigatethecellsunder microscope.
* Image the cellsusing different stains
* Identify the cells, organelles and stages of cell division
* Identify the spotters

**I MICROSCOPYANDSTAININGTECHNIQUES**

1. Studythepartsoflightandcompoundmicroscope
2. Preparation of Slides andMicrometry
3. Examinationofprokaryoticandeukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. StainingandvisualizationofmitochondriabyJanusgreenstain

**II GROUP EXPERIMENT**

7.Identificationofdifferentstagesofmitosisinonionroottip

8.Identification of different stages of meiosis in onion bulb

**III SPOTTERS**

9. a) **Cells**:Nerve,plantandAnimalcell

b) **Organelles**:Mitochondria,Chloroplast,Endoplasmicreticulum,

c) **Mitosisstages**–Prophase,Anaphase,Metaphase,Telophase

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Identifythepartsofmicroscope. | PO1,PO2 |
| CO2 | PreparationofSlides | PO1,PO2 |
| CO3 | Identifythestagesofmitosis&meiosis | PO1,PO2 |
| CO4 | Visualizenucleusandmitochondriabystaining methods | PO1,PO2 |
| CO5 | Identifythespottersofcells,organellesandstages ofcelldivision | PO1,PO2 |

**Text books**

1.Rickwood,DandJ.R.HarriscellBiology:EssentialTechniques,Johnwikey1996.

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

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

**Referencebooks**

1) Essential practical handbook of Cell biology ,Genetics andMicrobiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017

2) CellbiologyPractical,Dr.VenuguptaISBN8193651219,Prestigepublisher,1stJan2018.

3) Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987

**Web resources**

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

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

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

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

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

6.https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-geneticdiversity/a/phases-of-meiosis

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

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

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SECOND YEAR :****SEMESTER III**

**BIOMOLECULES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 5: Biomolecules** | Core | 2 | 1 | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning objectives**

Themainobjectivesofthiscourseareto:

* Introduce the structure, properties and biological significance of carbohydrates
* Comprehend the classification, functions and acid base properties of amino acids
* ElucidatethevariouslevelsoforganizationofProteins.
* Impartknowledgeonthe classification, propertiesandcharacterization of lipids.
* Acquaint with the classification, structure, properties and functions of nucleic acids

**Module I:**Carbohydrates-Classification and biological significance, physical properties - stereo isomerism, optical isomerism, anomers,epimers and mutarotation. Monosaccharides: Occurrence, linear and cyclic structure, Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and keto groups. Disaccharides: Structure and properties of reducing disaccharides (lactose and mannose), non-reducing disaccharide(sucrose).Polysaccharides: Homopolysaccharides - Occurrence, structure and biological significance ofstarch, glycogen and cellulose. Heteropolysaccharides - Structure and biological significanceofmucopolysaccharides - hyaluronic acid, chondroitin sulphate and heparin. (structural elucidation not needed).12 hrs

**Module II :**Amino acids -Classification based on composition of side chain and nutritional significance. General structure of amino acids. 3 - and 1- letter abbreviations. Modified amino acids in protein non - protein amino acids. Physical properties of amino acids, isoelectric point, titration curve (alanine, lysine, glutamic acid), optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids. 12Hrs

**Module III :**Proteins-Classification based on shape, composition, solubility and functions. Properties of proteins - Ampholytes,isoelectricpoint,salting in and salting out, denaturation and renaturation, UV absorption. Levels of Organization of protein structure- Primary structure, Formation and characteristics of peptide bond, phi and psi angle, Secondary structure-α helix (egg albumin), β- pleated sheath (keratin), triple helix (collagen). Tertiary structure – with reference to myoglobin.Quaternary structure with reference to haemoglobin. 12 Hrs

**Module IV :**Lipids- Lipids: Bloor’sclassification, chemical nature and biological functions. Fatty acids: classification, nomenclature, structure and properties of fatty acids. Simple and mixed triglycerides: structure and general properties, Characterization of fats- iodine value, saponification value, acid number, acetyl number, polensky number, Reichert –Meissl number along withtheirsignificance. Compoundlipids-Structureandfunctionsofphospholipidsandglycolipids.Derivedlipids-Structureandfunctionsofcholesterol,bileacidsandbilesalts.12Hrs

**Module V :**Nucleic acids-Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA: A, B, C, Z DNA, structure and biological significance, superhelicity. Types of RNA: mRNA, tRNA, rRNA, hnRNA, snRNA ,Secondary and tertiary structure of tRNA. Properties of DNA-Hypochromic and hyperchromic effect, melting temperature, viscosity. Denaturation and annealing.12Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Classify, illustratethestructureandexplainthephysicalandchemicalpropertiesofcarbohydrates. | PO1 |
| CO2 | Indicate the classification, structure, properties and biological functions of amino acids. | PO1 |
| CO3 | Explain the classification and elucidate the different levels ofstructuralorganizationofproteins. | PO1 |
| CO4 | Elaborateonclassification,structure,properties,functionsand characterizationoflipids | PO1,PO4 |
| CO5 | Describe the structure, properties and functions of different types of nucleic acids | PO1 |

**Textbooks**

1.Biochemistry,U.Sathyanarayana&U.Chakrapani,2013,5thedition ElsevierIndiaPvt.Ltd.,Books&AlliedPvt.Ltd.

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

3.TextbookofMedicalBiochemistry,MNChatterjea,RanaShinde,2002,8thedition,JaypeeBrothers.

**Referencebooks**

1.DavidL.Nelson,MichaelM.Cox,2005,Principlesof Biochemistry,4theditionW.H.FreemanandCompany.

2.Voet.D,Voet.J.G.andPratt,C.W,2004,PrinciplesofBiochemistry,4theditionJohnWiley&Sons,Inc.

3.ZubayG.L,*et.al*.,1995,PrinciplesofBiochemistry,1stedition,WmC.BrownPublishers.

**Webresources**

https://www.britannica.com/science/biomolecule<https://en.wikipedia.org/wiki/Biomolecule><https://www.khanacademy.org/science/biology/macromolecules>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 |  |  | 2 |  |  | 3 | 2 |  | 3 |
| **CO5** | 3 |  |  |  |  |  | 3 |  |  | 3 |

**S-Strong(3) M-Medium (2) L-Low**

**SECOND YEAR :SEMESTER III**

**PRACTICAL III BIOMOLECULES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core Paper-6 practical III**  **Biomolecules** | Core Practical | - | - | 3 | - | 3 | 3 | 40 | 60 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseare to

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

I**)Qualitative testfor 15 Hrs**

1) Carbohydrates

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

2) Amino acids

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

**II Titrimetric methods15 Hrs**

1) Determination of Saponification value of an edible oil

2) Determination of Iodine number of an edible oil

3) Determination of Acid number of an edible oil

**III. Group Experiments 15 hrs**

1) Isolation of DNA from plant/animal source.

2) Isolation of RNA from rich source.

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Qualitatively analyze the carbohydrates and report the type of carbohydrate based on specific tests | PO1,PO2,PO3 |
| CO2 | Qualitatively analyze amino acids and report the type of amino acids based on specific tests | PO1,PO2,PO3 |
| CO3 | Determine the Saponification, Iodine and acid number of edible oil | PO1, PO3,PO4 |
| CO4 | Isolate the nucleic acid from biological sources | PO1,PO3 |

**Text books**

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

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

3. S. Sadasivam A. Manickam Biochemical Methods New age International Pvt Ltd publisher’s third edition 2018

**Reference books**

1.Rageeb, Kiran Patil, M. Bakshi Rahman, Sufiyan Ahmad Raees A Practical book on Biochemistry Everest publishing house1st Edition, 2019

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

3. Biochemical Tests – Principles and Protocols. Anil Kumar, SarikaGarg and NehaGarg.VinodVasishtha Viva Books Pvt Ltd, 2012.

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

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

**Web resources**

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

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

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **3CO 2** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 |  | 3 | 2 |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SECOND YEAR :SEMESTER IV**

**BIOCHEMICAL TECHNIQUES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core Paper 7 Biochemical techniques** | Core | 2 | 1 | - | - | 3 | 3 | 25 | 75 | 100 |

**Learning objectives**

The objectives of this course are to

* Introduce the basic principles, types and applications of various sedimentation technique.
* Provide an understanding of the underlying principles of chromatographic techniques
* Demonstrate experimental skills in various electrophoretic techniques.
* Appraisetheuseofcolorimetricandspectroscopictechniquesin biology
* Impart knowledge about the measurement of radioactivity and safety aspects of radioactive isotopes.

**Module I :** Centrifugation  -Basic principles, RCF**,** Sedimentation coefficient,Svedberg constant. Types of rotors. Preparative centrifugation- differential and density gradient centrifugation, RatezonalandIsopycnictechniques, construction, working and applications ofanalyticalultracentrifuge-Determinationofmolecularweight (Derivation excluded)9 Hrs

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

**ModuleIII :**Electrophoresis - Generalprinciples, factorsaffectingelectrophoreticmobility. Tiselius moving boundary electrophoresis.Electrophoresis with paper and starch.Principle, instrumentationandapplicationsofagarosegelelectrophoresisandSDS-PAGE.9Hrs

**Module IV:** Basics of Electromagnetic radiations- Energy, wavelength, wavenumber and frequency. Absorption and emission spectra, Lambert – Beer Law, Lightabsorption and transmittance.Colorimetry-Principle, instrumentationandapplications. Visible and UV spectrophotometry – Principle, instrumentation and applications -enzymeassay,structuralstudiesofproteinsandnucleicacids. 9 hrs

**Module V:** Radioactivity **-** Types of Radioactive decay, half-life, units of radioactivity, Detection and measurement of radioactivity - Methods based upon ionization -Geiger MullerCounter. Methods based upon excitation - Solid &Liquidscintillationcounters. Autoradiography. Biological applications and safety aspects of radioisotopes.9 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Describetypesof rotors and identify the centrifugation  technique for the separation of biomolecules. | PO1,PO2,PO6 |
| CO2 | Demonstratetheprinciples,operationalprocedureand applicationsofplanarandcolumnchromatography. | PO1,PO2, PO6 |
| CO3 | Specifythe factors andexplain the separationofDNAandproteinusingelectrophoretictechnique. | PO1,PO2, PO6 |
| CO4 | State Beer’s Law and illustrate theinstrumentation and usesof colorimeterand spectrophotometer . | PO1,PO2, PO6 |
| CO5 | Enumerate various methodsof measurement ofradioactivityand safety aspects of radioactive isotopes. | PO1,PO2, PO6 |

**Textbooks**

1.AvinashUpadhyay,KakoliUpadhyay&NirmalenduNath,2002,Biophysical Chemistry, Principles and Techniques, 3rd edition, HimalayaPublishingHouse.

2.L.Veerakumari,2009,Bioinstrumentation,1stedition,MJPPublishers.

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

CambridgeUniversityPress,4thedition.

**Referencebooks**

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

2.Gurumani,ResearchMethodologyforBiologicalSciences, 2011,1stedition,MJPPublishers.

3.SarojDua, Neera Garg, Biochemical Methods of Analysis,2010, 1stedition,NarosaPublishinghouse.

**Web Resources**

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

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

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

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 5** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SECOND YEAR :SEMESTER IV**

**PRACTICAL IV BIOCHEMICAL TECHNIQUES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 8-PracticalIV-Biochemical techniques** | Core Practical | - | - | 3 | - | 3 | 3 | 40 | 60 | 100 |

**Learning objectives**

The objectives of this course are to:

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

**I Colorimetry**

1. Estimation of amino acid by Ninhydrin method.

2. Estimation of protein by Biuret method.

3. Estimation of DNA by Diphenylamine method.

4. Estimation of RNA by Orcinol method.

5. Estimation of Phosphorus by Fiske and Subbarow method.

**II Chromatography**

1. Separation and identification of sugars and amino acids by paper chromatography.

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

**III Demonstration**

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

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Estimate the amount of biomolecules by Colorimetric method. | PO1,PO3,PO6 |
| CO2 | Quantify the amount of minerals by Colorimetric method | PO1,PO3,PO6 |
| CO3 | Separate and identify sugars, lipids and amino acids by chromatography | PO1,PO3 |
| CO4 | Operate centrifuge for the separation of serum and plasma | PO1,PO3,PO6 |
| CO5 | Demonstrate the separation of proteins electrophoretically | PO1,PO3,PO6 |

**Text books**

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

2. S.SadasivamA.ManickamBiochemicalMethodsNewageInternationalPvtLtdpublishers third edition 2018.

3. KeithWilsonandJohnWalkerPrinciplesandtechniquesofPracticalBiochemistryCambridge University Press2010, Seventh edition.

**Reference books**

1. S. K. Sawhney andRandhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd 2nd edition, 2005.

2.David T. Plummer, 2001, An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw- Hill publishing company limited.

3. Varley’s Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition,1988.

**Web resources**

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

**Mapping with ProgramOutcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  | 3 |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 2** | 2 |  | 3 |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 3** | 2 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 |  | 3 |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 5** | 2 |  | 3 |  |  | 2 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR: SEMESTER V**

**ENZYMES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 9 Enzymes** | Core | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning objectives**

Themainobjectivesofthiscourseareto

* Providefundamentalknowledgeonenzymesandtheirproperties.
* Understandthemechanismofactionofenzymes and the role of coenzymes in catalysis.
* Introduce the kinetics of enzymes and determine the Km and Vmax.
* Explaintheeffectofinhibitorsonenzymeactivity
* Understandthe roleofenzymesinclinicaldiagnosisandindustries.

**Module I :**Introduction to enzymes :Nomenclature and Classification based on IUB with examples, enzyme as catalyst-Activation energy, Enzyme specificity-absolute, Group, linkage and stereo specificities. Concept of Active site, Lock and key hypothesis and induced fit theory, Enzyme expression Units-IU, turnover number, katal and specific activity.12 Hrs

**Module II :Mechanism of enzyme catalysis -** AcidBasecatalysis,covalentcatalysis,electrostaticcatalysis,metal ion catalysis, proximity and orientationeffect. Coenzymes -Definition, types, co-enzymatic forms of vitamins- NAD/NADP,FAD, FMN, Coenzyme A TPP,PLP, lipoic acid and biotin. Multienzyme complexes - Pyruvate dehydrogenase complex. Isoenzyme with reference to LDH and CK.12 Hrs

**Module III:Enzymekinetics** --Definition of kinetics, Factorsaffectingenzymeactivity - temperature, pH, substrate and enzyme concentration, activators-cofactors, Derivation of Michaelis-Menton equation for unisubstrate reactions , Lineweaver - Burk plot, Eadie -Hofsteeplot Significance of Km and V max andtheirdeterminationusing the plots.12 Hrs

**Module IV:**Enzyme inhibition **-** Reversible and irreversible inhibition-types of reversible inhibitors, competitive, non-competitive, un-competitive inhibitors. Graphical representation by L-B plot,(Kineticderivationsnotrequired),DeterminationofKmandVmaxinthe presence and absence of inhibitors. Allosteric enzymes - Sigmoidal curve, positiveandnegativemodulators12 Hrs

**Module V:** Applications of enzymes **-**Immobilized enzymes - methods of immobilization-adsorption,covalentbonding,crosslinking,encapsulation,entrapmentandapplications of immobilized enzymes. Biosensors – e.g. Glucose sensors. Industrial applications of enzymes –Food, textile and pharmaceutical industries.12Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme outcome** |
| CO1 | Identifythe major classes of enzymes,differentiatebetweenachemicalcatalyst and a biocatalyst and define the units of enzymes. | PO1 |
| CO2 | Explain the mechanismofenzymecatalysis and the role of coenzymes in enzyme action. | PO1,PO2 |
| CO3 | Illustrate the steady state kinetics,,interpretMMplotandLBplotbasedonkineticsdata, and determineKm andVmax. | PO1,PO3 |
| CO4 | Distinguish the types of inhibition along with itsimportanceinbiochemicalreactions. | PO1,PO3 |
| CO5 | Comprehend the various methods for production of immobilized enzymes and discuss the application of enzymes in clinical diagnosis and various industries. | PO1,PO2,PO6 |

**Textbooks**

1.U.Sathyanarayana&U.Chakrapani,2013,Biochemistry, 4th edition,ElsevierIndiaPvt.Ltd.,Books&AlliedPvt.Ltd.

2.Dr. G.R Agarwal, Dr. Kiran Agarwal & O.P. Agarwal, 2015, Textbook ofBiochemistry(Physiologicalchemistry),18thedition,GoelPublishingHouse,

3.T.Devasena,2010,Enzymology,1stedition,OxforduniversityPress.

**Referencebooks**

1.Trevor Palmer, 2008, Enzymes: Biochemistry, Biotechnology, ClinicalChemistry,2ndedition,EastWestPressPvt.Ltd.

2.DavidL.Nelson,MichaelM.Cox,2005,PrinciplesofBiochemistry,4theditionW.H.FreemanandCompany,

3. Voet.D,Voet.J.G.andPratt,C.W,2004,PrinciplesofBiochemistry,4theditionJohnWiley&Sons,Inc.

4. ZubayG.L,*et.al*.,1995,PrinciplesofBiochemistry,1stedition,WmC.BrownPublishers.

**Web resources**

[www.biologydiscussion.com/notes/enzymes-notes](http://www.biologydiscussion.com/notes/enzymes-notes)<https://www.britannica.com/science/protein/The-mechanism-of-enzymatic-action><https://www.youtube.com/watch?v=oVJ2LJxO6tU>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 | 2 |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  | 2 |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 |  | 2 |  |  |  | 3 |  |  | 3 |
| **CO 5** | 3 | 2 |  |  |  | 2 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1**

**THIRD YEAR :SEMESTER V**

**INTERMEDIARY METABOLISM**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper:10**  **Intermediary metabolism** | **Core** | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Reviewthebasicconceptsoffreeenergytransformationanddescribe biologicaloxidation.
* Illustratethepathwaysofcarbohydratemetabolism.
* Explainthepathwaysofoxidationandbiosynthesis of lipids.
* Detail the catabolism of amino acids and synthesis ofspecializedproductsfromaminoacids.
* Acquaint the metabolismofnucleicacids anditsregulation

**Module I :**Bioenergetics-High energy compounds**:** Role of high energy compounds, free energy hydrolysis of ATP and other organophosphates, ATP-ADPcycle.

Biological Oxidation: Electron transport chain -its organization and function. Inhibitors of ETC. Oxidative phosphorylation, P/Oratio, Peter Mitchell’s chemiosmotic hypothesis. Mechanism of ATP synthesis, uncouplers of oxidativephosphorylation,substratelevelphosphorylationwithexamples.15 Hrs

**Module II:**Metabolism of carbohydrates -Glycolysis, TCA Cycle, Amphibolicnatureandintegrating roleofTCAcycle.Anaplerosis,Pentose Phosphate Pathway (HMP shunt), Gluconeogenesis, Glycogenesis, Glycogenolysis anditsregulation, glyoxylate cycle, Entner- Duodoroff pathway andCoricycle.15 Hrs

**Module III**:Metabolism of lipids -Oxidation of fatty acids - α, β and ω -oxidation of saturated fatty acids, Oxidation of fatty acids with odd number ofcarbonatomsandunsaturatedfattyacids,Ketogenesis,Biosynthesis of saturated fatty acids and unsaturated fattyacids,Biosynthesis and degradation of triglycerides, phospholipids and cholesterol. 15 Hrs

**Module IV:**Metabolism of amino acid- Metabolic nitrogen pool, Catabolism of amino acid: Oxidative deamination, non – oxidative deamination, transamination and decarboxylation, Biogenic amines, Urea cycle and its regulation.15 Hrs

**Module V:**Metabolismof nucleotides-Biosynthesis of purines and pyrimidines, - denovo synthesis and salvage pathways, Degradation of purines and pyrimidines, Conversion of ribonucleotide to deoxyribonucleotide15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Statetheconceptsofbioenergeticsand illustratethemechanismofflowofelectronsandthe productionofATP. | PO1,PO2 |
| CO2 | Elaboratethebiochemicalreactionsandintegrationofpathwaysofcarbohydratemetabolism. | PO1, |
| CO3 | Sketch the oxidation and biosynthesisoffattyacids,phospholipids,triglyceridesandcholesterolwithsuitableexamples | PO1 |
| CO4 | Explain catabolism of amino acids,synthesisofnonessentialaminoacidsandspecializedproductsfromaminoacids. | PO1 |
| CO5 | Describethemetabolismofnucleicacids with necessaryillustrationsanditsregulation. | PO1 |

**Textbooks**

1,U.Sathyanarayana&U.Chakrapani,2015,Biochemistry,4thElsevierIndiaPvt.Ltd.,

2.M.N. Chatterjea andRanaShinde,2002, TextbookofMedicalBiochemistry,5theditionJaypeeBrothersMedicalPublishersPvt.Ltd.

**Referencebooks**

1.LehningerPrinciplesofBiochemistry, David L. Nelson, Michael M.Cox, 2008,5thedition,W.H.FreemanandCompany.

2.RobertK.Murray,DarylK.Granner,VictorW.Rodwell,2006,Harper’sIllustratedBiochemistry,27thedition,McGrawHillPublishers.

3.PrinciplesofBiochemistry Voet.D,Voet.J.G,andPrattC.W.,2010,,Fourthedition,JohnWiley&Sons,Inc,.

4.PrinciplesofBiochemistry,GeoffreyL.Zubay,WilliamW.Parson,DennisE.Vance,1995,2ndEdition,Wm.C. BrownPublishers.

5.Biochemistry, Garret,R.H.andGrisham,C.M.2005, 3rdEdition.ThomsonLearningINC.

**Web resources**

1.https://nptel.ac.in/courses/104/105/104105102/ [2.http://www.nptelvideos.in/2012/11/bioche](http://www.nptelvideos.in/2012/11/biochemistry-i.html)mi[stry-i.html](http://www.nptelvideos.in/2012/11/biochemistry-i.html) 3.https:/[/www.saddleba](http://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_)c[k.edu/faculty/jzoval/mypptlectures/ch15\_metabolism/lecture\_notes\_](http://www.saddleback.edu/faculty/jzoval/mypptlectures/ch15_metabolism/lecture_notes_) ch15\_metabolism\_current-v2.0.pdf

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 | 2 |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 5** | 3 |  |  |  |  |  | 3 |  |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER V**

**CLINICAL BIOCHEMISTRY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 11**  **Clinical Biochemistry** | Core | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning objectives**

Themainobjectivesofthiscourseareto

* Comprehendthebasicconcepts and disorders of carbohydrate metabolism
* Explainthedisorders of lipid metabolism.
* Elucidatetheliver function test and kidney function test.
* Designate the gastric function test.
* Familiarize the clinical enzymology.

**Module I :**Disordersofcarbohydratemetabolism: Maintenance of blood glucose by hormone with special reference to insulin and glucagon. Abnormalities in glucose metabolism: Diabetes mellitus;types, causes, biochemical manifestations, diagnosis and treatment, glycated hemoglobin. Inborn errors of carbohydrate metabolism, glycosuria, Fructosuria,Pentosuria, Galactosemia andGlycogenstoragediseases.15 hrs

**Module II:**Disorders of Lipid Metabolism**:** Lipid Profile,Atherosclerosis,Fattyliverandhyperlipidemia.Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach`s disease, Niemann-Pick disease, lipotropic agents 15 Hrs

**Module III :**LiverFunctionTests**:** Bilirubin metabolism and jaundice, Estimation of conjugated and total bilirubininserum(Diazomethod).Detectionofbilirubinandbilesaltsinurine(Fouchet’stest andHay’s Sulphur test).Thymolturbiditytest,prothrombintime,serumenzymesinliverdisease serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). 15 Hrs

KidneyFunctionTests**:** Measurement of urine pH, volume, specific gravity, osmolality, sediments in urine, inulin, urea and creatinine clearance tests. Concentration and dilution tests.Phenol red test. Levels of plasma protein and its significance related to kidney function. Proteinuria. 15Hrs

**Module IV :**GastricFunction test:Composition of gastric juice, collection of gastric contents,examination of gastric residuum, fractional test meal (FTM), stimulation test-alcohol and histamine stimulation, Tubeless gastric analysis1.5 Hrs

**Module V**:Clinical enzymology**:** Enzymes of diagnostic importance- LDH, creatine kinase, transaminases, phosphatases, Isoenzymes of lactate dehydrogenase.15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Explaintheconceptsofhormones and their importance to maintain glucose and types of Diabetes, diagnosis and treatment. | PO1,PO3,PO6 |
| CO2 | Analyzethelipid profile and different deficiency state. | PO1,PO3,PO6 |
| CO3 | Describe the liver and kidney functions and specific diagnostic methods used for biological sample. | PO1,PO3,PO6 |
| CO4 | Detail about the composition of gastric juice and special test for diagnosis. | PO1,PO3,PO6 |
| CO5 | Elaboratetheenzyme markers used for diagnostic studies. | PO1,PO3,PO6 |

**Text books**

1. MNChatterjeeandRanaShinde,TextBookofMedicalBiochemistry,JaypeeBrothers Medical Publishers (P) LTD, New Delhi, 8th Edition,2012

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

**Referencebooks**

1. Philip.D.Mayne,ClinicalChemistryindiagnosisandtreatment.ELBSPublication,6th edition, 1994.

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

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

**Web Resources**

1. https:/[/www.britannica.com/scienc](http://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate-)e[/metabolic-disease/Disorders-of-carbohydrate-](http://www.britannica.com/science/metabolic-disease/Disorders-of-carbohydrate-) metabolism

2. https:/[/www.slideshare.net/MohitAdhikary/gastric](http://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests)-[and-pancreatic-function-tests](http://www.slideshare.net/MohitAdhikary/gastric-and-pancreatic-function-tests) 3.https://onlinecourses.nptel.ac.in/noc20\_ge13/preview

**Mapping with ProgramOutcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  | 3 |  |  | 2 | 3 | 2 | 2 | 3 |
| **CO 2** | 3 |  | 3 |  |  | 2 | 3 | 2 |  | 3 |
| **CO 3** | 3 |  | 3 |  |  | 2 | 3 | 3 | 2 | 3 |
| **O 4** | 3 |  | 3 |  |  | 2 | 3 | 3 | 2 | 3 |
| **CO 5** | 3 |  | 3 |  |  | 2 | 3 | 3 | 2 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER V**

**IMMUNOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Elective Course IA Immunology** | Elective | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

The objective of this course are to

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

**Module I** :Structure and function of primary lymphoid organs ( thymus ,bone marrow), secondarylymphoid organs (spleen, lymph node), Cells involved in immune system- Functions-Phagocytosis -Inflammation 15 Hrs

**Module II**: Antigens - Nature, Immunogens, haptens ,cross reactions - Immunoglobulin- types- structure and function. Cells involved in antibody formation, Clonal selection theory, Co-operation of T-cell with B-cell. Differentiation of T and B lymphocyte -Humoral and cell mediated immunity. Monoclonal antibody – Production and application in biology. 15Hrs

**Module III**- Immunity and its types-Innate, Acquired, active and passive.- Natural and Artificial - Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines, rDNA Vaccines, DNA and subunit vaccines 15Hrs

**Module IV**: Hypersensitivity – Immediate (Type 1) and Delayed (Type IV), Auto- immune diseases with examples. Organ specific and systemic autoimmunity. SLE, RA. Transplantation – Types of Grafts, structure& functions of MHC, graft Vs host reaction, immunosuppressive Agents. 15Hrs

**Module V**: Antigen-antibody reactions, General features of Antigen Antibody reactions. Precipitation, Immuno diffusion, SID and DID -Oudin Procedure, Oakley Fulthrope Procedure, Radio immunodiffusion, Ouchterlony double diffusion, CIE, Rocket electrophoresis, Agglutination-Coomb’s test Complement Fixation test-Wasserman’s reaction, RIA, ELISA. 15Hr

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Associate structure and function of the organs involved in our body’s natural Defence | PO1 |
| CO2 | Classify antigens and antibodies and the role of lymphocytes in defending the host | PO1,PO2 |
| CO3 | Describe the types of immunity and the uses of vaccines | PO1, PO4 |
| CO4 | Understand the immune related diseases and mechanism of transplantation | PO1,PO2 |
| CO5 | Examine the immunological tests and relate it to the immune status of an Individual | PO1,PO3 |

**Text Books**

1.Kuby, J. (2018). Immunology(5th ed). W.H. Freeman - ISBN-10 : 1319114709 / ISBN-13 : 978-1319114701

2. Rao, C. V. (2017 ). Immunology (3rd ed.). Chennai: Alpha Science Int. Ltd - ISBN-10 : 1842652559/ ISBN 13:978-1842652558

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

**References Books**

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

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

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

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

**Web resources**

1.<https://onlinecourses.nptel.ac.in/noc22_bt40/preview>

2.https://onlinecourses.swayam2.ac.in/cec20\_bt05/preview

3.https://youtu.be/8uahFPl6ny8

**Mapping with ProgramOutcomes**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  | 2 |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |
| **CO 4** | 3 | 2 |  |  |  |  | 3 | 1 |  | 3 |
| **CO 5** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR: SEMESTER V**

**BIOCHEMICAL PHARMACOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Elective Course IB Biochemical Pharmocology** | Elective | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

The objectives of this course are to

* Introduce the basic concepts of pharmacology.
* Explain the metabolism of drugs and factors responsible for metabolism.
* Acquaint the adverse response and side effects of drugs .
* Familiarize important drugs used for common metabolic disorders.
* Provide an understanding about the action of antibiotics .

**Module I**: Drugs – classification based on sources, routes of drug administration - Oral/Enteral, Parenteral and Local application. Absorption of drugs, factors influencing drug absorption, distribution and excretion of drugs. 15 Hrs

**Module II:** Drug metabolism **-** Phase I and Phase II reactions, role of cytochrome P450 , non- microsomal reactions of drug metabolism. Factors influencing drug metabolism.Therapeutic index. 15 Hrs

**Module III**: Drug allergy, Drug tolerance - IC 50, LD50 of a drug, Drug intolerance, Drug addiction, Drug abuses and their biological effects. Drug resistance - biochemical mechanism. 15 Hrs

**Module IV :** Therapeutic Drugs - Analgesics and Non-steroidal anti-inflammatory drugs (NSAIDs) – Aspirin and Acetaminophen. Insulin, Oral antidiabetic drugs - Sulfonylureas, Biguanides. Antihypertensive drugs - ACE inhibitors, Calcium channel blockers. Anti-cancer agents – Antimetabolites. 15 Hrs

**Module V**: Antibiotics - Definition, Examples and Biochemical mode of action of penicillin, streptomycin, tetracyclines and chloramphenicol. 15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Classify the different routes of drug administration, describe the absorption, distribution, metabolism and excretion of drugs. | PO1 |
| CO2 | Illustrate the metabolism of drugs, classify the microsomal and non- microsomal reactions and explain the role of cytochromes. | PO1 |
| CO3 | List out the various adverse response and side effects of drugs. | PO1,PO2,PO4 |
| CO4 | Justify the use of synthetic drugs and elucidate its pharmacological actions and its adverse effects for different disease. | PO1,PO4 |
| CO5 | Highlight the importance and explain the mode of action of important antibiotics. | PO1,PO4 |

**Text Books**

1. N.Murugesh, A concise text book of Pharmacology –Sathya Publishers.
2. Jayashree Ghosh, A Textbook of Pharmaceutical chemistry –S. Chand & Company Ltd.
3. S C Metha, Ashutosh Kar, Pharmaceutical Pharmacology –New Age International (P) Limited, Publishers.

**References Books**

1. Lippincott’s illustrated Reviews- Pharmacology by Mary J.Mycek, Richard A.Harvey,

Pamela C. Champe, Lippincott – Raven publishers, New Delhi.

1. David . E. Golan, Principles of Pharmacology, Wolters Kluwer (India) Pvt.Ltd.
2. R.S. Satoskar, S. B. Elsevier Pharmacology and pharmacotherapy. - ISBN-10 : 9788131248867 / ISBN-13 : 978-8131248867 ,2017.
3. Tripathi, K.Essentials of Medical Pharmacology. Jaypee Publishers- ISBN-10 : 9350259370 / ISBN-13 : 978-9350259375.2018.

**Web Resources**

<https://slideplayer.com/slide/3728296/64/video/What+is+bioremediation%3F.mp4>

**Mapping with Program Outcomes**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 | 2 |  | 2 |  |  | 3 | 2 |  | 3 |
| **CO 4** | 3 |  |  | 2 |  |  | 3 | 2 |  | 3 |
| **CO 5** | 3 |  |  | 2 |  |  | 3 | 2 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER V**

**RESEARCH METHODOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Elective Course IC**  **Research Methodology** | Elective | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning objectives**

The objectives of the course are to:

* Introduce the components of research.
* Acquaint on the experimental design and literature survey
* Analyse the data and find out the significance statistically
* Highlight the importance of computation in research.
* Provide mechanics of writing a research reporthands-on experience in designing and working on small projects.

**Module I:** Characteristics and types of Research, Research Methods versus Methodology, Research designs in Biochemistry: experimental, *in vitro, in vivo, in situ*, clinical trials. Identification and criteria of selecting a research problem (Hypothesis); Formulation of objectives; Research plan and its components.15 Hrs

**Module II:** Experimental design - Objective, Design of work, Guidelines for design of experiments, Literature Search - Databases for literature search, Material and methods, Designing biological experiments, Compilation and documentation of data15 Hrs

**Module III :** Statistical Analysis: Measures of variation - standard deviation, Non-linear regression, Standard error. Analysis of variance for one-way and two-way classified data and multiple comparison procedures. Significance - students “t” test, chi-square test. Dunnet’s test 15Hrs

**ModuleIV**: Computer and its role in research: Basics of MS word, MS Excel: tabulation, calculation and data analysis, preparation of graphs, histograms and charts. Use of statistical software SPSS. Power Point: preparation of presentations and scientific poster designing

15 hrs.

**ModuleV**: Scientific writing for journals - Preparation of Abstract, Impact factor, h-index, i-10 index, citation index, Dissertation/Thesis writing: format, content and chapterization, writing style, drafting titles & sub-titles, captions and legends. Writing results, discussion and conclusions. Bibliography and references, referencing style - Harvard and Vancouver systems, Appendices and acknowledgement; Ethical issues in research; Intellectual property right and plagiarism.15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme outcome** |
| CO1 | Explain the types of research and formulate and plan the research. | PO1,PO3 |
| CO2 | Design experimental setup, review the literature, compile and document the data. | PO1,PO3 |
| CO3 | Analyze and validate the experimental data using statistical tools | PO1,PO2,PO3 |
| CO4 | Interpret the data using computational tools. | PO1,PO2,PO3 |
| CO5 | Compile and draft a research report, present results findings and publish ethically. | PO1,PO3,PO4 |

**Text Books**

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

2. Kothari, C.R., Research Methodology: Methods and Techniques. 2004, New Age International.

3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEss Publications.2 volumes.

4. Gurumani.N, Research Methodology for biological Sciences, 2014, MJP Publishers.

**Reference Books**

1. Dr. Prabhat Pandey ,Dr.Meenu Mishra Pandey, Research Methodology: Tools and Techniques 2015

2.Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.

4. Day, R.A., 1992.How to Write and Publish a Scientific Paper, Cambridge University Press.

5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications

6. Scientific Thesis Writing and Paper Presentation . MJP Publishers.2010

7. Research Methodology (2 Vols-Set) ,Suresh C. Sinha and Anil K. Dhiman, Vedams Books (P) Ltd.2002.

**Web Resources**

1. <https://explorable.com/research-methodology>

2. <http://www.scribbr.com>

3. <http://www.open.edu>

4. http://www.macmillan .ihe.com.

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  | 3 |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 2 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 2 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 5** | 3 |  | 3 | 2 |  |  | 3 | 3 | 33 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER V**

**CLINICAL BIOCHEMISTRY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Core paper 12**  **Practical V- Clinical Biochemistry** | Core Practical V | 1 | 0 | 5 | 0 | 4 | 6 | 40 | 60 | 100 |

**Learning Objectives**

The objectives of this course are to

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

1. Collection and preservation of blood and urine samples.

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

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

4.Estimation of uric acid ( serum&urine)

5.Estimation of cholesterol by Zak’s method

6.Estimation of Glucose by Ortho Toluidine method

7.Estimation of Protein by Lowry’s method

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

9.Assay of SGPT and SGOT

10.Qualitative analysis of normal constituents of urine

Urea, Creatinine, Phosphorus, Calcium

Abnormal constituents

a ) Calcium

b) Sugar(Glucose, fructose, pentose)

c)Protein

d)Aminoacids( Tyrosine, Histidine,Tryptophan)

e)Ketone bodies

f)Bile pigments with clinical significance. 80 Hrs

**DEMONSTRATION EXPERIMENTS(10 Hrs)**

HEMATOLOGY

1. RBC Counting
2. Total and differential count of white blood cells
3. Packed cell volume
4. Erythrocyte sedimentation rate
5. Blood clotting time
6. Blood grouping

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme outcome** |
| CO1 | Acquaint knowledge on collection of biological samples (urine, blood) and their preparation for diagnostic purpose. | PO1,PO2 |
| CO2 | Assay the activity of various clinically important enzymes and relate their clinical importance. | PO1,PO2 |
| CO3 | Estimate the important biomolecules in biological samples and relate their clinical significance | PO1,PO2,PO3,PO6 |
| CO4 | Qualitatively analyze urine sample for normal and abnormal constituents in urine and interpret the results | PO1,PO2,PO3 |
| CO5 | Perform the routine haematological tests. | PO1,PO2,PO3,PO6 |

**Text Books**

1.Manickam,S.S.(2018).BiochemicalMethods(3rded.).NewageInternationalPvtLtd publishers - ISBN 10: 8122421407 / ISBN 13: 9788122421408

2.Plummer,D.T.(n.d.).AnIntroductiontoPracticalBiochemistry.TataMcGrawHill-ISBN: 97800708416

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

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

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

6. Ranjna Chawla. 2014. Practical Clinical Biochemistry Methods and interpretations 58 (Paperback). 4th edition, Jaypee Brothers Medical Publishers, New York.

**Referencebooks**

1.Singh,S.K.(2005).IntroductoryPracticalBiochemistry(2nded.).AlphaScience International, Ltd- ISBN 10: 8173193029 / ISBN 13: 9788173193026

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

**Web resources**

1.https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors 2.http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/ Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf

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

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 3 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 3 | 3 | 3 |  |  | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 | 3 | 2 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 5** | 3 | 3 | 3 |  |  | 3 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR: SEMESTER VI**

**MOLECULAR BIOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core Paper 13**  **Molecular Biology** | Core | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

The objectives of this course are to

* Provide insightsintothecentraldogmaofmolecularbiology and explainthemechanismofDNAreplication.
* Elaborate themechanismof transcription andreverse transcription.
* Highlight the characteristics of genetic code and describetheprocessof protein synthesis.
* Introduce the concept of regulationofgeneexpressioninprokaryotes
* Familiarize the different types of mutationsand explain the mechanismof DNA repair.

**Module I:**Central Dogma of molecular Biology, DNA as the unit of inheritance. Experimentalevidences by Griffith’s transforming principle, Avery, McLeod and McCarthy’sexperiment,andHersheyandChaseExperiment.Replicationinprokaryotes:Modesofreplication,MeselsonandStahl’sexperimental proof for semiconservative replication. Mechanism of Replication – Initiation, events at Ori C, Elongation - replicationfork, semi discontinuous replication, Okazaki fragments, and termination. Bidirectional replication, Inhibitorsofreplication. Modelsofreplication-theta,rolling circleandD loopmodel. 15 Hrs

**Module II:** Transcription - Mechanism of transcription: DNA dependent RNA polymerase(s), recognition, binding and initiation sites, TATA/ Pribnow box, elongation and termination. Post-transcriptional modifications;inhibitorsoftranscription.RNAsplicing and processing of mRNA, tRNA and rRNA. Reverse transcription. 15 Hrs

**Module III**:GeneticCode and its characteristics, Wobble hypothesis. Translation: Adaptor role of tRNA, Activation of amino acids, Initiation, elongationandterminationofproteinsynthesis,post-translationalmodificationsandinhibitors of protein synthesis. 15 Hrs

**Module IV:**RegulationOfGeneExpressionInProkaryotes - Principlesofgeneregulation,negativeandpositiveregulation,conceptofoperons,regulatory proteins, activators, repressors, regulation of lac operon and trp operon.15 Hrs

**Module V:**Mutation:Types-Nutritional,Lethal,Conditionalmutants.Missensemutationandother point mutations. Spontaneous mutations; chemical and radiation – induced mutations.DNA repair: Direct repair, Photoreactivation, Excision repair, Mismatch repair, Recombination repair and SOS repair . 15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | IllustratetheCentralDogmaofmolecularbiology, explainthe multiplication of DNA in the cell and describe the types andmodesofreplication. | PO1 |
| CO2 | Elaborate the mechanism of transcribing DNA into RNA, discuss the formationofdifferenttypesofRNA. | PO1 |
| CO3 | Decipher the genetic code and summarize the processoftranslation. | PO1 |
| CO4 | Comprehend the principles ofgeneexpression and explain the concept of operon inprokaryotes. | PO1,PO2 |
| CO5 | Distinguish the types of mutations and explain the various mechanismsofDNArepair. | PO1,PO2 |

**Textbooks**

1.Veer Bala Rastogi, 2008, Fundamentals of Molecular Biology, 1st edition,AnebooksIndia.

2.David Friefelder,1987, Molecular Biology, 2nd edition, Narosa PublishingHouse.

3.Dr.P.S.VermaandDr.V.K.Agarwal,2013,Cellbiology, Genetics,MolecularBiology,EvolutionandEcology,1stedition,S.Chand&CompanyPvt.Ltd.

**Referencebooks**

1.Karp,G.,2010,CellandMolecularBiology:ConceptsandExperiments,6thedition,JohnWiley&Sons.Inc.

2.DeRobertis,E.D.P.andDeRobertis,E.M.F.,2010,CellandMolecularBiology,8thedition,LippincottWilliamsandWilkins,Philadelphia.

3.James.D.Watson,2013,MolecularBiologyoftheGene7thedition,BenjaminCummings.

4.GeorgeM.Malacinski,1992,Freifelder'sEssentialsofMolecularBiology,4thedition,NarosapublishingHouse.

**Web resources**

1. [www.mednotes.net/notes/biology](http://www.mednotes.net/notes/biology)

2. [https://www.onlinebiologynotes.com/repair-mechanism-of mutation/](https://www.onlinebiologynotes.com/repair-mechanism-of%20mutation/)

3. <https://teachmephysiology.com/biochemistry/protein-synthesis/dna-translation/>

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 | 2 |  |  |  |  | 3 |  |  | 3 |
| **CO 5** | 3 | 2 |  |  |  |  | 3 | 1 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER VI**

**HUMAN PHYSIOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 14**  **Human Physiology** | Core | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Aidinunderstandingthephysiologyofrespiratory and circulatory systems
* Explain the structure and physiology of the nervous and muscular system
* Explicatethefunctionsof digestive and excretory system of the body.
* Impartknowledge about the process of reproduction.
* Emphasize the importance of various endocrine factors that regulate metabolism, growth, homeostasis and reproduction.

**Module I:** RespiratorySystem-Overviewofrespiratorysystem,Typesofrespiration,Transport of respiratory gases, Exchange of respiratory gases in lungs and tissues -ChlorideShift&Bohr’seffect,Lungsurfactant.Circulatory System**-**Structure and functions of the Heart. Arterial and venoussystem,Cardiaccycle,Pace maker, BloodpressureandFactors affecting blood pressure. 15Hrs

**Module II**: Nervous system- Structure ofneuron,synaptic transmission, reflex action, neurotransmission- Resting membrane andAction potential. neuro transmitters- acetyl choline, Noradrenaline, Dopamine,Serotonin,Histamine,GABA,SubstanceP.Muscular system-structure and types of muscles - skeletal, smooth and cardiac muscles, muscle proteins- types and functions, mechanism of muscle contraction. 15Hrs

**Module III**: Digestive system- composition, functions of saliva, gastric pancreatic intestine and bile secretions, structure of digestive system, Digestion, absorption of carbohydrates, lipids, proteins.Excretorysystem-Structureofnephron,mechanism of urine formation, Concentration and acidificationofUrine.Roleofkidneysinthemaintenanceofacidbasebalance. 15Hrs

**Module IV:** Reproductive system:**-**Oogenesis, spermatogenesis, capacitation and transport of sperm- blood testis barrier.Fertilization, early development, Implantation, Placentation and Parturition. 15Hrs

**Module V**: Endocrinology- Classification of hormones, endocrineglandsand their secretions, structure and functions of Insulin, thyroxine. Steroid hormones- Corticosteroids, Sex hormones – testosterone and estrogen, menstrual cycle. 15Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Explaintheexchangeofgases,designofbloodvesselsandcardiaccycle. | PO1 |
| CO2 | Summarize the events in transmission of nerveimpulsesandmechanismof muscle contraction. | PO1 |
| CO3 | Elaborate the structure and functions of digestive system, structure of nephron and mechanismofurineformationandroleofkidneyin maintenanceofpH. | PO1 |
| CO4 | Describe the process of Oogenesis, Spermatogenesis, Fertilization, and Parturition. | PO1,PO2 |
| CO5 | Understand the role of different hormones that regulate metabolism, growth, glucose homeostasis and reproductive function. | PO1.PO2 |

**Textbooks**

1. K.Sembulingam&PremaSembulingam,2016,EssentialsofMedicalPhysiology,7thedition,JaypeeBrothersMedicalPublishers(P)Ltd.

2.Chatterjee.C.C.,1988,HumanPhysiology-VolI&II,1stedition,MedicalAlliedAgency.

3,AnimalPhysiology-MariakuttikanandArumugam,Saraspublication,2017.

**Referencebooks**

1.Text book of medical biochemistry physiology- MN. Chatterjee and Rana shinde, 7th edition, Jaypee brothers- medical publishers, 2007.

2.Meyer,Meyer&Meij,2002,HumanPhysiology,3rdedition,A.I.T.B.SPublishers.

3.GuytonandHall,2011,TextbookofMedicalPhysiology, 12thedition,W.B.SaundersCompany.

4.TestbookofMedicalPhysiology –Guyton&Hall,12thedition,Saunders Publishers, 2010

5.Humananatomyandphysiology–ElaineN.Marieb,3rdedition,Benjamin/Cummings (a Pearson education company), 1995.

**Web resources**

<https://www.youtube.com/watch?v=6qnSsV2syUE>

<https://www.youtube.com/watch?v=9_h0ZXx1lFw>

<https://slideplayer.com/slide/9431799/>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 | 2 |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 | 2 |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 | 2 |  | 3 |
| **CO 4** | 3 | 3 |  |  |  |  | 3 | 2 |  | 3 |
| **CO5** | 3 | 3 |  |  |  |  | 3 | 2 |  | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**THIRD YEAR**

**SEMESTER VI**

**PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 15**  **Plant Biochemistry and**  **Plant Therapeutics** | Core | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

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

**Module I:** Photosynthesis- Photosynthesis apparatus, pigments of photosynthesis, photo chemical reaction, photosynthetic electron transport chain, path of carbon in photosynthesis- Calvin cycle, Hatch – lack pathway (4 ways) CAM path way, significance of photosynthesis. 15Hrs

**Module II:** Secondary metabolites: Structure, Types, Sources, Biosynthesis and function of phenolics, tannins, lignins, terpenes and alkaloids. Medicinal properties of secondary metabolite15Hrs

**Module III:** PlanthormonesStructureandfunctionofplanthormonessuchasethylene,cytokinIns,auxins, Absicic acid, Florigin and Gibberlins. 15Hrs

**Module IV:** Free radicals, types, production, free radical induced damages, lipid peroxidation, reactive oxygen species, antioxidant defense system, enzymatic and non-enzymatic antioxidants, role of antioxidants in prevention of disease, phytochemicals as antioxidants.15Hrs

**Module V:** Plant therapeutics: Bioactive principles in herbs, plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties.15Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Gain knowledge on photosynthetic apparatus, pigments present, pathways, and significance of photosynthesis | PO1 |
| CO2 | Learn in detail about the structure, types, sources, biosynthesis and functions of secondary metabolites. | PO1,PO3 |
| CO3 | Understand the structure and functions of plant hormones. | PO1 |
| CO4 | Discuss about free radicals, types and its harmful effects. Role of enzymatic and non-enzymatic antioxidant in defence mechanism, prevention in disease. | PO1,PO2.PO3 |
| CO5 | Identify the plants with antidiabetic, anticancer, antibacterial, antiviral, anti-malaria and anti-inflammatory properties. | PO1, PO2,PO3 |

**Text books**

1. SinghM.PandPanda.H2005.MedicinalHerbswiththeirformulations,Daya publishing house, Delhi

2. PlantPhysiology-DevlinN.RobertandFrancisH.Witham,CBSPublications

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

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

**Referencebooks**

1. Khan,I.AandKhanum.A2004.Roleofbiotechnologyinmedicinalandaromaticplants, Vol.1andVol.10,Ukka2publications,Hyderabad.

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

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

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

**Web resources**

1 [https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory- chapter-secondary-metabolites](https://www.intechopen.com/books/secondary-metabolites-sources-and-applications/anintroductory-%20%20chapter-secondary-metabolites)

2 [https://www.toppr.com/guides/biology/plant-growth-and development/plantgrowth](https://www.toppr.com/guides/biology/plant-growth-and%20%20development/plantgrowth)

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  | 2 |  |  |  | 3 | 3 |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 | 3 | 3 |  |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 | 3 | 3 |  |  |  | 3 | 3 |  | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**THIRD YEAR**

**SEMESTER VI**

**BIOTECHNOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Elective Course2 A - Biotechnology** | Elective | 2 | 1 | 0 | 0 | 3 | 5 | 25 | 75 | 100 |

**Learningobjectives**

The main objectives of this course are to

* Impart knowledge on gene manipulation and gene transfer technologies
* Make the students understand the procedures involved in plant tissue culture.
* Acquire knowledge on animal cell culture and stem cell technology.
* Improve the employability skills of students by providing knowledge in recent techniques such as PCR, blotting, ELISA etc.
* Understand the application of fermentation technology.

**Module I: Recombinant DNA technology**

Recombinant DNA technology - Principles of gene cloning: restriction endonucleases and other enzymes used in manipulating DNA molecules. Ligation of DNA molecules, DNA ligase, linkers and adapters, homopolymer tailing.end labeling and construction maps of PBR322, λ bacteriophage.15 Hrs

**Module II: Plant Tissue culture**

Plant tissue culture- basic requirements for culture, M S medium, callus culture, protoplast culture. Vectors – Ti plasmid (cointegration vector and binary vector), Viral vectors- TMV, CaMV and their applications. Transgenic plants – pest resistant, herbicide resistant and stress tolerant plants**.**15 Hrs

**Module III:** **Animal Tissue culture**

Animal cell lines and organ culture - culture methods and applications. Transgenic animals: transgenic mice- Production and its applications. Stem cell technology: definition, types, and applications. 15 Hrs

**Module IV: Molecular Techniques**

PCR –Principle, types and its application in clinical diagnosis and forensic science. Southern blotting, Northern blotting and DNA finger printing Technique-principle and their applications. 15 Hrs

**Module V: Fermentation technology**

Fermentation technology – Fermentors - general design, fermentation processes - Media used, downstream processing. Production and applications of ethanol, Streptomycin and Proteases.Production of edible vaccines.15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Acquire knowledge on rDNA technology, DNA manipulation, and use of restriction endonuclease | PO1,PO3 |
| CO2 | Get acquainted with the use of cloning and vectors in plant tissue culture. | PO1,PO2,PO3 |
| CO3 | Understand the methods for production of proteins using recombinant DNA technology and their applications, basics of tissue culture, transgenesis, stem cell technology, risks, and safety aspects and patenting in biotechnology | PO1,PO3 |
| CO4 | Gain knowledge about the importance of gene and gene manipulation technologies | PO1,PO3 |
| CO5 | Know the concept fermentation technology and its applications. | PO1,PO3 |

**Text Books**

1.James D. Watson , Amy A. Caudy , Richard M. Myers , Jan Witkowski (2006)Recombinant DNA: Genes and Genomes - a Short Course (3rd ed),W.H.Freeman & Co

2. Satyanarayana U (2008), Biotechnology, Books & Allied (P) Ltd.

3. Cassida L (2007) Industrial Microbiology , New Age International

**Reference books**

1. Reed G (2004) Prescott and Dunn’s Industrial Microbiology, CBS Publishers & Distributors

2.Biotechnology: applying the genetic revolution- David P. clark , Pazdernik N. J, Elsevier (2009).

3.Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4th ed) American Society for Microbiology

**Web Sources**

NPTEL Certification course - Gene Therapy by Sachin Kumar <https://nptel.ac.in/courses/102/103/102103041/>

Coursera Certification course –Vaccines

https://futureoflife.org/background/benefits-risks-biotechnology/

https://www.sciencedirect.com/topics/neuroscience/genetic-engineering

http://www.biologydiscussion.cm/biotechnology/techniques-biotechnology/important-techniques-of-biotechnology-3-techniques/15683

https://iopscience.iop.org/book/978-0-7503-1347-6/chapter/bk978-0-7503-1347-6ch1

https://www.slideshare.net/zeal\_eagle/fermentation-technology

https://www.slideshare.net/zeal\_eagle/fermentation-technology

<https://www.slideshare.net/Chepkitwai/blotting-techniques-6129300>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  | 3 |  | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 2** | 3 |  | 3 |  | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 3** | 3 |  | 3 |  | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO 4** | 3 |  | 3 |  | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 |  | 3 |  | 3 | 3 | 3 | 3 | 3 | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**THIRD YEAR :SEMESTER VI**

**BIOINFORMATICS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Elective Course2 B Bioinformatics -** | EP2 | 2 | 1 | 0 | 0 | 3 | 5 | 25 | 75 | 100 |

**Learning Objectives**

The objective of this course are to

* Impart knowledge on bioinformatics and applications
* Learn about biological databases
* Understand the local and global sequence alignment
* Provide insights on BLAST and Microarray
* Familiarize about structural genomics and visualization tools

**Module I**:Introduction to Bioinformatics – Bioinformatics and its applications. –Genome, Metabolome-Definition and its applications. Metabolome-Metabolome database-E.coli metabolome database, Human Metabolome database.Transcriptome-Definition and applications.15 Hrs

**Module II** :Biological Databases - definition, types and examples –, Nucleotide sequence database (NCBI, EMBL, Genebank, DDBJ) Protein sequence database- SwissProt, TrEMBL, Structural Database-PDB,Metabolic database-KEGG15 Hrs

**Module III :**Sequence Alignment-Local and Global alignment-Dot matrixanalysis, PAM, BLOSUM. Dynamic Programming, Needleman- Wunch algorithm, Smith waterman algorithm.Heuristic methods of sequence alignment 15 Hrs

**Module IV** :BLAST-features, types (BLASTP, BLASTN, BLASTX), PSI BLAST, result format. DNAMicroarray-Procedure and applications.15 Hrs

**Module V**:Structural genomics-Whole genome sequencing (Shotgun approach), Comparative genomics-tools for genome comparison, VISTA servers and precomputed tools. Molecular visualizationtools.RASMOL, Swiss PDB viewer. Nutrigenomics-Definition and applications15 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Introduce the fundamentals of Bioinformatics and its applications Genome, metabalome& Transcriptome. | PO1 |
| CO2 | Classify biological database and to correlate the different file formatsused by nucleic acid, protein database, structural and metabolic database.. | PO1,PO2.PO3 |
| CO3 | Develop algorithms for interpreting biological data. | PO1,PO2 |
| CO4 | Discuss the concepts of sequence alignment and its types. Understand the tool used to detect the expression of genes | PO1.PO2,PO3 |
| CO5 | Apply the various tools employed in genomic study and protein visualization. Analyse the entire genome by shot gun method. | PO1.PO2 |

**Text books**

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

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

3.Bioinformatics by Saras publication

4.Introduction to Bioinformatics by Arthur Lesk

**Reference books**

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

2.Chemoinformatics and Bioinformatics in the Pharmaceutical Sciences

Navneet Sharma PhD Pharmaceutics, Himanshu Ojha, Pawan Raghav, Ramesh K. Goyal

**Web resources**

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

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

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

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  | 2 | 3 |
| **CO 2** | 3 | 3 | 3 |  |  |  | 3 |  | 3 |  |
| **CO 3** | 3 | 3 |  |  |  |  | 3 |  | 3 |  |
| **CO 4** | 3 | 3 | 3 |  |  |  | 3 |  | 3 |  |
| **CO5** | 3 | 3 |  |  |  |  | 3 |  | 3 |  |

**S-Strong (3) M-Medium (2) L-Low (1)**

**THIRD YEAR**

**SEMESTER VI**

**BIOENTREPRENEURSHIP**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Elective Course 2C Bioentrepreneurship** | Elective | 2 | 1 | - | - | 3 | 5 | 25 | 75 | 100 |

**Learning Objectives**

The objective of this course are to

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

**Module I:** Introduction to Bio entrepreneurship; Types of industries – Biopharma, Bio agriculture and CRO; Introduction to Trademarks , Copyrights and patents 15 Hrs

**Module II:** Business Plan, Budgeting and Funding Idea or opportunity; Business proposal preparation; funds/support from Government agencies like MSME/banks, DBT, BIRAC, Start-up and make in India Initiative; dispute resolution skills; external environment changes; avoiding/managing crisis; Decision making ability. 15 Hrs

**Module III :**Market Strategy- Basics of market forecast for the industry; distribution channels – franchising, policies, promotion, advertising, branding and market; Introduction to information technology for business administration and Expansion15 Hrs

**Module IV:**Legal Requirements, Finance and Accounting; Registration of company in India; Ministry of Corporate Affairs (MCA); basics in accounting: introduction to concepts of balance sheet, profit and loss statement, double entry, bookkeeping; finance and break-even analysis; difficulties of entrepreneurship in India.15 Hrs

**Module V:**Role of knowledge centres such as universities, innovation centres, research institutions (public & private) and business incubators in Entrepreneurship development; quality control and quality assurance; Definition, role and importance of CDSCO, NBA, GLP, GCP, GMP.15 Hrs

**Course Outcomes**

After completion of the course the students will be able to

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Understand the concept and scope for entrepreneurship | PO1 |
| CO2 | Identify various operations involved in a venture creation | PO1.PO5,PO6 |
| CO3 | Gather funding and launching a winning business | PO1.PO5,PO6 |
| CO4 | Nurture the organization and harvest the rewards | PO1.PO5,PO6 |
| CO5 | Illustrate about the Business incubator centres and Bio entrepreneurship | PO1.PO5,PO6 |

**Text books**

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

2.Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, managing, and Leading Biotech Companies. Academic London Press - ISBN 10: 0124047300 / ISBN 13: 9780124047303

3.Onetti, A. &. (2015). Business modeling for life science and biotech companies: Creating value and competitive advantage with the milestone bridge. Routledge - ISBN 10: 1138616907 / ISBN 13: 9781138616905

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

**Reference books**

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

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

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

**Web sources**

**1**. http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/

2.https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introductionto-entrepreneurship**/**

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 2 |  |  |  | 2 | 3 | 3 |  |  | 3 |
| **CO 3** | 2 |  |  |  | 2 | 3 | 3 |  |  | 3 |
| **CO 4** | 2 |  |  |  | 2 | 3 | 3 |  | 3 | 3 |
| **CO 5** | 2 |  |  |  | 2 | 3 | 3 |  |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**THIRD YEAR; SEMESTER VI**

**PROJECT**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper 16 Project** | Core | 3 |  | 5 | - | 3 | 8 | 40 | 60 | 100 |

**SKILL ENHANCEMENT COURSE -SEC (NME)**

**SKILL ENHANCEMENT COURSE -SEC (NME)**

**Choose any of the skill enhancement course (NME) for Semester I & II**

**FIRST YEAR**

**SEMESTER I/II**

**HEALTH AND NUTRITION**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **NME:Health and Nutrition** | SEC | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Gain basic knowledge about health.
* Understand about vitamins.
* Learn about functions of fat on health.
* Understand the types of minerals and its functions
* Know about the importance of carbohydrates and proteins on health

**Module I:** Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people.Balanced diet and calorific value. 6Hrs

**Module II:** Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. 6Hrs

**Module III:** Sources and functions of dietary fats, role of fats in health and diseases. 6Hrs

**Module IV:** Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc. 6Hrs

**Module V:** Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications.6Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Understand about the importance of health and diet | PO1 |
| CO2 | Discuss about the classification properties and deficiencies of vitamins | PO1 |
| CO3 | Understand about sources and functions of fats and lipids on health | PO1.PO4 |
| CO4 | Detail about the different typed of minerals and its role in health | PO1,PO4 |
| CO5 | Relatetherole of proteins and carbohydrates on health | PO1,PO4 |

**Text books**

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

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

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

**Reference Books**

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

**Web Resources**

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

2. nhp.gov.in/healthyliving/healthydiet

3. [www.anme.com.mx/libros/PrinciplesofNutrition.pdf](http://www.anme.com.mx/libros/PrinciplesofNutrition.pdf)

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 3** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |
| **CO 4** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**FIRST YEAR :SEMESTER I/II  
LIFE STYLE DISEASES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Lifestyle Diseases** | Non – Major Elective | 2 |  | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

Theobjectivesofthiscourseareto

* Createawarenessonlifestylediseasesamongadolescents.
* List out the lifestyle diseases.
* Explain the common lifestyle diseases and their prevention.
* Acquaintthedisordersassociatedwithwomen’shealth.
* Impartlifeskillssoastopreventlifestylediseases.

**Module I:** Lifestyle diseases: Definition, Factors contributing to lifestyle diseases - Physicalinactivity, Poorfood habits ,disturbedbiological clock, sleep deprivation. 6Hrs

**Module II:** Top lifestyle diseases, Impact of Lifestyle diseases on family, societyandeconomyofcountry.**6** Hrs

**Module III** : Causes,symptoms**,**types,preventivemeasuresandtreatment of Obesity ,cardiovasculardiiiseases, diabetes and cancer.6 hrs

**Module IV:** Women’s lifestyle diseases : Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis. 6 hrs

**Module V:** Prevention of lifestyle diseases: Balanced diet, sufficientintakeofwater,physicalactivity ,sleep-wakecycle,stressmanagement and meditation. 6Hrs**Courseoutcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of the course the students will be able to** | **Program Outcomes** |
| CO1 | DefineLifestylediseasesanddescribethecontributingfactors | PO1 |
| CO2 | Enumeratethetoplifestylediseasesand its impact on life. | PO1,PO4,PO5 |
| CO3 | Elaboratethetreatmentandpreventionmeasures of common lifestyle diseases. | PO1,PO4,PO5 |
| CO4 | Highlight thelifestylediseasesthataffectsthewomen’shealth | PO1,PO4,PO5 |
| CO5 | Illustratethevariousmeasuresforpreventionoflifestylediseases | PO1,PO4,PO5 |

**Textbooks**

1. JamesM R,LifestyleMedicine,2ndEdition,CRCPress,2013
2. AkiraMiyazaki,NewFrontiersinLifestyle-RelatedDisease,Springer,2008

**Referencebooks**

1. Steyn K, Lifestyleandrelatedriskfactorsforchronicdiseases
2. Willett WC,Preventionofchronicdiseasebymeansofdietandlifestyle.
3. Kumar M & R. Kumar,.Guidetopreventionoflifestylediseases.Deep & Deep publications

**Web resources**

1.https://youtu.be/jDdL2bMQXfE

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

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 2** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 3** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 4** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 5** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**FIRST YEAR :SEMESTER I/II**

**MEDICINAL DIET**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** |  | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
|  | **CIA** | **External** | **Total** |
|  | **NME: Medicinal Diet** | SEC |  | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

* Provide basic knowledge about diet
* Understand of diet modification for GI diseases
* Plan a diet for liver diseases
* Prepare diet chart for Infectious diseases
* Plan a diet for Diabetes ,Renaland Cardio-vascular diseases

**Module-I :**Principlesof Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, soft Diet and Liquid diet. Objectives of Diet Therapy.Advantages of using normal diet as the basis for Therapeutic diet.Normal Diet-therapeutic modification of normal diet.6 Hrs

**Module II**:Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome 6 Hrs

**Module III**:Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment in jaundice, hepatitis, cirrhosis of liver and hepatic coma. 6 Hrs

**Module IV**:Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.6 Hrs

**Module V**:Diet Modification in Diabetes , Renaland Cardio-vascular diseases-Diabetes, acute & chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.6 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Possess basic knowledge about diet | PO1 |
| CO2 | Sketch diet plan for GI diseases | PO1,PO4,PO5,PO6 |
| CO3 | Sketch diet plan for liver diseases | PO1,PO4,PO5,PO6 |
| CO4 | Sketch a diet plan for Infectious diseases | PO1,PO4,PO5,PO6 |
| CO5 | Prepare diet chart for Diabetes Renaland Cardio-vascular diseases | PO1,PO4,PO5,PO6 |

**Text Books**

**1.**M.RaheenaBegum ,AText Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt.Ltd.

2.M.V.RajaGopal,Sumati.R.,Mudambi, Fundamentals of foods and Nutrition, Wiley Eastern Limited, Year-1990.

3.William S.R Nutrition and Diet Therapy, 1985, 5thedition, MoslyCo.St.Louis.

**Reference books**

1.Rodwell Williams Nutrition and Diet Therapy, 1985,the C.V MoslySt.Louis.

2.M.V.Krause&M.A.Mohan ,Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company, Philadelphia, London.

3.Davidson and Passmore ,Human Methods and Diabetics, 1976 the English Language Book Society and Churchill.

**Web sources**

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 2** | 2 |  |  | 2 | 3 | 2 | 3 | 3 |  | 3 |
| **CO 3** | 2 |  |  | 2 | 3 | 2 | 3 | 3 |  | 3 |
| **CO 4** | 2 |  |  | 2 | 3 | 2 | 3 | 3 |  | 3 |
| **CO 5** | 2 |  |  | 2 | 3 | 2 | 3 | 3 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**SKILL ENHANCEMENT COURSE -SEC**

**(Discipline/Subject/ Entrepreneurial))**

**Choose any of the skill enhancement course (Discipline/subject/ entrepreneurial) for Semester - II,III& IV/ Year - I/II**

**BIOMEDICAL INSTRUMENTATION**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Biomedical**  **Instrumentation** | SEC(Discipline) | 2 | - | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

The objectives of this course are to

* Provide insights about the blood pressure and its measurement.
* Elaborate themechanismof instruments related to respiration.
* Highlight the importance of imaging techniques.
* Acquaint students about the basics of medical assisting devices.
* Familiarize about the life saving therapeutic equipments.

**Module I:**Measurement of blood pressure – sphygmomanometer. Cardiac output – Cardiac rate – Heartsound – Stethoscope, ECG – EEG – EMG – ERG.6 Hrs

**Module II:**Monitoring of inspired/expired anaesthetic gases, capnograph, inhalators, nebulizers,aspirators, infant respirator, Plethysmography.6 Hrs

**Module III:**Medical imaging: X-ray machine - Radio graphic and fluoroscopic techniques – Computed tomography – MRI – PET, Ultrasonography – Endoscopy – Thermography.6 Hrs

**Module IV:**Assisting equipments: Pacemakers – Defibrillators – Ventilators6 Hrs

**Module V:** Therapeutic equipments: Nerve and muscle stimulators –Diathermy – Heart – Lung machine – Audio meters – Dialyzers. 6 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme outcome** |
| CO1 | Illustratethe functions of instruments used for measuring blood pressure. | PO1,PO2, PO5 |
| CO2 | Elaborate the devices required for monitoring of respiratory gases. | PO1,PO2, PO5 |
| CO3 | Understand the operation of the imaging and sonographic instruments. | PO1,PO2, PO5 |
| CO4 | Differentiate between the action of pacemakers , defibrillators and ventilators. | PO1,PO2, PO5 |
| CO5 | Demonstrate the function of therapeutic equipments | PO1,PO2, PO5 |

**Text books**

1. M.Arumugam, ‘Bio-Medical Instrumentation’, Anuradha Agencies.

2. L.A. Geddes and L.E.Baker, ‘Principles of Applied Bio-Medical Instrumentation’, John

Wiley & Sons.

3. J.Webster, ‘Medical Instrumentation’, John Wiley & Sons.

4. C.Rajarao and S.K.Guha, ‘Principles of Medical Electronics and Bio-medicalInstrumentation’, Universities (India) Ltd, Orient Longman Ltd.

**Reference books**

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, ‘Bio-Medical Instrumentation and

Measurements’, II Edition, Pearson Education, 2002.

2. R.S.Khandpur, ‘Handbook of Bio-Medical instrumentation’, Tata McGraw Hill

Publishing Co Ltd.,

**WebResources**

<https://youtu.be/GkUCmb0cKwo?list=PLCZ9KmODEcu138IlVeHClJ4nskArYr1Dg>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  | 3 |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  | 3 |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  | 3 |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  | 3 |  | 3 | 3 | 3 | 3 |
| **CO 5** | 2 | 3 |  |  | 3 |  | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low**

**FIRST AID**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **First Aid** | SEC (Discipline) | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto:

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

**Module I:** Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.6 Hrs

**Module II:** Basics ofRespiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma. 6 Hrs

**Module III:**Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. 6Hrs

**Module IV:**First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy6Hrs

**Module V:**First aidin poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant ,acid and alkali poisoning .6Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Discuss on the rules of first aid, dealing during emergency and first aid techniques | PO1.PO4,PO5 |
| CO2 | Understand the first aid techniques to be given during different types of respiratory problems | PO1.PO4,PO5 |
| CO3 | Provide first aid for injuries, shocks and bone injury | PO1.PO4,PO5 |
| CO4 | Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions | PO1.PO4,PO5 |
| CO5 | Gain expertise in giving first aid for insect bites and chemical poisoning | PO1.PO4,PO5 |

**Text books**

1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.ManjulMungali

1SBN-978-93-92208-19-5

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

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

**Reference books**

**Web resources**

1)https://www.redcross.org/take-a-class/first-aid/first-aid-training/first-aid-online • 2)https://www.firstaidforfree.com/

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 |  |  | 3 | 3 |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 |  |  | 3 | 3 |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 |  |  | 3 | 3 |  | 3 | 3 | 3 | 3 |
| **CO5** | 2 |  |  | 3 | 3 |  | 3 | 3 | 3 | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**BASICS OF FORENSIC SCIENCE**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Basics of Forensic Science** | SEC  (Discipline) | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

Themainobjectivesofthiscourseareto

C1 Gain knowledge on the basic practices of forensic analysis.

C 2 Perform investigation using fresh blood.

C 3 Carry out the analysis using body fluids

C 4 Investigate the presence of forms of drugs and poisons in body fluids.

C5 Execute the identification test on multiple samples.

**Module I:** Forensic Science: Definition, History and Development. Crime scene management and investigation; collection, preservation, packing and forwarding of physical and trace evidences for analysis. 6Hrs

**Module II:** Blood – grouping and typing of fresh blood samples including enzyme .Cases of disputed paternity and maternity problems, DNA profiling.6Hrs

**Module III:** Analysis of body fluids- Analysis of illicit liquor including methyl and ethyl alcohol in body fluids and breathe. Chemical examination, physiology and pharmacology of Insecticides and pesticides. 6Hrs

**Module IV:** Psychotropic drugs -Sedatives, stimulants, opiates and drugs of abuse. Identification of poisons from viscera, tissues and body fluids. 6Hrs

**Module V:** Identification tests- Identification of hair, determination of species origin, sex, site and individual identification from hair. Classification and identification of fibers. Examination and identification of saliva, milk, urine and faecal matter 6Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Gain knowledge on basics of forensic science and method for collection and preservation of samples | PO1,PO2,PO6 |
| 6CO2 | Assess the paternity ,maternity problems and DNA profiling | PO1,PO2 |
| CO3 | Identify the presence of alcohol ,insecticides and pesticides in body fluids | PO1,PO2 |
| CO4 | Detail on the test performed to identify the presence of drugs and poisons in body fluids | PO1,PO2 |
| CO5 | Identify species and sex from the available body fluids | PO1,PO2 |

**Reference books**

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

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

4. Forensics by Embar-Seddon, Ayn and Pass. Allan D.

5. Forensic Medicine by Adelman, Howard C &Kobilinsky, Lawrence Page 24 of 63

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  |  | 3 |  | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  |  | 3 |  | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  |  | 3 |  | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  |  | 3 |  | 3 | 3 |
| **CO5** | 2 | 3 |  |  |  |  | 3 |  | 3 | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

**MEDICAL LABORATORY TECHNOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Medical Laboratory Technology** | SEC  (Discipline) | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

The main objectives of this course are to

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

**ModuleI** :Collection, transport, analysis of specimen – blood, routine urine, feces, sputum, semen, CSF Documentation of samples & results. Disposal of laboratory/ hospital waste-Non infectious waste , biomedical waste, infected sharp waste disposal, infected non sharp disposal – color coding as per guidelines 6 Hrs

**Module II** :Determination of Blood group and Rh factor -Basic blood banking procedures- cross matching, screening test. Blood transfusion and hazards.6 Hrs

**Module III :**Estimation of blood sugar – Enzymatic method,HbA1C, Qualitative and quantitative analysis of urine sample- NPN-urea, uric acid, creatinine. Mineral ,vitamin and CSF analysis.6 Hrs

**Module IV :**Immuno diagnostics -Widal test, VDRL test, ASO, RA, CRP and Complement fixation Test. RIA, ELISA,, Skin test – Montaux and Lepramin test.6 Hrs

**Module V :**.Assay of clinically important enzymes- Estimation of clinically important hormones – Insulin, Thyroid and Reproductive hormones and its clinical significance6 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Collect&preserve of biological samples. | PO1,PO2 |
| CO2 | Estimate the various constituents in biological sample | PO1,PO2,PO6 |
| CO3 | Perform the routine procedures adopted in blood bank | PO1,PO2.PO6 |
| CO4 | Analyze and interpret the values for both normal and disease conditions. | PO1,PO2,PO6 |
| CO5 | Assay the enzymes and hormones &interpret clinical implications | PO1,PO2,PO6 |

**Text Books**

1 Kanai L Mukherjee and Anuradha Chakravarthy Medical Laboratory Technology IVthedition,Vol I,2022

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

3.Tietz, N. (2018) Fundamentals of Clinical Chemistry and Molecular Diagnostics 8th

edition,W.B. Saunders Company

**Reference books**

**Web Resources**

1 https://www.youtube.com/watch?v=QNYlX5Ne9lQ

2 <https://www.slideshare.net/doctorrao/>

agglutination-tests-and-immunoassys

3 <https://microbenotes.com/introduction-to-precipitation-reaction/>

**Mapping with Program Outcome**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |

S - Strong (3) M - Medium (2) L -Low(1)

**TISSUE CULTURE**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Tissue Culture** | SEC  (Discipline) | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |

**Learning Objectives**

The objectives of this course are to

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

**Module l:**Introduction to Tissue culture, Types- seed, embryo, Callus, Organ, Protoplast culture, Advantages and importance of tissue culture, Tools and techniques 6 Hrs

**ModuleII :**Media and Culture Preparation - pH, temperature, solidifying agents. Role of Micro and macro nutrients. Maintenance of cultures.6 Hrs

**Module III :** Methods of gene transfer in plants and animals - direct and indirect gene transfer methods.6 Hrs

**Module IV :** Cell culture technique - Explants selection, sterilization and inoculation. 6 Hrs

**Module V :** Transgenic plants for crop improvement. Transgenic plants for molecular farming. Animal Cloning - an overview-Applications of animal cell culture 6 Hrs

**Course outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Introduction to plant tissue culture | PO1,PO2.PO3 |
| CO2 | Brief knowledge on preparation of tissue culture media | PO1,PO2 |
| CO3 | Understanding on different methods of gene transfer | PO1,PO2.PO3 |
| CO4 | Gain knowledgeon plant and animal cell culture techniques | PO1,PO2,PO3 |
| CO5 | Study of applications of genetically modified plants and animals. | PO1,PO2,PO3 |

**Text books**

1.Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.

2,Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.

3.Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.

4.Grierson and Covey, S.N.1988. Plant Molecular biology.Blackie.

5.Chawla, H.S., “Introduction to Plant Biotechnology”, 3rd Edition, Science Publishers, 2009.

**Reference books**

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

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

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

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

5.Davis, J. M. (2011).Animal Cell Culture.John Willy and Sons Ltd. USA.6Freshmen R. I. (2005).Culture of Animal Cells.John Willy and Sons Ltd. USA.

6.Butler, M. (2004). Animal Cell Culture and Technology.Taylor and Francis.Keywork USA.

7.Verma, A. S. and Singh, A. (2014).Animal Biotechnology. Academic Press, ELSEVIER, USA

**Web Resources**

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

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

<https://microbeonline.com/animal-cell-culture-introduction-types-methods-applications/>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |

S - Strong (3) M - Medium (2) L -Low(1)

**MEDICAL CODING**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Medical Coding** | SEC(Discipline) | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Courseobjectives**

The objectives of this course are to

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

**Module- I :** Introduction to Medical coding, coding theory, Healthcare Common Procedure Coding, First Aid and CPR 6Hrs

**Module- II:** Introduction toMedical Terminology, specialization I & II, Diagnostic coding, factors affecting diagnostic coding 6Hrs

**Module III:** Documenting medical records- Importance of Documentation, Types of dictation formats 6Hrs

**Module- IV :**Introduction to Human Anatomy and Coding, ICD-10- CM classification system

6Hrs**Module- V :** Introduction to CPT coding, types of CPT coding Medical Law and Ethics6hrs

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program**  **Outcomes** |
| CO1 | Explaining the basic concept of coding and its application. Possess the knowledge about the First aid and CPR | PO1,PO2,  PO6 |
| CO2 | Possess the knowledge about medical terminology used in Medical coding industry | PO1,PO2,  PO6 |
| CO3 | Possess the knowledge about the ICD-10 CM international classification of diseases based on WHO | PO1,PO2,  PO6 |
| CO4 | Possess the knowledge about the CPT codes used for diseases as per American Medical Association (AMA) | PO1,PO2,  PO6 |
| CO5 | Understand CPT coding and its types | PO1,PO2,  PO6 |

**Text books**

**1**.Understanding Medical Coding,A comprehensive guideSandraLJohnsonRobin Linker

2.Buck’s Step – by – step Medical CodingElsevier reference

**Reference books**

1.Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CMcoding guidelines made easy2017.

4.Besty J Shiland- Medical terminology and anatomy for ICD-10.

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  | 3 | 3 |  | 2 | 3 |
| **CO 2** | 2 | 3 |  |  |  | 3 | 3 |  | 2 | 3 |
| **CO 3** | 2 | 3 |  |  |  | 3 | 3 |  | 2 | 3 |
| **CO 4** | 2 | 3 |  |  |  | 3 | 3 |  | 2 | 3 |
| **CO5** | 2 | 2 |  |  |  | 2 | 3 |  | 2 | 3 |

**S - Strong (3) M - Medium (2) L -Low(1)**

**MICROBIAL TECHNIQUES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **SEC-**  **Microbial techniques** | SEC(Discipline) | 1 | 1 | - | - | 2 | 2 | 25 | 75 | 100 |

**Learning objectives**

The objectives of this course are to

* Study the growth of bacteria
* Know the parts & uses of microscope
* Learn staining methods to identify microbes
* Learn different types of culture methods
* Study food preservation methods

**Module – I:** Growth of bacteria- Definition, growth phases, factors affecting growth (pH, temperature, and oxygen), cell count (hemocytometer, Bacterial cell- Bacillus subtilis), fungal cell (Saccharomyces) and human blood cell.6 Hrs

**Module -II:**Microscopy- Principle, types - Compound microscope, electron microscope- TEM, SEM, use of oil immersion objective.6 Hrs

**Module III :**Stains and staining- Principles of staining, simple staining, negative staining, Differential staining, Gram and acid-fast staining, flagella staining, capsule and endospore Staining. Staining of yeast (methylene blue), lactophenol cotton blue, staining of mold (Penicillium, Aspergillus), Agaricus.6 Hrs

**Module IV:**Cultivation of bacteria– Types of growth media (natural, synthetic, complex, enriched, selective- definition with example), culture methods (streak plate, spread plate, pour plate, stab culture, slant culture, liquid shake culture, anaerobiosis) - aerobic and Anaerobic bacteria.6 Hrs

**Module V:**Food microbiology- Microbiological examination of food: microscopic examination and culture, phosphatase test of Pasteurized milk. Preservation of food- High temperature (boiling, pasteurization, appreciation), low temperature (freezing), dehydration, osmotic pressure, chemical preservations, radiation. Microorganisms as food SCP.6 Hrs

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program**  **Outcomes** |
| CO1 | Understand the growth of bacteria and to perform cell count | PO1,PO2 |
| CO2 | Acquire knowledge of microscope and its uses | PO1,PO2 |
| CO3 | Identify the microbes by staining methods | PO1,PO2,  PO6 |
| CO4 | Culture microbes by various methods | PO1,PO2,  PO6 |
| CO5 | Preserve foods at high and low temperature | PO,PO2,  PO6 |

**Text books**

1. Sherris Medical Microbiology, 7th Edition byAuthors: Kenneth Ryan, C. George Ray, Nafees Ahmad, W. Lawrence Drew, Michael Lagunoff, Paul Pottinger, L. Barth Reller and Charles R. Sterling

2. Food Microbiology: Fundamentals And Frontiers, 5th Edition by Editor(s):Michael P. Doyle, Francisco Diez-Gonzalez, Colin Hill

3.Text book of microbiology by Ananthanarayan and Panicker’s

4. Textbook of microbiology by P.C. Trivedi Sonali Pandey Seema Bhadauria5. 5.Prescott’s Microbiology, 10th Edition by Authors: Joanne Willey, Linda Sherwood and Christopher J. Woolverton

**Reference books**

1.Bailey& Scott’s Diagnostic Microbiology, 14th Edition by Author: Patricia Title

2. Medical Microbiology, 7th Edition Authors: Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller

3. Microbiology: Laboratory Theory and Application, 3rd Edition Authors: Michael J. Leboffe and Burton E. Pierce

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 3 |  |  |  | 2 | 3 | 3 | 3 | 3 |

**S - Strong (3) M - Medium (2) L -Low(1)**

**ALLIED COURSE OFFERED BY BIOCHEMISTRY**

**FIRST YEAR :FIRST SEMESTER**

**ALLIED BIOCHEMISTRY I**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Allied Biochemistry I** | (Theory)Allied I | 2 | 1 | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning objectives**

The objectives of this course are to

* Introduce the structure and classification of carbohydrates
* Comprehend the metabolism of carbohydrates
* Study the classification and properties of amino acids
* Elucidate the various levels of organization of Proteins
* Study functions and deficiency diseases of vitamins

**Module I:**Definition and classification of carbohydrates, linear and cyclic forms (Haworth projection) for glucose, fructose and mannose and disaccharides (maltose, lactose, sucrose).General properties of monosaccharides and disaccharides. Occurrence andsignificance of polysaccharides.12Hrs

**Module II**:Metabolism- Catabolism and Anabolism.Carbohydrate metabolism- Glycolysis, TCA cycle, HMP shunt and glycogen metabolism and energetics 12Hrs

**Module III:**Amino acids -Classifications, physical properties -amphoteric nature, isoelectric point and chemicalreactions of carboxyl ,amino and both groups. Amino acid metabolism- transamination, deamination and decarboxylation.12Hrs

**Module IV :**Proteins- classification - biological functions ,physical properties- ampholytes, iso electric point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure, α-helix and β-pleated sheet, tertiary structure, various forces involved- quaternary structure. 12Hrs

**Module V:** Vitamins- Fat(A,D,E and K) and water soluble vitamins( B complex and C)- sources, RDA, biological functions and deficiency diseases12 Hrs

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme**  **Outcome** |
| CO1 | Classify the structure of carbohydrates and its properties | PO1 |
| CO2 | Explain the metabolism of carbohydrates and its significance | PO1 |
| CO3 | Classify amino acids and its properties | PO1 |
| CO4 | Explain the classification and elucidate the different levels of structural organization of proteins | PO1 |
| CO5 | Identify the disease caused by the deficiency of vitamins | PO1 |

**Text Books**

1 Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

2.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers 311

**Reference books**

**1.** David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.

**2.** Voet.D&Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.

**3.** Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman

**4.** Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

5.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers 31

**Web sources**

1.onlinecourses.swayam2.ac.in/cec20\_bt12

2 onlinecourses.swayam2.ac.in/cec20\_bt19

**Mapping with Program Outcome**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO5** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |

**S - Strong (3) M - Medium (2) L -Low(1)**

**FIRST YEAR : SEMESTER** I

**ALLIED BIOCHEMISTRY PRACTICAL-I**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **AlliedBiochemistry Practical I** | Allied Practical I | - | - | 3 | - | 3 | 4 | 25 | 75 | 100 |

**Learning objectives**

* Identify carbohydrates by qualitative test
* Estimate biomolecules volumetrically
* Estimate protein quantitatively

**I Qualitative analysis of carbohydrates**- 25Hrs

1. Monosaccharides-Glucose, Fructose
2. Disaccharides- Lactose, Maltose, Sucrose
3. Polysaccharides-Starch

**II Volumetric analysis 15 Hrs**

a) Estimation of ascorbic acid using 2,6dichlorophenolindophenol as link solution

b) Estimation of Glucose by Benedicts method

c)Estimation of Glycine by Sorenson Formal titration

**III Quantitative analysis**(Demonstration Expt)5 hrs

a)Colorimetric estimation of protein by Biuret method

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program**  **Outcomes** |
| CO1 | Qualitatively analyze and report the type of carbohydrate based on specific tests | PO1,PO2.PO3 |
| CO2 | Quantitatively estimate the carbohydrates, amino acids and ascorbic acid | PO1,PO2,PO3 |
| CO3 | Estimate protein by colorimetric method | PO1,PO2,PO3 |

**Text books**

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

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

Hill Publishing Company Limited, 2001.

3. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, New Age International Publishers, 2016

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |

**S - Strong (3) M - Medi) L -Low(1)**

**FIRST YEAR ;SEMESTER II**

**ALLIED BIOCHEMISTRY II**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Allied Biochemistry II** | Allied II | 2 | 1 | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning objectives**

The objectives of this course are to

* Impart knowledge on the classification, properties and characterization of lipids.
* Comprehend the metabolism of Lipids
* Acquaint with the structure, properties and functions of nucleic acids
* Learn about the enzyme kinetics and inhibition
* Study the importance of Hormones

**Module I :**Lipids–Bloor’s classification of lipids- simple lipids, fatty acids (saturated and unsaturated), compound lipids, derived lipids.Properties of lipids- reduction, oxidation, halogenation,saponification and rancidity .Classification andfunctions of phospholipids, Cholesterol – structure and biological importance.12 Hrs

**Module II** :Lipid metabolism- Oxidation of fatty acids(Palmitic acid ) – Beta oxidation-Role of carnitine,energetics , alpha oxidation and omega oxidation.Biosynthesis of saturated fatty acids.12 Hrs

**Module III :**Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure, various types, properties- absorbance, effect of temperature. Different types of RNA, structure and function, Genetic code. 12 Hrs

**Module III :**Enzymes - Nomenclature, IUB system of enzyme classification,active site, specificity, isoenzymes, units of enzyme activity factors affecting enzyme activity- substrate concentration, pH, temperature.Enzyme Kinetics- Michaelis and Menten equation.Lineweaver- Burk plot. Enzyme inhibition, competitive, uncompetitive and andnon competitive inhibition 12Hrs

**Module V:** Hormones -classification,Biological functions of Insulin, Thyroid and Reproductive hormones . 12Hr

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program**  **Outcomes** |
| CO1 | Elaborate on classification, structure, properties, functions and characterization of lipids | PO1 |
| CO2 | Discuss the metabolism of lipids and its importance | PO1 |
| CO3 | Explain about structure, properties and functions of nucleic acids | PO1 |
| CO4 | Derive Michaelis Menten equation and concepts of enzyme inhibition | PO1,PO3 |
| CO5 | Classify the Hormones and its biological functions | PO1,PO4 |

**Text books**

1.Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

2.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers

**Reference books**

**1.** David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.

**2.** Voet.D & Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.

**3.** Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman

**Web sources**

1.onlinecourses.swayam2.ac.in/cec20\_bt12

2 onlinecourses.swayam2.ac.in/cec20\_bt19

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 |  | 3 |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 |  |  | 3 |  |  | 3 |  |  | 3 |
| **CO5** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |

**S - Strong (3) M - Medium (2) L -Low(1)**

**FIRST YEAR: SEMESTER II**

**ALLIED BIOCHEMISTRY : PRACTICAL II**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **AlliedBiochemistry Practical II** | Allied Practical II | 2 | 1 | - | - | 3 | 4 | 25 | 75 | 100 |

**Learning objectives**

The objectives of this course are to

* Identify amino acids by qualitative test
* Prepare biomolecules from its sources
* Estimate phosphorus quantitatively

I.**Qualitative analysis of amino acids**

a) Arginine b)Cysteine c) Tryptophan d)Tyrosine e) Histidine

II. **Biochemical preparations**

a) Preparation of casein from milk.

b)Preparation of starch from potato.

c)Preparation of albumin from egg.

**IIIGroup Experiment**

Determination of Iodine/ Saponification number of an edible oil(Demonstration) .

**Course Outcome**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programme**  **Outcome** |
| CO1 | Qualitatively analyze the amino acids and report the type of amino acids based on specific tests | PO1,PO2,PO3 |
| CO2 | Prepare the macronutrients from the rich sources. | PO1,PO2,PO3 |
| CO3 | Check the quality of edible oil | PO1,PO2,PO3 |

**Text books**

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

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

Hill Publishing Company Limited, 2001.

**Reference books**

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016

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

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 | 3 |  |  |  | 3 | 3 | 3 | 3 |

**S - Strong (3) M - Medium (2) L -Low**

**LIST OF ALLIED COURSES TO BE OFFERED TO B.ScBIOCHEMISTRY APPROVED BY OTHER BOARD ( SEMESTER I ,II,III and IV)**

**Chemistry**

**Microbiology**

**Biostatistics**

**Zoology**

**Botany**

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