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| --- |
| **B.Sc.,**  **MEDICAL BIOTECHNOLOGY** |
| **SYLLABUS**  **2023-2024** |
|  |
|  |
| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |

**Preamble**

The Medical Biotechnology programme aims to generate highly skilled human resources with the ability to comprehend and analyze biological problems paramount to human health and contribute to the development of updated, contemporary and appropriate solutions. Medical biotechnology is the application of biotechnology which is used for medical purposes, including drug design, discovery and pharmacokinetics. It is one of the most important fields in working for the implications of health and medicine.  
 The scientists in this field can create new medicines that are required for the treatment of cancer patients, synthetic human growth hormone and synthetic insulin.

Medical Biotechnology has been a boon to the medical field in recent times that has occurred in the field. The students at the end of the programme will be able to analyze and formulate solutions to existing and emerging issues related to human health, ability to effectively use computational biology and other advanced techniques in order to understand the intricacies of the life process and functions at systems level and to design and develop therapeutics and diagnostics which have immense relevance in human healthcare. The graduates can contribute in an interdisciplinary team to develop and offer solutions to complex human health problems.

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| --- |
| **TANSCHE REGULATIONS ON LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION** |
| **Programme: B.Sc. Medical Biotechnology** |
| **Programme Code** |
| **Duration 3 years [UG]** |
| **PROGRAM OUTCOMES (POs)** |

|  |  |
| --- | --- |
| 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, synthesizing 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 Broad based knowledge in Industrial Biotechnology |
| PO9 | **Employability and Entrepreneurship:** Capacity to become employable; Eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship |
| PO10 | **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. |

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

|  |  |
| --- | --- |
| **PSO1** | Comprehend the knowledge in the biotechnological, microbiological, bio-engineering and computational areas |
| **PSO2** | Ability to understand the technical aspects of existing technologies that help in addressing the biological and industrial challenges faced by various biotech industries |
| **PSO3** | Acquiring analytical and hands on skills to perform research in multidisciplinary environments |
| **PSO4** | Demonstrate an ability to acquire technical skills and work ethics to meet the industry needs and to become an entrepreneur. |
| **PSO5** | Ability to understand various facets of molecular procedures and basics of genomics, proteomics and metabolomics that could be employed in early diagnosis and prognosis of human diseases. |

**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, etc., as they keep up with technological 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.

# **Course Design and Scheme of Examinations for B.Sc. Program**

**First Year Semester-I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Content** | **Name of the Course** | **Inst. Hours** | **Credits** | **Int Marks** | **Ext Marks** | **Total** |
| Part-I | Language Tamil – I | 6 | 3 | 25 | 75 | 100 |
| Part-II | English Paper – I | 6 | 3 | 50 | 50 | 100 |
| Part-III | Core Paper I-Introduction to Biotechnology | 5 | 5 | 25 | 75 | 100 |
| Core Practical II- Introduction to Biotechnology | 5 | 5 | 40 | 60 | 100 |
| Elective Paper I- Basic Chemistry | 4 | 3 | 25 | 75 | 100 |
|  | 4 | 2 | 40 | 60 | 100 |
| Part-IV | Skill Enhancement Foundation Course Basic Tamil/ Adv. Tamil/ | 2 | 2 | 25 | 75 | 100 |
|  | **Total** | **30** | **23** |  |  |  |

**Semester-II**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Course Content | Name of the Course | Inst. Hours | Credits | Int Marks | Ext Marks | Total |
| Part-I | Language Tamil | 6 | 3 | 25 | 75 | 100 |
| Part-II | English Paper | 6 | 3 | 25 | 75 | 100 |
| Part-III | Core Paper II- Cell Biology | 5 | 5 | 25 | 75 | 100 |
| Core Practical IV- Cell Biology | 5 | 5 | 40 | 60 | 100 |
| Elective II – Biophysics | 4 | 3 | 25 | 75 | 100 |
| Elective Practical II – Biophysics | 4 | 2 | 40 | 60 | 100 |
| Part-IV | Skill Enhancement \*Basic Tamil/ Adv. Tamil/ Non Major Elective | 2 | 2 | 25 | 75 | 100 |
|  | Skill Enhancement | 2 | 2 |  |  |  |
|  | Total | 30 | 23 |  |  |  |

**Second Year**

**Semester-III**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Course Content | Name of the Course | Inst. Hours | Credits | Int. Marks | Ext. Marks | Total |
| Part-I | Language – Tamil | 6 | 3 | 25 | 75 | 100 |
| Part-II | English | 6 | 3 | 25 | 75 | 100 |
| Part-III | Core Paper V- Medical Microbiology-I | 5 | 5 | 25 | 75 | 100 |
| Core Practical VI- Medical Microbiology-I | 5 | 5 | 40 | 60 | 100 |
| Elective III – Genetics- I | 4 | 3 | 25 | 75 | 100 |
| Elective Practical III– Genetics- I | 4 | 2 | 40 | 60 | 100 |
| Part-IV | Skill Enhancement Course | 1 | 1 | 50 | 50 | 100 |
| Skill Enhancement Course | 2 | 2 |  |  |  |
| Environmental Studies | 1 | - | - | - | - |
|  | Total | 30 | 22 |  |  |  |

**Semester-IV**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Content** | **Name of the Course** | **Inst. Hours** | **Credits** | **Int. Marks** | **Ext. Marks** | **Total** |
| Part-I | Language - Tamil | 6 | 3 | 25 | 75 | 100 |
| Part-II | English | 6 | 3 | 25 | 75 | 100 |
| Part-III | Core Paper VII- Medical Microbiology-II | 5 | 5 | 25 | 75 | 100 |
| Core Practical VIII - Medical Microbiology-II | 5 | 5 | 40 | 60 | 100 |
| Elective IV – Genetics- II | 3 | 3 | 25 | 75 | 100 |
| Elective Practical IV– Genetics- II | 4 | 2 | 40 | 60 | 100 |
| Part-IV | Skill Enhancement Course | 2 | 2 | 50 | 50 | 100 |
| Skill Enhancement Course | 2 | 2 |  |  |  |
| Environmental Studies | 1 | 2 | 25 | 75 | 100 |
|  | **Total** | **30** | **23** |  |  |  |

**Third Year Semester-V**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Content** | **Name of the Course** | **Inst. Hours** | **Credits** | **Int. Marks** | **Ext. Marks** | **Total** |
| Part-III | Core Paper IX- Human Biochemistry | 5 | 4 | 25 | 75 | 100 |
| Core Paper X – Enzyme Technology | 5 | 4 | 25 | 75 | 100 |
| Core Paper XI – Fermentation Technology | 5 | 4 | 25 | 75 | 100 |
| Core XII- (Project with Viva) | 5 | 4 | 40 | 60 | 100 |
| Elective V Human Biochemistry | 4 | 3 | 25 | 75 | 100 |
|  | Elective VI Practical Enzyme Technology | 4 | 3 |  |  |  |
| Part-IV | Summer Internship and Industrial Training | - | 2 | 50 | 50 | 100 |
| Value Education | 2 | 2 | 25 | 75 | 100 |
|  | Total | 30 | 26 |  |  |  |

**Semester-VI**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Course Content** | **Name of the Course** | **Inst. Hours** | **Credits** | **Int. Marks** | **Ext. Marks** | **Total** |
| Part-III | Core Paper XIII- Ethical Issues in Medical Biotechnology | 6 | 4 | 25 | 75 | 100 |
| Core Paper XIV - Pharmaceutics | 6 | 4 | 25 | 75 | 100 |
| Core Paper XV | 6 | 4 |  |  |  |
| Elective VII | 5 | 3 | 25 | 75 | 100 |
|  | Elective VIII | 5 | 3 | 25 | 75 | 100 |
| Part- V | Extension Activities |  | 1 |  |  |  |
|  | Professional Competence Skill | 2 | 2 |  |  |  |
|  | **Total** | **30** | **21** |  |  |  |

**Total Credits: 140**

**SCHEME OF EVALUATION**

**Evaluation Pattern for Internal Assessment (25 Marks)**

* Internal Assessment – Best 2 Exam marks taken out of 3 (10 Marks)
* Assignment / Power-point presentation/ Case study (10 Marks)
* Attendance (5 Marks)

**Evaluation Pattern for External Assessment (75 Marks)**

* Section- A (Multiple Choice Questions) (1×10=10 Marks)
* Section- B (Five Mark Questions with choice) (7×5=35 Marks)
* Section- C (Ten Mark Questions with choice) (3×10=30 Marks**)**

**Mandatory Subjects**

1. Introduction to Biotechnology
2. Basic Chemistry
3. Cell Biology
4. Biophysics
5. Medical Microbiology-I
6. Genetics- I
7. Medical Microbiology-II
8. Genetics- II
9. Human Biochemistry
10. Enzyme Technology
11. Biomembranes
12. Ethical issues in Medical Biotechnology
13. Pharmaceutics

**Non-Mandatory Subjects- Electives**

|  |  |  |
| --- | --- | --- |
|  | **Group** | **Title of the subject** |
| **Elective – I** | **E1A** | Immunology |
| **E1B** | Medical Laboratory Technology |
| **E1C** | Recombinant DNA Technology |
| **E1D** | Plant Therapeutics |
| **Elective – II** | **E2A** | Medical coding |
| **E2B** | Entrepreneurial Microbiology |
| **E2C** | Medical Biochemistry |
| **Elective - III** | **E3A** | Dairy Microbiology |
| **E3B** | Bionanotechnology |
| **E3C** | Bioinformatics |

**FIRST YEAR: SEMESTER I**

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

# **Learning objectives:**

1. To enrich the knowledge of Commercial Production of Microorganisms
2. To develop in-depth knowledge about Products from Microorganisms
3. To provide the basic knowledge of Principles of Microbial growth
4. To provide the basic knowledge of Technology of Microbial cell maintenance
5. To enrich the students’ knowledge with respect to Downstream processing

**Course Outcomes:**

1. After studying unit-1, the student will be able to know the basic knowledge of Commercial Production of Microorganisms
2. After studying unit-2, the student will be able to understand about Products from Microorganisms
3. After studying unit-3, the student will be able to understand about Principles of Microbial growth
4. After studying unit-4, the student will be able to know about Technology of Microbial cell maintenance
5. After studying unit-5, the student will be able to know about the Downstream processing

**Unit I Modern Biotechnology**

Biotechnology- Brief outline, ancient Biotechnology classical biotechnology, the foundation of Modern Biotechnology, the DNA Revolution: Promise and Controversy, the early years of Molecular Biology, the first recombinant DNA Experiments, concerns about safety, drafting the NIH Guidelines

Current and Future Concerns

**Unit II Microbial Biotechnology**

Commercial Production of Microorganisms, Bioconversion, Microorganisms and Agriculture, Products from Microorganisms, Bioremediation, oil and Mineral Recovery

**Unit III Animal Biotechnology**

Future Animal Biotechnology, Gene Transfer Methods in Animals, Transgenic Animals, Animal Diseases, Animal Propagation, Conservation Biology, Regulation of Transgenic Animals, Patenting Genetically Engineered Animals

**Unit IV Marine Biotechnology**

Aquaculture, Marine Animal Health, Algal Products, Fuels from Algae, Algal Cell culture, Medical Application, Probing the marine Environment, Transgenic Fish, The Human Genome Project, Goals of the human genome, Genetic Linkage Maps, Polymorphic DNA Markers, Physical Maps, DNA sequencing, Ethical, Legal and Social Implications

**Unit V Medical Biotechnology**

Gene Therapy, Gene Delivery Methods,Viral Delivery,Models,Commercialization,Vaccines,Synthetic DNAs,Tissue Engineering, Xenotransplantation, Antibody Engineering,Dell Adhesion Based Therapy

Drug Delivery, Forensic and DNA Profiling, Satellite DNA, Population Genetics and Allele, Single and Multi-locus VNTRs, RFLPs, DNA Profiling, PCR, Digital DNA typing, Frye test, DNA Database

**References:**

1. Concept in biotechnology - D. Balasubraniam et al., Universal press India 1996.

2. Plant tissue culture - Razdan, Oxford IBH Publisher.

3. Animal cell culture - Freshney, IRL Press.

4. Animal Biotechnology - 2005. A.K. Srivastava, R.K. Singh and M.P. Yadav Oxford & IBH.

5. Molecular biotechnology 2006 - Channarayappa Univ. Press

**Text Books:**

6. Molecular Biology & Biotechnology - H.D. Kumar (1997), Vivas publishing house Pvt .Ltd

7. Molecular biotechnology - principle and application of recombinant DNA 3rd edition Bernard, R. Glick Jack, J. Pasternak 2003, Library of Congress cataloging in publication data.

8. A text book of Biotechnology - R. C. Dubey, S. Chand & co

9. Biotechnology - Prakash S. Lohar, MJP publisher, Chennai -5

10. Biotechnology: An Introduction - by Susan R. Barum

**Web Sources:**

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3722627/

https://www.intechopen.com/chapters/40265

https://www.creative-biolabs.com/gene-therapy/strategies-for-gene-delivery.htm

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Introduction to Biotechnology** | Core Practical-1 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

## [**Techniques**](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques)

[1. Lab Safety and Laboratory Notebook](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.01:_Lab_Safety_and_Laboratory_Notebook)

[2. Metrics and Measurements](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.02:_Metrics_and_Measurements)

[3. Micropipetting](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.03:_Micropipetting)

4. Sterilization of glasswares and media

[5. Microscopy](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.05:_Microscopy)

[6. Spectrophotometry](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.06:_Spectrophotometry)

7. [pH and Buffers](https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Manual:_Introduction_to_Biotechnology/01:_Techniques/1.07:_pH_and_Buffers)

**Reference Books:**

1. Das, S. K., Dash, S., Thatoi, H. N. (2017). Practical Biotechnology: Principles and Protocols. India: I.K. International Publishing House Pvt. Limited.
2. Bal Ram Singh and Raj Kumar, (2021). Practical Techniques in Molecular Biotechnology. UK: Cambridge University Press.
3. Lisa A. Seidman, Cynthia J. Moore, 2002. 3rd Edition, Basic Laboratory Methods for Biotechnology Text Book and Laboratory Reference, USA: CRC Press.

**Web Sources**

1. https://content.kopykitab.com/ebooks/2018/04/17800/sample/sample\_17800.pdf
2. https://www.freebookcentre.net/biology-books-download/Introduction-to-Biotechnology-Laboratory-Manual.html
3. https://www.routledge.com/Laboratory-Manual-for-Biotechnology-and-Laboratory-Science-The-Basics/Seidman-Kraus-Brandner-Mowery/p/book/9781032419916

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

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

# **Learning objectives:**

1. To enrich the knowledge of Measurements in Chemistry
2. To develop in-depth knowledge about Elements, compounds, and their composition
3. To provide the basic knowledge of Chemical Reactions
4. To provide the basic knowledge of oxidation-reduction reactions
5. To enrich the students’ knowledge with respect to Nuclear chemistry

**Course Outcomes:**

1. After studying unit-1, the student will be able to know the Measurements in Chemistry
2. After studying unit-2, the student will be able to understand about Elements, compounds, and their composition
3. After studying unit-3, the student will be able to understand about Chemical Reactions
4. After studying unit-4, the student will be able to know about oxidation-reduction reactions
5. After studying unit-5, the student will be able to know about the Nuclear chemistry

**Unit I**

Introduction to the Study of Chemistry, Measurements in Chemistry, Matter, Changes, and Energy.

**Unit II**

Elements, compounds, and their composition, the periodic table and chemical nomenclature

modern atomic theory, the chemical bond

**Unit III**

Chemical Reactions, quantitative relationships in chemistry, the gaseous state, the solid and liquid states, aqueous solutions

**Unit IV**

Acids, bases, and salts, oxidation-reduction reactions, reaction rates and equilibrium

**Unit V**

Nuclear chemistry, organic chemistry

**Text Books:**

1. Basic concepts of chemistry – by Leo J. Malone
2. Basic Physical Chemistry: The Route to Understanding, Revised Edition, July 2013, E Brian Smith (Formerly Master of St Catherine's College, Oxford, UK & Vice-Chancellor of Cardiff University, UK)

**Web Sources**

1. https://chem.libretexts.org/Bookshelves/Introductory\_Chemistry/Basics\_of\_General\_Organic\_and\_Biological\_Chemistry\_(Ball\_et\_al.)/01%3A\_Chemistry\_Matter\_and\_Measurement
2. https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Chemistry** | **Allied Practical-1** | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

# Practical:

**Unit: 1 Colorimetry**

1. Estimation of Glucose by O-Toluidine
2. Estimation of phosphorus by Fiske-Subbarow method
3. Estimation of Urea by DAM-TSC method
4. Estimation of Uric acid by Carraway method
5. Estimation of Iron by Wong’s method
6. Estimation of Protein by Lowry’s method
7. Estimation of Creatinine by Picric acid method
8. Estimation of RNA by Orcinol method.

# **Unit: 2 Volumetric Analysis**

1. Estimation of Sodium hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Ferrous sulphate using standard Mohr's salt
4. Estimation oxalic acid using standard Ferrous Sulphate.
5. Estimation of Potassium permanganate using standard Sodium hydroxide.
6. Estimation of Magnesium using EDTA.
7. Estimation of Ferrous iron using diphenylamine as internal indicator.

**Text Book(s)**

1. Pattabiraman, Laboratory manual in bio-chemistry.

2 J.Jayaraman, Practical bio-chemistry.

3. Basic Principles of practical Chemistry: Venkateswaran, Veerasamy & Kulandaivel, S.Chand & Co.

1. N. S. Gnanapragasam, G. Ramamurthy Organic Chemistry Lab Manual , S. Viswanathan Printers & Publishers Pvt. Ltd. Reprint 1996
2. I. Vogel, A Text Book of Quantitative Inorganic Analysis, Longman Publishers 6th Edn., 2009

# **Reference Books:**

1. Methods in Enzymology Vol. I and II by S.P. Colowick and N.O. Kaplana. New York: Academia Press 1955.
2. A Textbook of Practical Biochemistry by David Plummer. Tata McGraw- Hill Education, 1988.
3. Laboratory Mannual in Biochemistry by J. Jayaraman. New Age International Publishers. 2nd Edn. 1981.
4. Varley’s Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition, 1988.

**Web Sources:**

1. https://laboratorytests.org/colorimeter/
2. https://pubs.acs.org/doi/10.1021/jf950522b
3. https://pubmed.ncbi.nlm.nih.gov/7363448/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to POs** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

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

# **Learning objectives:**

To enrich the knowledge of Cells and Genomes

To develop in-depth knowledge about Visualizing Cells

To provide the basic knowledge of Intracellular compartments and Protein Sorting

To provide the basic knowledge of Intracellular Vesicular Traffic-1

To enrich the students’ knowledge with respect to Intracellular Vesicular Traffic-2

**Course Outcomes:**

After studying unit-1, the student will be able to know the Cells and Genomes

After studying unit-2, the student will be able to understand about Visualizing Cells

After studying unit-3, the student will be able to understand about Intracellular compartments and Protein Sorting

After studying unit-4, the student will be able to know about Intracellular Vesicular Traffic

After studying unit-5, the student will be able to know about the Intracellular Vesicular Traffic

**Unit I Cells and Genomes**

* Universal features of cells
* Genome diversity and tree of life
* Genetic information in eukaryotes

**Unit II Visualizing Cells**

* Looking at the structures of cell in the microscope
* Visualizing molecules and structures in living cells

**Unit III Intracellular compartments and Protein Sorting**

* The compartmentalization of cells
* The Transport of molecules between the nucleus and the cytosol
* The Transport of Proteins into Mitochondria and Chloroplasts
* Peroxisomes
* The Endoplasmic Reticulum

**Unit IV Intracellular Vesicular Traffic-1**

* The Molecular Mechanisms of Membrane Transport and the Maintenance of Compatmental Diversity
* Transport from the ER through the Golgi Apparatus

**Unit V Intracellular Vesicular Traffic-2**

* Transport from the *trans* Golgi Network to Lysomes
* Transport into the Cell from the Plasma Membrane: Endocytosis
* Transport from the trans Golgi Network to the Cell Exterior: Exocytosis

**Text Books:**

1. Nelson DL (January 2017). Lehninger principles of biochemistry. Cox, Michael M., Lehninger, Albert L. (Seventh ed.). New York, NY. ISBN 978-1-4641-2611-6. OCLC 986827885.
2. Lodish, Berk, Kaiser, Krieger, Bretscher, Ploegh, Martin, Yaffe, Amon (2021). Molecular Cell Biology (9th ed.). New York, NY: W.H. Freeman and Company. ISBN 978-1-319-20852-3.
3. Bruce Albert Lodish Cooper
4. Sheeler and Bianchi Walker and Rapley

**Web Sources**

1. Blobel G, Dobberstein B (December 1975). "Transfer of proteins across membranes. I. Presence of proteolytically processed and unprocessed nascent immunoglobulin light chains on membrane-bound ribosomes of murine myeloma". The Journal of Cell Biology. 67 (3):3551. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1083/jcb.67.3.835](https://doi.org/10.1083%2Fjcb.67.3.835). [PMC](https://en.wikipedia.org/wiki/PMC_(identifier)) [2111658](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2111658). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [811671](https://pubmed.ncbi.nlm.nih.gov/811671).
2. Schmidt V, Willnow TE (February 2016). ["Protein sorting gone wrong--VPS10P domain receptors in cardiovascular and metabolic diseases"](https://doi.org/10.1016%2Fj.atherosclerosis.2015.11.027). Atherosclerosis. 245: 194– 9. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1016/j.atherosclerosis.2015.11.027](https://doi.org/10.1016%2Fj.atherosclerosis.2015.11.027). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [26724530](https://pubmed.ncbi.nlm.nih.gov/26724530).
3. Guo Y, Sirkis DW, Schekman R (2014-10-11). "Protein sorting at the trans-Golgi network". Annual Review of Cell and Developmental Biology. 30 (1): 169–206. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1146/annurev-cellbio-100913-013012](https://doi.org/10.1146%2Fannurev-cellbio-100913-013012). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [25150009](https://pubmed.ncbi.nlm.nih.gov/25150009).
4. Leslie M (August 2005). ["Lost in translation: the signal hypothesis"](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2254867). The Journal of Cell Biology. 170 (3): 338. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1083/jcb1703fta1](https://doi.org/10.1083%2Fjcb1703fta1). [PMC](https://en.wikipedia.org/wiki/PMC_(identifier)) [2254867](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2254867). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [16167405](https://pubmed.ncbi.nlm.nih.gov/16167405)

**Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Cell Biology** | Core Practical-1 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

**Experiments:**

1. Microscope – Bright field and Dark field

2. Structure observation - Prokaryotic & Eukaryotic cell

3. Observation – Different types of cells – parenchyma, collenchymas, sclerenchyma, epithelium;

4. Observation - Cell division - Mitotic stages - Onion Root Tip, Meiotic stages – (Tradescantia) Flower bud, Binary fission of yeast

5. WBC cell count using Neubauer Counting Chamber

6. RBC cell count using Neubauer Counting Chamber

7. Identification and study of cancer cells by photomicrographs.

**Reference Books**

1. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
2. P.Gunasekaran. 2007. Laboratory Mannual in Microbiology. New Age International.
3. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
4. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by RonJon Publishing. Incorporated

**Web Sources**

1. https://webstor.srmist.edu.in/web\_assets/srm\_mainsite/files/files/BT0213%20-%20CELL%20BIOLOGY%20PRACTICAL%20MANUAL.pdf
2. https://sos.cg.nic.in/E-Books/12th/English/eng-book%20314%20Biology/Lab\_Manual.pdf
3. https://cellbiolady.com/wp-content/uploads/2019/05/CellBioLab-Manual-1.pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**FIRST YEAR: SEMESTER II**

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

# **Learning objectives:**

To enrich the knowledge of Nature and Subject of Biophysics

To develop in-depth knowledge about Thermal Molecular Movement, Order and Probability

To provide the basic knowledge of Energetics and Dynamics of Biological Systems

To provide the basic knowledge of the Mechanical Properties of Biological Materials

To enrich the students’ knowledge with respect to the Kinetics of Biological Systems

**Course Outcomes:**

After studying unit-1, the student will be able to know about Nature and Subject of Biophysics

After studying unit-2, the student will be able to understand about Thermal Molecular Movement, Order and Probability

After studying unit-3, the student will be able to understand about Energetics and Dynamics of Biological Systems

After studying unit-4, the student will be able to know about the Mechanical Properties of Biological Materials

After studying unit-5, the student will be able to know about the Kinetics of Biological Systems

**Unit I** **Nature and Subject of Biophysics**

* Molecular Structure of Biological Systems: Intramolecular Bonds
* Molecular Excitation and Energy Transfer

**Unit II Thermal Molecular Movement, Order and Probability**

* Molecular and Ional Interactions as the Basis for the Formation of Biological Structures
* Interfacial Phenomena

**Unit III Energetics and Dynamics of Biological Systems**

* Some Fundamental Concepts of Thermodynamics
* The Aqueous and Ionic Equilibrium of the Living Cell
* The Thermodynamic Analysis of Fluxes
* Non-equilibrium States of Ions in Cells and Organelles

**Unit IV The Mechanical Properties of Biological Materials**

* The Biomechanical Consequences of Fluid Behavior
* Physical Factors in the Environment: Temperature; Pressure
* Mechanical Oscillations; Electromagnetic Fields; Ionizing Radiation

**Unit V** **The Kinetics of Biological Systems**:

* The General Foundation of System Theory
* Metabolism and Exchange Systems
* Propagation, Growth and Evolution

**Text Books:**

Biophysics – by Roland Glaser

**References**

1. [Rodney M. J. Cotterill](https://en.wikipedia.org/wiki/Rodney_M._J._Cotterill) (2002). Biophysics : An Introduction. [Wiley](https://en.wikipedia.org/wiki/John_Wiley_%26_Sons). [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [978-0-471-48538-4](https://en.wikipedia.org/wiki/Special:BookSources/978-0-471-48538-4).
2. Sneppen K, Zocchi G (2005-10-17). Physics in Molecular Biology (1 ed.). [Cambridge University Press](https://en.wikipedia.org/wiki/Cambridge_University_Press). [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [978-0-521-84419-2](https://en.wikipedia.org/wiki/Special:BookSources/978-0-521-84419-2).
3. Glaser R (2004-11-23). Biophysics: An Introduction (Corrected ed.). Springer. [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [978-3-540-67088-9](https://en.wikipedia.org/wiki/Special:BookSources/978-3-540-67088-9).
4. Hobbie RK, Roth BJ (2006). [Intermediate Physics for Medicine and Biology](https://files.oakland.edu/users/roth/web/hobbie.htm) (4th ed.). Springer. [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [978-0-387-30942-2](https://en.wikipedia.org/wiki/Special:BookSources/978-0-387-30942-2).

**Web Sources**

1. Cooper WG (August 2009). "Evidence for transcriptase quantum processing implies entanglement and decoherence of superposition proton states". Bio Systems. **97** (2): 73–89. [*doi*](https://en.wikipedia.org/wiki/Doi_(identifier)):[*10.1016/j.biosystems.2009.04.010*](https://doi.org/10.1016%2Fj.biosystems.2009.04.010). [*PMID*](https://en.wikipedia.org/wiki/PMID_(identifier)) [*19427355*](https://pubmed.ncbi.nlm.nih.gov/19427355).

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Biophysics** | **Allied Practical-1** | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

1. Basic Laboratory Techniques
2. Quantification of Protein and Nucleic acid Concentration using spectrophotometer
3. Chromatography - Gel Electrophoresis of Proteins using SDS- PAGE
4. Chromatography - Gel Electrophoresis of Proteins and Nucleic acids using Agarose Gel Electrophoresis
5. Isolation and Characterization of the Enzyme Alkaline Phosphatase from *Escherichia coli*.

**Text Books:**

1. Block-2 , Practical Manual-Biophysics - Indira Gandhi Nation Open University, New Delhi
2. Meurant G. (2014). *Practical capillary electrophoresis*. Elsevier Science. Retrieved May 4 2023 from http://qut.eblib.com.au/patron/FullRecord.aspx?p=1130071.
3. Block R. J. Durrum E. L. & Zweig G. (2013). A manual of paper chromatography and paper electrophoresis (2nd ed.). Elsevier Science. Retrieved May 4 2023 from https://public.ebookcentral.proquest.com/choice/publicfullrecord.aspx?p=1837581.

**Web Sources**

1. http://egyankosh.ac.in//handle/123456789/64189
2. https://upf.biochem.oregonstate.edu/lab-manual-pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**SECOND YEAR SEMESTER-III**

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

# **Learning objectives:**

To enrich the knowledge of Microbes and parasites

To develop in-depth knowledge about entry, exit and transmission

To provide the basic knowledge of Parasite survical strategies and persistent infections

To provide the basic knowledge of General principles and specimen quality

To enrich the students’ knowledge with respect to Microbiological techniques for the diagnosis of infection

**Course Outcomes:**

After studying unit-1, the student will be able to know about the Microbes and parasites

After studying unit-2, the student will be able to understand about Entry, exit and transmission

After studying unit-3, the student will be able to understand about Parasite survical strategies and persistent infections

After studying unit-4, the student will be able to know about General principles and specimen quality

After studying unit-5, the student will be able to know about Microbiological techniques for the diagnosis of infection

**Unit I Microbes and parasites**

* The host-parasite relationship
* The organisms

**Unit II Entry, exit and transmission**

* Natural defence in action
* Spread and replication

**Unit III Parasite survival strategies and persistent infections**

* Pathological consequences of infection
* parasite immune evasion, immunological privilege sites,
* antigenic disguise, antigenic mimicry,
* alternatively activated macrophages,
* immune checkpoints, regulatory immune cells, insect vectors

**Unit IV General principles and specimen quality**

* Description of pathogenesis, etiology and laboratory diagnosis of bacteraemia, blood stream infections
* Respiratory tract infections (Pneumonia, Flu) Central Nervous System infections (meningitis, encephalitis) Urinary tract infections and Gastrointestinal tract infections (*E. coli* and *Klebsiella*).
* Sexually transmitted diseases: *Treponema, Neisseria*

**Unit V Microbiological techniques for the diagnosis of infection**

### Manifestations of Infection, Microbial Causes of Infection,

### Specimen Selection, Collection, and Processing

### Microbiologic Examination

**References:**

1. Aron EJ, Pererson LR, Finegold SM (eds): Bailey and Scott's Diagnostic Microbiology. 9th ed. CV Mosby, St. Louis, 1994 .
2. Koneman EW, Allen SD, Schreckenberg PC, Winn WC (eds): Atlas and Textbook of Diagnostic Microbiology. 4th ed. JB Lippincott, Philadelphia, 1992 .
3. Kunin CM: Detection, Prevention and Management of Urinary Tract Infections. 4th ed. Lea & Febiger, Philadelphia, 1987 .
4. Murray PR, Baron EJ, Pfaller MA, Tenover PC, Yolken RH (eds): Manual of Clinical Microbiology. 6th ed. American Society for Microbiology, Washington, DC, 1995 .
5. Pennington JE (ed): Respiratory Infections: Diagnosis and Management. 3rd ed. Raven Press, New York, 1994 .

**Text Books:**

1. Mosby (1998) Diagnostic Microbiology , Bailey and Swotts, 10th Edition, published.
2. David Greenwood, Richard C.B.Slack, John.F.Peutherer (2002) Medical Microbiology, 16th Edition.
3. Sharma J.B(2022) Medical Microbiology – A Clinical perspective, paras publishing.
4. Patrick R.Murray, Ken.S.Rosenthal, George.S.Kobayashi, Michael A. Ptaller,(1997) Medical Microbiology, 3rd Edition.
5. Jawetz, Melnick and Adelberg’s, Medical Microbiology (2004) 23rd Edition, Mc Graw Hill.

**Web Sources:**

1. https://basicmedicalkey.com/parasite-survival-strategies-and-persistent-infections/
2. https://www.clinicalkey.com/#!/content/book/3-s2.0 B9780702071546000175?scrollTo=%23hl0000638
3. https://www.science.org/doi/10.1126/sciadv.aap7399
4. https://pubmed.ncbi.nlm.nih.gov/29546242/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | MEDICAL MICROBIOLOGY – A | Core Practical-1 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

1. Laboratory precautions.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Culture media preparation – Liquid and Solid medium.
4. Methods of sterilization.
5. Pure culture techniques – Pour plate, Spread plate and Streak plate methods (Simple, Quadrant and Continuous).
6. Determination of Motility – Hanging drop
7. Staining of Bacteria - Simple, Negative, Gram, Spore, Fungal wet mount –LCB - Slide culture method.
8. Isolation of pure cultures of bacteria by streaking method. Estimation of CFU count by spread plate method/pour plate method.

**References**

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.

2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall

3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.

4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.

5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht

**Text Books**

1. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
2. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott’s Microbiology. 9th edition. McGraw Hill Higher Education.

**Web Sources**

* 1. https://www.jaypeedigital.com/book/9788184486377
  2. https://onlinelibrary.wiley.com/doi/book/10.1128/9781555817381
  3. https://www.wiley.com/enus/Manual+of+Clinical+Microbiology%2C+2+Volume+Set%2C+12th+Edition-p-9781555819835
  4. https://www.studocu.com/en-us/document/california-state-polytechnic-university-pomona/medical-bacteriology/bio-4635l-medical-microbiology-lab-manual/4577069
  5. https://www.cbspd.co.in/competency-based-practical-manual-of-medical-microbiology

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**SECOND YEAR: SEMESTER III**

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

# **Learning objectives:**

To enrich the knowledge of Mendelian Genetics

To develop in-depth knowledge about Replication.

To provide the basic knowledge of Linkage, Crossing-Over

To provide the basic knowledge of Transposable Genetic Elements

To enrich the students’ knowledge with respect to Mutation.

**Course Outcomes:**

After studying unit-1, the student will be able to know about Mendelian Genetics

After studying unit-2, the student will be able to understand about Replication.

After studying unit-3, the student will be able to understand about Linkage, Crossing-Over

After studying unit-4, the student will be able to know about Transposable Genetic Elements

After studying unit-5, the student will be able to know about Mutation.

**Unit I**

Mendelian Genetics. Cell Mechanics. Sex Determination and Sex Linkage.

**Unit II**

Genetic Material: Properties and Replication. Structure and Replication of Eukaryotic Chromosomes.

**Unit III**

Linkage, Crossing-Over, and Chromosome Mapping. Recombination in Bacteria.

**Unit IV**

Transposable Genetic Elements. Gene Expression.

**Unit V**

Mutation.

**Text Books:**

Principles of Genetics – by Eldon J. Gadner, D. Peter Snustad, Michael J. Simmons

**References:**

1. Rolston, Holmes (1999-02-13). Genes, Genesis, and God. ISBN 9780521646741. Retrieved 6 April 2015.
2. Tamarin, Robert H.; Krebs, Charles J. (1973). "Selection at the transferrin locus in cropped vole populations1". Heredity. **30** (1): 53–62. doi:10.1038/hdy.1973.6. PMID 4510057.
3. Paul, Diane B. (January 1998). The Politics of Heredity. ISBN 9780791438213. Retrieved 6 April 2015.
4. "Principles of Genetics Tamarin 7th Edition". scribd.com. Retrieved 6 April 2015.

**Web Sources:**

1. https://bioprinciples.biosci.gatech.edu/module-4-genes-and-genomes/4-2-4-mendelian-genetics/
2. https://onlinelibrary.wiley.com/doi/full/10.1111/cge.13107

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low – 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Genetics-A** | Allied Practical-1 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

**Experiments:**

1. Mitotic stages of onion (*Allium cepa*) root tip preparation
2. Meiotic stages of cockroach testes/ flower bud preparation
3. Giant chromosomes of Chironomous larvae/ Drosophila salivary glands
4. Identification of Barr bodies from buccal smear preparation
5. Human karyotyping (Demo)

**Text Books:**

# Genetics with Practicals by [Dr. Rajashri P. Nemade, Dr. S. R. Gaikwad, Dr. N G. Mahajan, Dr. Manojkumar Chopda](https://www.kopykitab.com/index.php?route=product/search&q=Dr.+Rajashri+P.+Nemade%2C+Dr.+S.+R.+Gaikwad%2C+Dr.+N+G.+Mahajan%2C+Dr.+Manojkumar+Chopda), 2019, First Edition, [Prashant Publications](https://www.kopykitab.com/Prashant-Publications)

# Practical Manual of Genetics & Plant Breeding, 2022, by Bineeta Singh, G.M. LaL, **ISBN:** 9789390660513.

**Web Sources**

1. https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Genetics.pdf
2. https://coabnau.in/uploads/1610707528\_GPB3.2PracticalManual-Final.pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**SECOND YEAR SEMESTER-IV**

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

# **Learning objectives:**

To enrich the knowledge of clinical manifestations of infection

To develop in-depth knowledge about Urinary tract infections

To provide the basic knowledge of Obstetric and perinatal infections

To provide the basic knowledge of General principles and specimen quality

To enrich the students’ knowledge with respect to Vector-borne infections

**Course Outcomes:**

After studying unit-1, the student will be able to know about clinical manifestations of infection

After studying unit-2, the student will be able to understand about Urinary tract infections

After studying unit-3, the student will be able to understand about Obstetric and perinatal infection

After studying unit-4, the student will be able to know about General principles and specimen quality

After studying unit-5, the student will be able to know about Vector-borne infections

**Unit I**

* The clinical manifestations of infection: An introduction
* Upper respiratory tract infections
* Infections of the eye
* Lower respiratory tract infections

**Unit II**

* Urinary tract infections
* Sexually transmitted diseases
* Gastrointestinal tract infections

**Unit III**

* Obstetric and perinatal infections
* Central nervous system infections
* Infections of the skin, muscle, joints, bone and haemopoietic system

**Unit IV**

* World-wide virus infections
* Vector-borne infections
* Multisystem zoonoses
* Pyrexia of unknown origin
* Infection in the compromised host

**Unit V**

* Strategies for control: An introduction Antimicrobial agents and chemotherapy Vaccination
* Passive and non-specific immunotherapy
* Epidemiological aspects of the control of infection and disease, Hospital infection, sterilization and disinfection

**References**

1. Aron EJ, Pererson LR, Finegold SM (eds): Bailey and Scott's Diagnostic Microbiology. 9th ed. CV Mosby, St. Louis, 1994 .
2. Koneman EW, Allen SD, Schreckenberg PC, Winn WC (eds): Atlas and Textbook of Diagnostic Microbiology. 4th ed. JB Lippincott, Philadelphia, 1992 .
3. Kunin CM: Detection, Prevention and Management of Urinary Tract Infections. 4th ed. Lea & Febiger, Philadelphia, 1987.
4. Murray PR, Baron EJ, Pfaller MA, Tenover PC, Yolken RH (eds): Manual of Clinical Microbiology. 6th ed. American Society for Microbiology, Washington, DC, 1995 .
5. Pennington JE (ed): Respiratory Infections: Diagnosis and Management. 3rd ed. Raven Press, New York, 1994.

**Text Books**

1. Woods GL, Washington JA: The Clinician and the Microbiology Laboratory. Mandell GL, Bennett JE, Dolin R (eds): Principles and Practice of Infectious Diseases. 4th ed. Churchill Livingstone, New York, 1995.
2. Medical Microbiology –by David Greenwood BSc PhD DSc FRCPath (Editor), Richard C. B. Slack MA MB BChir FFPHM MRCPath DRCOG (Editor), Michael R. Barer MBBS PhD FRCPath (Editor), Will L Irving (Editor)
3. Bailey & Scott's Diagnostic Microbiology: 15ed Hardcover – 9 April 2021, Elsevier Publications.
4. David Greenwood, Richard C.B.Slack, John.F.Peutherer (2002) Medical Microbiology, 16th Edition.
5. Sharma J.B(2022) Medical Microbiology – A Clinical perspective, paras publishing.
6. Patrick R.Murray, Ken.S.Rosenthal, George.S.Kobayashi, Michael A. Ptaller,(1997) Medical Microbiology, 3rd Edition.
7. Jawetz, Melnick and Adelberg’s, Medical Microbiology (2004) 23rd Edition, Mc Graw Hill.

**Web Sources**

* 1. https://www.ncbi.nlm.nih.gov/books/NBK532961/
  2. https://my.clevelandclinic.org/health/articles/4022-upper-respiratory-infection
  3. https://www.medicalnewstoday.com/articles/324413
  4. https://www.sciencedirect.com/topics/nursing-and-health-professions/upper-respiratory-tract-infection
  5. https://www.ncbi.nlm.nih.gov/books/NBK532961/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Medical Microbiology -B** | Core Practical-1 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

1. Measurement of Microbial growth –Turbidity methods – Determination of Generation time, Neubaur Counting chamber.
2. Indole, MR, VP, Citrate utilization tests
3. Carbohydrate fermentation tests – TSI – H2S production tests
4. Catalase – Oxidase – Urease – Nitrate production tests
5. Starch hydrolysis, Gelatin and Casein hydrolysis tests
6. Antibiotic sensitivity test (Demo)
7. Observation of representative forms of Fungi – Aspergillus – Pencillium – Rhizopus – Yeast
8. Observation of representative forms of Parasites – *Entamoeba , Plasmodium, Ascaris, Taenia.*

**References**

1. James Cappuccino. Microbiology: A Laboratory Manual 10thEd.
2. William Claus. G.W. (1989). Understanding Microbes – A Laboratory textbook for Microbiology, W.H. Freeman and Co., New York.
3. Wilson. K and Goulding. K.H, (1986). A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London.
4. Dubey*,* R.C. & D.K. Maheshwari*.* Practical Microbiology*.* S. Chand & Co
5. Kannan. N (1996). Laboratory Manual in General Microbiology. Palani Paramount Publication, Palani.
6. Tiwari, G. S. Hoondal, (2005). Laboratory Techniques In Microbiology & Biotechnology. Swastik publishers.
7. K. R. Aneja, (2018). Laboratory Manual of Microbiology and Biotechnology, ED-TECH

**Web Sources**

1. https://asm.org/ASM/media/Protocol-Images/Triple-Sugar-Iron-Agar-Protocols.pdf?ext=.pdf
2. https://www.barnesandnoble.com/w/passive-and-non-specific-immunotherapy-richard-goering/1115568682
3. https://www.academia.edu/50938129/Medical\_Microbiology\_Murray\_9th\_Edition
4. https://apps.who.int/iris/bitstream/handle/10665/352275/9789240038059eng.pdf?sequence=1&isAllowed=y
5. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4711191/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**SECOND YEAR: SEMESTER IV**

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

# **Learning objectives:**

To enrich the knowledge of Classical Genetics

To develop in-depth knowledge about Regulation of Gene Expression in Prokaryotes

To provide the basic knowledge of Genetic Control of Cell Division

To provide the basic knowledge of Extrachromosomal Inheritance

To enrich the students’ knowledge with respect to Population and Evolutionary Genetics

**Course Outcomes:**

After studying unit-1, the student will be able to know about Classical Genetics

After studying unit-2, the student will be able to understand about Regulation of Gene Expression in Prokaryotes

After studying unit-3, the student will be able to understand about Genetic Control of Cell Division. After studying unit-4, the student will be able to know about Extrachromosomal Inheritance

After studying unit-5, the student will be able to know about Population and Evolutionary Genetics

**Unit I**

Genetic Fine Structure: Classical Genetics. Genetic Fine Structure: Gene Cloning and Sequencing.

**Unit II**

Regulation of Gene Expression in Prokaryotes. Regulation of Gene Expression and Development in Eukaryotes. Genetic Control of the Immune Response.

**Unit III**

Genetic Control of Cell Division: Oncogenes and Protooncogenes. Variations in Chromosome Structure. Variations in Chromosome Number.

**Unit IV**

Extrachromosomal Inheritance. Quantitative Genetics.

**Unit V**

Population and Evolutionary Genetics. Genetics of Behavior. Genetic Engineering and the Future.

**Text Books:**

Principles of Genetics – by Eldon J. Gadner, D. Peter Snustad, Michael J. Simmons

**References:**

1. Rolston, Holmes (1999-02-13). Genes, Genesis, and God. ISBN 9780521646741. Retrieved 6 April 2015.
2. Tamarin, Robert H.; Krebs, Charles J. (1973). "Selection at the transferrin locus in cropped vole populations1". Heredity. **30** (1): 53–62. doi:10.1038/hdy.1973.6. PMID 4510057.
3. Paul, Diane B. (January 1998). The Politics of Heredity. ISBN 9780791438213. Retrieved 6 April 2015.
4. "Principles of Genetics Tamarin 7th Edition". scribd.com. Retrieved 6 April 2015.

**Web Sources**

1. https://www.nature.com/scitable/topicpage/proto-oncogenes-to-oncogenes-to-cancer-883/
2. https://www.nature.com/scitable/topicpage/cell-cycle-control-by-oncogenes-and-tumor-14191459/
3. https://www.ncbi.nlm.nih.gov/books/NBK12538/
4. https://www.ncbi.nlm.nih.gov/books/NBK26816/
5. https://plato.stanford.edu/entries/population-genetics/

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Genetics- B** | Allied Practical-4 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

1. Study of different types of DNA and RNA using micrographs.
2. Extraction of genomic DNA, quantitative estimation (A260) and estimation of purity (A260/280).
3. Estimations: DNA by Diphenylamine method; RNA by Orcinol method; Protein by Folin-Lowry method
4. Isolation of total DNA from *E.coli*. and detection by agarose gel electrophoresis.
5. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE) – Demonstration

# **References**

1. Frobisher M, Fundamentals of Microbiology, W. B. Saunders Co, Philadelphia.
2. Pelczar MJ, Chan ECS and Krieg NR. Microbiology. McGraw Hill Book Company. Willey JM, Sherwood LM, and Woolverton CJ. Prescott’s Microbiology. McGraw Hill Higher Education.
3. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. General Microbiology. McMillan Press.
4. Tymoczko JL, Berg JM and Stryer L. Biochemistry, W.H. Freeman and Company
5. Nelson DL and Cox MM. Lehninger Principles of Biochemistry, W.H. Freeman and Company.

**Text Books**

1. Goodenough U, Genetics, Holt, Rinehart & Winston of Canada Ltd.
2. Gardner EJ, Simmons MJ, Snustad DP. Principles of Genetics. Wiley-India.
3. Maloy SR, Cronan JE and Friefelder D. Microbial Genetics, Jones and Barlett Publishers.
4. Strickberger M, Microbial Genetics, Prentice Hall India Learning Private Limited
5. Goldstein ES, Lewin’s Genes, Jones and Bartlett Publishers.

**Web Sources**

1. https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1008&context=ny\_oers
2. https://www2.umbc.edu/summerstem/documents/biology/BIOL302L-SU14-Caruso.pdf
3. https://www.rlbcau.ac.in/pdf/Agriculture/AGP%20113%20%20Fundamentals%20of%20Genetics.pdf
4. https://www.researchgate.net/publication/334330459\_Practical\_Manual\_on\_Fundamentals\_of\_Genetics\_PBG-121
5. https://uou.ac.in/sites/default/files/slm/BSCZO-103.pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**THIRD YEAR SEMESTER-V**

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

# **Learning objectives:**

* To enrich the knowledge of Biochemistry & Medicine
* To develop in-depth knowledge about Carbohydrates of Physiologic Significance
* To provide the basic knowledge of Biosynthesis of Fatty Acids
* To provide the basic knowledge of Metabolism of Purine & Pyrimidine Nucleotides
* To enrich the students’ knowledge with respect to Population and Evolutionary Genetics

**Course Outcomes:**

* After studying unit-1, the student will be able to know about Biochemistry & Medicine
* After studying unit-2, the student will be able to understand about Carbohydrates of Physiologic Significance
* After studying unit-3, the student will be able to understand about Biosynthesis of Fatty Acids
* After studying unit-4, the student will be able to know about Integration of Metabolism - the Provision of Metabolic Fuels
* After studying unit-5, the student will be able to know about Metabolism of Purine & Pyrimidine Nucleotides

**Unit I**

* Biochemistry & Medicine
* Water & pH
* Amino Acids & Peptides
* Proteins: Myoglobin & Hemoglobin
* Bioenergetics: The Role of ATP
* Biologic Oxidation
* The Respiratory Chain & Oxidative Phosphorylation

**Unit II**

* Carbohydrates of Physiologic Significance
* Lipids of Physiologic Significance
* Overview of Metabolism
* The Citric Acid Cycle: The Catabolism of Acetyl-CoA
* Glycolysis & the Oxidation of Pyruvate
* Metabolism of Glycogen
* Gluconeogenesis & Control of the Blood Glucose
* The Pentose Phosphate Pathway & Other Pathways of Hexose Metabolism

**Unit III**

* Biosynthesis of Fatty Acids
* Oxidation of Fatty Acids: Ketogenesis
* Metabolism of Unsaturated Fatty Acids & Eicosanoids
* Metabolism of Acylglycerols & Sphingolipids
* Lipid Transport & Storage
* Cholesterol Synthesis, Transport, & Excretion

**Unit IV**

* Integration of Metabolism - the Provision of Metabolic Fuels
* Biosynthesis of the Nutritionally Nonessential Amino Acids
* Catabolism of Proteins & of Amino Acid Nitrogen
* Catabolism of the Carbon Skeletons of Amino Acids Conversion of Amino Acids to Specialized Products Porphyrins & Bile Pigments

**Unit V**

* Nucleotides
* Metabolism of Purine & Pyrimidine Nucleotides
* The Diversity of the Endocrine System
* Hormone Action

**Text Books:**

Harper’s Illustrated Biochemistry – Robert Murray, Peter A., Mayes, Victor W. Rodwell, Daryl K. Granner Leninger: Principles of Biochemistry, (2012) 29th ed, V.W., Lange Medical Books/McGraw Hill.

Voet **Fundamentals of Biochemistry**: Life at the Molecular Level

Garrett and Grisham – Biochemistry. Saunders College Publishers, 1995.

Murray, K. Robert, et al., - Harper’s Biochemistry. 29th edition, 2012

Lippincott’s Biochemistry - P.C. Champe. 4th Edition. 2010 John Wiley and Sons,

Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M.,W.H.Freeman and Company, New York.

Mathews, Freeland and Miesfeld - Biochemistry – a short course.Wiley & sons. 1996.

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | Human Biochemistry | Core Practical-5 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

# Practical:

**Unit: 1 Colorimetry**

1. Estimation of Glucose by O-Toluidine
2. Estimation of phosphorus by Fiske-Subbarow method
3. Estimation of Urea by DAM-TSC method
4. Estimation of Uric acid by Carraway method
5. Estimation of Iron by Wong’s method
6. Estimation of Protein by Lowry’s method
7. Estimation of Creatinine by Picric acid method
8. Estimation of RNA by Orcinol method.

**Unit -2 Demonstration Experiments**

1. Preparation of buffer and its pH measurements using pH meter.
2. Separation of amino acids by **Paper chromatography** and TLC.

**Text Book(s)**

1 Pattabiraman, Laboratory manual in bio-chemistry.

2 J.Jayaraman, Practical bio-chemistry.

# Reference Books:

1. Methods in Enzymology Vol. I and II by S.P. Colowick and N.O. Kaplan eds. New York: Academia Press 1955.
2. A Textbook of Practical Biochemistry by David Plummer. Tata McGraw- Hill Education, 1988.
3. Laboratory Mannual in Biochemistry by J. Jayaraman. New Age International Publishers. 2nd Edn. 1981.
4. Varley’s Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishers and distributors, India Sixth Edition, 1988.

**Web Sources**

https://kau.in/sites/default/files/documents/prsvkm\_laboratory\_manual\_of\_biochemistry.pdf

https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**THIRD YEAR: SEMESTER V**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper: 6** ENZYME TECHNOLOGY | **Core** | 3 | 2 | - | - | 5 | 5 | 25 | 75 | 100 |

# **Learning objectives:**

To enrich the knowledge of enzymes and function

To develop in-depth knowledge about Enzyme Kinetics

To provide the basic knowledge of Regulatory enzymes

To provide the basic knowledge of Production of enzymes

To enrich the students’ knowledge with respect to Synthesis of chemicals using enzymes

**Course Outcomes:**

After studying unit-1, the student will be able to know about enzymes and function

After studying unit-2, the student will be able to understand about Enzyme Kinetics

After studying unit-3, the student will be able to understand about Regulatory enzymes

After studying unit-4, the student will be able to know about Production of enzymes

After studying unit-5, the student will be able to know about Synthesis of chemicals using enzymes

**Unit I**

Introduction: Enzymes are mainly proteins, enzymes are classified by the reactions they catalyze.

Enzyme function: Enzymes affect reaction rates not equilibria, Reaction rates and equilibria have precise thermodynamic definition, Principles behind catalytic power and specificity of enzymes, Weak interaction between enzyme and substrate are optimized in transition state, Enzyme use binding energy to provide reaction specificity and catalysis, Specific catalytic groups contribute to catalysis.

**Unit II**

Enzyme Kinetics: Kinetics and mechanism, Substrate concentration and rate of reaction, Quantitative expression of relationship between substrate concentration and rate of reaction, The meaning of Vmax and Km, Enzymes catalyzing reactions involving two or more substrate Pre-steady state kinetics can provide evidence for specific reaction.Enzyme Inhibition:Reversible and irreversible, Effect of pH, Examples of enzymatic reactions.

**Unit III**

Regulatory enzymes:Allosteric enzymes are regulated by non-covalent binding of modulators, Allosteric organs are exceptions to many general rules, two models explain the kinetic behavior of allosteric enzymes, Other mechanisms of enzyme regulation.

**Unit IV**

Production of enzymes: Enzymes from animal and plant sources, Enzymes from microbial sources, Large scale production, Biochemical fundamentals, Genetic engineering, Recovery of enzymes, Isolation of soluble enzymes, Enzyme purification, Immobilised enzymes, Legislative and safety aspects.

**Unit V**

Synthesis of chemicals using enzymes:Hydrolytic enzymes, Chiral building blocks for synthesis, Reduction and oxidation, Use of enzymes, in sugar chemistry, Use of enzymes to make amino acids and peptides.

#### **Reference Books:**

1. A text of biochemistry, - A.V.S.S. Rama Rao 9th ed. (UBS Publisher’s and Distributors Pvt. Ltd.)
2. Leninger: Principles of Biochemistry, 3nd Ed. – Nelson D. et al (Worth Publishers)

**Text books**

1. Trevor Palmer, 3rd edition, 1991. Understanding enzymes. Ellis-Horwood Limited.
2. Enzymes – Dixon and Webb
3. Enzyme Technology – Chapline & Bucke
4. Alan Welshman, 2nd edition,
5. Hand book of enzyme biotechnology
6. Biochemistry, 5th, - Ed. Breg, J.M. Tymoczko J.L. and Stryer L. (W.H. Freeman & Co.)

**Web Sources:**

1. https://www.khanacademy.org/science/ap-biology/cellular-energetics/environmental-impacts-on-enzyme-function/a/enzyme-regulation
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=4066
3. https://pubs.acs.org/doi/10.1021/acscatal.8b03326

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | ENZYME TECHNOLOGY | Core Practical-6 | - | - | 2 | - | 2 | 4 | 40 | 60 | 100 |

**Unit: 1 Enzymes**

1. Preparation of crude enzyme extract.
2. Effect of pH on the activity of acid phosphatase and catalase.
3. Effect of temperature on the activity of acid phosphatase and catalase.
4. Effect of enzyme concentration on the activity of acid phosphatase and catalase.
5. Effect of substrate concentration on the activity of acid phosphatase and catalase.

**Unit: 2 Kit Method: (Demonstration Experiment)**

1. Estimation of SGOT
2. Estimation of SGPT
3. Estimation of Triglycerides
4. Estimation of Hemoglobin

**Reference Books:**

1. Bioprocess Engineering by Shule and Kargi Prentice Hall.

2. Chemical Engineering Kinetics by Smith J.M. McGraw Hill.

3. Enzyme Technology by M.F. Chaplin and C. Bucke, Cambridge University Press, Cambridge.

**Web Sources**

https://www.studocu.com/in/document/chandigarh-university/web-designing-lab/enzyme-technology-and-biokinetics-lab-manual-bt-47l/44573190

https://www.coursehero.com/file/75477779/Lab-Manualpdf/

https://www.avit.ac.in/lab/immunology\_bioprocess\_engineering\_lab/download/17BTCC91/lab\_manual.pdf

http://projekty.ipan.lublin.pl/uploads/laboratory\_manual.pdf

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**THIRD YEAR: SEMESTER V**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper: 7**  **FERMENTATION TECHNOLOGY** | **Core** | 3 | 2 | - | - | 5 | 5 | 25 | 75 | 100 |

# **Learning objectives:**

To enrich the knowledge of Introduction to fermentation processes

To develop in-depth knowledge about the isolation, preservation and improvement of industrial microorganisms

To provide the basic knowledge of development of inocula for industrial fermentations

To provide the basic knowledge of Aeration and agitation

To enrich the students’ knowledge with respect to Effluent treatment

**Course Outcomes:**

After studying unit-1, the student will be able to know about Introduction to fermentation processes

After studying unit-2, the student will be able to understand about the isolation, preservation and improvement of industrial microorganisms

After studying unit-3, the student will be able to understand about development of inocula for industrial fermentations

After studying unit-4, the student will be able to know about Aeration and agitation

After studying unit-5, the student will be able to know about Effluent treatment

**Unit I**

* Introduction to fermentation processes
* Microbial Growth Kinetics

**Unit II**

* The isolation, preservation and improvement of industrial microorganisms
* Media for industrial fermentations
* Sterilization

**Unit III**

* The development of inocula for industrial fermentations
* Design of a fermentor
* Instrumentation and control

**Unit IV**

* Aeration and agitation
* The recovery and purification of fermentation products

**Unit V**

* Effluent treatment
* Fermentation economics

**Text Books**

1. Industrial Microbiology:An Introduction
2. Mike J. Waites, Neil Morgan, John Rockey, Gary Higton, John S. Rockey Bioreactor Operation, BIOTOL series
3. Product Recovery in Bioprocess Technology, BIOTOL Series
4. Principles of fermentation technology – P.F. Stanbury et.al.
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.

**Web Sources**

1. https://www.brainkart.com/article/Strain-isolation,-improvement-and-preservation\_21313/
2. https://edscl.in/pluginfile.php/2834/mod\_resource/content/1/17-7-ET-V1-S1\_\_l-7\_theory\_the\_preservation\_of\_microbes.pdf
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6017179/
4. https://link.springer.com/article/10.1007/s00449-019-02101-0
5. https://www.sciencedirect.com/topics/engineering/downstream-processing

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**THIRD YEAR: SEMESTER VI**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper: 8** ETHICAL ISSUES IN BIOTECHNOLOGY | **Core** | 3 | 2 | - | - | 5 | 5 | 25 | 75 | 100 |

* Fundamental Issues of Ethics and Biotechnology

# **Learning objectives:**

To enrich the knowledge of Ethical Questions about Genetic Engineering

To develop in-depth knowledge about Ethical Issues in Food Biotechnology

To provide the basic knowledge of Ethics of Using Animals for Human Benefit

To provide the basic knowledge of Human Genetic Testing and Therapy

To enrich the students’ knowledge with respect to Human Cloning and Stem Cell Research

**Course Outcomes:**

* After studying unit-1, the student will be able to know about Genetic Engineering
* After studying unit-2, the student will be able to understand about Ethical Issues in Food Biotechnology
* After studying unit-3, the student will be able to understand about Ethics of Using Animals for Human Benefit
* After studying unit-4, the student will be able to know about Human Genetic Testing and Therapy
* After studying unit-5, the student will be able to know about Human Cloning and Stem Cell Research

**Unit I**

* How to Assess the Consequences of Genetic Engineering
* Redesigning the World: Ethical Questions about Genetic Engineering
* The Scientific and Health Aspects of Genetically Modified Foods: Rapporteurs
* The Safety of Foods Developed by Biotechnology
* Hazards of Genetically Engineered Foods and Crops: Why We Need a Global Moratorium
* Why We Need Labeling of Genetically Engineered Food

**Unit II**

* Ethical Issues in Food Biotechnology
* Animal Biotechnology
* A Critical View of the Genetic Engineering of Farm Animals
* The "Frankenstein Thing": The Moral Impact of Genetic Engineering of Agricultural Animals on Society and Future Science

**Unit III**

* On the Ethics of Using Animals for Human Benefit
* The Case for the Use of Animals in Biomedical Research
* Artificial Lives: Philosophical Dimensions of Farm Animal Biotechnology
* Genetic Engineering as Animal Slavery
* Uncertainty in Xenotransplantation: Individual Benefit versus Collective Risk
* Critical Ethical Issues in Clinical Trials with Xenotransplants

**Unit IV**

* Human Genetic Testing and Therapy
* Social, Legal, and Ethical Implications of Genetic Testing
* Genetic Links, Family Ties, and Social Bonds: Rights and Responsibilities in the Face of Genetic Knowledge
* Human Inheritable Genetic Modifications: Assessing Scientific, Ethical, Religious, and Policy Issues
* Germ-Line Genetic Engineering and Moral Diversity

**Unit V**

* Human Cloning and Stem Cell Research
* Human Cloning: Report and Recommendations of the National Bioethics Advisory Commission
* The Wisdom of Repugnance
* Genetic Encores: The Ethics of Human Cloning
* Stem Cell Research and Applications: Findings and Recommendations
* On Human Embryos and Stem Cell Research: An Appeal for Legally and Ethically Responsible Science and Public Policy

**Text Books:**

1. Ethical Issues in biotechnology, 2002, by Richard Sherlock (Editor), John D. Morrey (Editor), Nicholas Agar (Contributor)
2. Goel D & Prashar S (2013). IPR, Biosafety and Bioethics. Pearson
3. Sydney H. Willin, Murray M. Tuckerman, William S. Hitchings IV(1997) Good Manufacturing practices for pharmaceuticals, second Edt., Mercel Dekker NC New york
4. Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S.(2008). IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.
5. Singh B.D.,(1998) Biotechnology, Kalyani publishers, Rajinder Nagar, Ludhiana

**Web Sources**

1. Horne LC (October 2016). ["Medical Need, Equality, and Uncertainty"](https://philpapers.org/rec/HORMNE). Bioethics. **30** (8): 588–96. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1111/bioe.12257](https://doi.org/10.1111%2Fbioe.12257). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [27196999](https://pubmed.ncbi.nlm.nih.gov/27196999). [S2CID](https://en.wikipedia.org/wiki/S2CID_(identifier)) [23682804](https://api.semanticscholar.org/CorpusID:23682804).
2. Markose, Aji; Krishnan, Ramesh; Ramesh, Maya (October 2016). ["Medical ethics"](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5074007). Journal of Pharmacy & Bioallied Sciences. **8** (Suppl 1): S1–S4. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.4103/0975-7406.191934](https://doi.org/10.4103%2F0975-7406.191934). [ISSN](https://en.wikipedia.org/wiki/ISSN_(identifier)) [0976-4879](https://www.worldcat.org/issn/0976-4879). [PMC](https://en.wikipedia.org/wiki/PMC_(identifier)) [5074007](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5074007). [PMID](https://en.wikipedia.org/wiki/PMID_(identifier)) [27829735](https://pubmed.ncbi.nlm.nih.gov/27829735).
3. Orfali K, de Vries R (2021). "Bioethics". The Wiley Blackwell Companion to Medical Sociology. John Wiley & Sons, Ltd. pp. 82–101. [doi](https://en.wikipedia.org/wiki/Doi_(identifier)):[10.1002/9781119633808.ch5](https://doi.org/10.1002%2F9781119633808.ch5). [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [978-1119633808](https://en.wikipedia.org/wiki/Special:BookSources/978-1119633808). [S2CID](https://en.wikipedia.org/wiki/S2CID_(identifier)) [241369995](https://api.semanticscholar.org/CorpusID:241369995).

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**THIRD YEAR: SEMESTER VI**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Core paper: 9** PHARMACEUTICS | **Core** | 3 | 2 | - | - | 5 | 5 | 25 | 75 | 100 |

# **Learning objectives:**

* To enrich the knowledge of Drug Products
* To develop in-depth knowledge about Chemical Kinetics and Drug Stability
* To provide the basic knowledge of Delivery of Drugs by the Pulmonary Route
* To provide the basic knowledge of Food and Drug Laws that Affect Drug Product Design
* To enrich the students’ knowledge with respect to Biotechnology-Based Pharmaceuticals

**Course Outcomes:**

* After studying unit-1, the student will be able to know about Drug Products
* After studying unit-2, the student will be able to understand about Chemical Kinetics and Drug Stability
* After studying unit-3, the student will be able to understand about Delivery of Drugs by the Pulmonary Route
* After studying unit-4, the student will be able to know about Food and Drug Laws that Affect Drug Product Design
* After studying unit-5, the student will be able to know about Biotechnology-Based Pharmaceuticals

**Unit I**

* Drug Products: Their Role in the Treatment of Disease, Their Quality, and Their Status and
* Future as Drug-Delivery Systems
* Principles of Drug Absorption
* Pharmacokinetics
* Factors Influencing Drug Absorption and Drug Availability
* The Effect of Route of Administration and Distribution on Drug Action

**Unit II**

* Chemical Kinetics and Drug Stability
* Preformulation
* Cutaneous and Transdermal Delivery - Processes and Systems of Delivery
* Disperse Systems
* Tablet Dosage Forms
* Hard and Soft Shell Capsules
* Parenteral Products

**Unit III**

* Design and Evaluation of Ophthalmic Pharmaceutical Products
* Delivery of Drugs by the Pulmonary Route
* Sustained- and Controlled-Release Drug Delivery Systems
* Target-Oriented Drug-Delivery Systems
* Packaging of Pharmaceutical Dosage Forms
* Optimization Techniques in Pharmaceutical Formulation and Processing

**Unit IV**

* Food and Drug Laws that Affect Drug Product Design, Manufacture, and Distribution
* European Aspects of the Regulation of Drug Products with Particular Reference to Development Pharmaceutics
* Pediatric and Geriatric Aspects of Pharmaceutics

**Unit V**

* Biotechnology-Based Pharmaceuticals
* The Pharmacist and Veterinary Pharmaceutical Dosage Forms
* Dietary Supplements
* Bioequivalency
* Drug Information
* Managed Care and Pharmacotherapy Management

**Text Books:**

1. Pharmaceutics – M.E. Aultom
2. Rhodes, Gilbert S. Banker, Christopher T. (24 May 2002). [*Modern Pharmaceutics, 1*](https://www.google.co.in/books/edition/Modern_Pharmaceutics/s1-BerNQAtsC?hl=en&gbpv=0&kptab=getbook) (5th ed.). Hoboken: [Informa Healthcare](https://en.wikipedia.org/wiki/Informa_Healthcare" \o "Informa Healthcare). [ISBN](https://en.wikipedia.org/wiki/ISBN_(identifier)) [0824744691](https://en.wikipedia.org/wiki/Special:BookSources/0824744691). [OCLC](https://en.wikipedia.org/wiki/OCLC_(identifier)) [52634365](https://www.worldcat.org/oclc/52634365). [Archived](https://web.archive.org/web/20220224121552/https:/www.goaogle.co.in/books/edition/Modern_Pharmaceutics/s1-BerNQAtsC?hl=en&gbpv=0&kptab=getbook) from the original on 24 February 2022.

**Web Sources**

* 1. [What is Pharmaceutics? | Pharmaceutics"](http://sop.washington.edu/pharmaceutics/about/what-is-pharmaceutics.html). Sop.washington.edu. Retrieved 2013-08-26.
  2. https://www.investopedia.com/ask/answers/033115/what-difference-between-biotechnology-company-and-pharmaceutical-company.asp
  3. https://www.scielo.br/j/bjps/a/JdZpw4JcNnZyHvL7BBp5Cpv/?format=pdf&lang=en
  4. Mazet, R.; Yaméogo, J.B.G.; Wouessidjewe, D.; Choisnard, L.; Gèze, A. Recent Advances in the Design of Topical Ophthalmic Delivery Systems in the Treatment of Ocular Surface Inflammation and Their Biopharmaceutical Evaluation. Pharmaceutics **2020**, 12, 570.

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

**ELECTIVE PAPERS**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | Immunology | E1A | 1 | 1 | 0 | 0 | 2 | 2 | 25 | 75 | 100 |

# **Learning objectives:**

1. To provide the basic knowledge of immune system and the associated organs
2. To provide the basic knowledge of immunity and immune response
3. To enable the students understand about immunoglobulin, structure and types
4. To enable the students to get an insight on Immunity to infection
5. To enrich the students’ knowledge with respect to immunotechniques and its applications in industries and R & D

**Course outcomes**

# After studying unit-1, the student will be able to know the basic knowledge of immune system and the associated organs

# After studying unit-2, the student will be able to understand the basic knowledge of immunity and immune response

1. After studying unit-3, the student will be able to understand about immunoglobulin, structure and types

# After studying unit-4, the student will be able to know about the insight on Immunity to infection

1. After studying unit-5, the student will be able to know about overview of immunotechniques and its applications in industries and R & D

## **Unit I**

The Immune system- Primary and Secondary Lymphoid organ, Lymphocytes- their origin and differentiation, NK cells. Antigen presenting cells-macrophages, dendritic cells, langerhans cell- their origin and function. Mechanism of phagocytosis. Complement –characteristic features- biological function-activation, types of immune responses, immune tolerance.

## **Unit II**

Immunity: Types of immunity- Innate immunity- classification- mechanism of nonspecific immunity. Acquired immunity- active and passive, vaccine-active immunization, passive immunization. Immunity to infection- bacteria, virus and protozoa. Immune response. Humoral and cell mediated immunity –induction- mechanism-cytokines -interleukins- Interferon-their role in immune response.

## **Unit III**

Immunoglobulins- Structure, types, biological functions - generation of diversity. Antigen- Types –factors determining antigenicity. Antigen- antibody interactions- agglutination, complement fixation - opsonization, bacteriolysis and precipitation- Antitoxins.

## **Unit IV**

Immunity to infection: Hypersensitivity reactions- types and mechanism- Transplantation-types-allograft rejection mechanism and prevention of graft rejection- immune-suppressive drugs. HLA- immune response genes- HLA molecules, Resistant to tumors: NK Cells: Tumor immuno therapy: Lymphoid tumors. Auto immune diseases- pathogenesis – treatment.

## **Unit V**

Immunochemical techniques. Production of antisera- the precipitation reaction, immunodiffusion, immunoelectrophoresis, immunofluorescence, complement fixation test. Principle, technique and applications of RIA and ELISA. Hybridomas –monoclonal antibody production-uses. Vaccination: Passive and active immunization: Recombinant vaccines: DNA vaccines.

## **Text Books:**

1. Immunology – 8th edition*,* Ivan Roitt, - *Publisher* Wiley-Blackwell: 2012.
2. Immunology – Weir, Churchill Livingstone, *Publisher*:; 8 *edition* (June 1997);
3. Donald M. Weir, Immunology, John Steward. Published by Harcourt *Publishers*Ltd; (1997).

Immunology –3rd ed Kuby,Freeman, 1997.

1. Immunology - Tizerd, Saunders College *Publishing*, 9th edition 2004.
2. Immunology- Dulsy Fatima and N. Arumugam, 2014.
3. Immunology- Male, with student Consult Online Access, 2012.
4. Immunology- C. Vaman Rao, 2007.

**Reference Books:**

1. Immunology – An introduction, Tizzard R Jan, 1995.
2. Immunology – Roitt Ivann, Jonathan Brastoff, David Male, 2017, 13 th Edition
3. Immunology – Janis Kuby, 8th edition. 2018

**Web Sources:**

1. <https://nptel.ac.in/courses/102/103/102103038/>
2. [https://nptel.ac.in/content/storage2/courses/102103038/download/unit6.pdf](https://nptel.ac.in/content/storage2/courses/102103038/download/module6.pdf)
3. Plasma Therapy – <https://www.slideshare.net/Tareqchowdhury/therapeutic-plasma-exchange-106849551>
4. Flow Cytometry - [https://www.slideshare.net/richardhastings589/kumc-introduction-to-flow-](https://www.slideshare.net/richardhastings589/kumc-introduction-to-flow-cytometry?qid=9f5e0389-0114-49eb-925b-7c984e1e7935&v&b&from_search=1) [cytometry?qid=9f5e0389-0114-49eb-925b-7c984e1e7935&v=&b=&from\_search=1](https://www.slideshare.net/richardhastings589/kumc-introduction-to-flow-cytometry?qid=9f5e0389-0114-49eb-925b-7c984e1e7935&v&b&from_search=1)
5. <https://www.iitk.ac.in/che/pdf/resources/Flow-Cytometry-reading-material.pdf>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |

**S**

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 2 | 3 |
| **CO3** | 3 | 3 | 2 | 2 | 3 |
| **CO4** | 3 | 3 | 2 | 2 | 3 |
| **CO5** | 3 | 3 | 2 | 2 | 3 |
| **Weightage** | 15 | 15 | 10 | 10 | 15 |
| **Weighted percentage (rounded of) Course Contribution to POs** | 3 | 3 | 2 | 2 | 3 |

**Strong - 3, Medium – 2, Low - 1**

**MEDICAL LABORATORY TECHNOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| CIA | External | Total |
|  | **Medical Laboratory Technology** | E1B | 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.

**Unit I** :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

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

**Unit 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.

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

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

**Course Outcomes**

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

**Text Books**

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

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

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

edition,W.B. Saunders Company

**Web Resources**

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

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

agglutination-tests-and-immunoassys

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

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **RECOMBINANT DNA TECHNOLOGY** | E-1C | 3 | 1 | - | - | 4 | 4 | 25 | 75 | 100 |

**Pre- requisite** Basic knowledge on DNA gained during HSc. and during the previous years of this programme.

**Course Objectives:**

The main objectives of this course are to:

* understand the role of Enzymes in Gene manipulation.
* learn tools and techniques of R – DNA technology.
* understand the role of vectors in R – DNA technology.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

* 1. Gain the basic knowledge about role of enzymes in Gene manipulation.
  2. Understand the Gene isolation techniques.
  3. Understand the uses of Vectors in rDNA technology

4 Gain knowledge about Gene transfer techniques.

5 Understand the Blotting techniques.

**Unit – I**

Gene manipulation – Definition and Application, Restriction Enzymes, Discovery, Types and Mode of Action – Ligases and Methylases, Modifying enzymes – Alkaline Phosphatase, Phosphonucleokinase.

**Unit –II**

Isolation – Purification of DNA (Chromosomal and Plasmid) – Isolation and Purification of RNA – Chemical Synthesis of DNA – Genomic Library and cDNA Library.

**Unit – III**

Vectors – Plasmid based Vectors – pBR322 and pUC8, Phage based Vectors – λ (Lamda) phage Vectors –Insertion and Replacement vectors – Hybrid Vectors – Phagemid ( pEMBL8 ) – Phasmid – Cosmid, Artificial Chromosomes – BAC and YAC.

**Unit – IV**

Gene Transfer Techniques: Physical – Biolistic Method, Chemical – Calcium chloride and DEAE Methods, Biological in vitro package method – Screening and Selection of recombinants

– Direct Method – Selection by Complementation – Indirect Methods – Immunological and Genetic Methods.

**Unit – V**

PCR – DNA Sequencing (Sanger's Method) – Blotting (Southern, Western, Northern) Techniques

– RFLP and Applications – RAPD and Applications – Microarray.

**Text books**

1. Sathyanarayana. U, Biotechnology, (2005). 1stEd. Books and Allied (P) Ltd.
2. [Desmond S. T. Nich](https://www.amazon.in/Desmond-S-T-Nicholl/e/B001IXTYLO/ref%3Ddp_byline_cont_ebooks_1)oll, (2008). An Introduction to Genetic Engineering. Cambridge University Press.

**References**

1. Brown T.A, (2012), An Introduction to gene cloning 6thEd. Chapman and hall
2. Old. RW and Primrose, (2003). Principles of Gene Manipulation, 7thEd. Blackwell
3. Scientific Publication, Boston.
4. Winnecker, E.D, (2003). From genes to clones, Introduction to Gene Technology, 4thEd. Panima Publishing Corporation.
5. Bernard. R Glick and Jack J Pasternak, (2004). Molecular biotechnology, 4thEd. Panima Publishing Corporation.

**Web Sources**

1. <https://www.youtube.com/watch?v=YSFqEZ6jvOk>
2. <https://www.youtube.com/watch?v=npb06rF6Qww>
3. <https://www.youtube.com/watch?v=2JKDu8kijrs>
4. <https://www.youtube.com/watch?v=fmMp6avlB6I>
5. <https://www.youtube.com/watch?v=ISqM-u3in2Y>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **PLANT THERAPEUTICS** | E-1D | 2 | 2 | - | - | 4 | 4 | 25 | 75 | 100 |

**Pre- requisite** Basic knowledge on botany gained during HSc. and during the previous years of this

programme.

**Course Objectives:**

The main objectives of this course are to:

* learn the historical and cultural aspects of plants and medicine.
* understand the contribution of medicinal plants to alternative therapeutics .
* have a complete understanding of phytochemicals and production of pharmaceutical compounds.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

1 Learn the history of medicinal plants and methods of extraction of various

therapeutics from medicinal plants.

2 be trained in skills associated with screening of active principle of biologically

important plants.

3 Comprehend the mechanism of free radicals damage in living cells and

antioxidant defense system from phytochemical sources.

4 Analyse the primary metabolites distribution in therapeutic plants and applying

the knowledge in maintaining health and lifestyle.

5 Develop novel pharmaceutical products and understand the tissue culture

techniques

**Unit– I**

Medicinal plants-bioactive principles in medicinal plants: methods of extraction, isolation, separation and screening, pharmacologically active plants – CNS, CVS, Hypoglycemic.

**Unit–II**

Hepatoprotective, nephroprotective, anti allergic, anticancer, antibacterial, antiviral and antimalarial, anti-inflammatory, immunoactive properties of the medicinal plants, plants protecting against oxidative stress, chemotherapeutic products.

**Unit– III**

Free radicals – types, sources, importance, production, free radicals induced damages, lipid peroxidation, measurement of free radicals, disease caused by radicals, reactive oxygen species, antioxidant defence system, enzymic and non-enzymic antioxidants, role of antioxidants in

prevention of diseases, phytochemicals as antioxidants.

**Unit– IV**

Primary metabolites, Alkaloids, flavanoids, terpenoids, phenolics, steroids, Vitamins, minerals – Occurrence, distribution & functions.

**Unit– V**

Production of secondary metabolite in plants, stages of secondary metabolite production, uses of tissue culture techniques, elicitation, biotransformation- production of pharmaceutical compounds

**Text books**

**1.** Purohit.S.S, (2005). Agricultural Biotechnology, Dr.Updesh Purohit Publishers, Jodhpur

**2.** Khan,I.A and Khanum.A, (2004). Role of Biotechnology in medicinal and aromatic plants,

Vol. 1 and Vol. 10, Ukkaz Publications, Hyderabad.

**References**

1 Slater.A. Scott.N.W and Fowler.M.R, (2004). Plant Biotechnology -The genetic

manipulation of plants, Oxford University Press, Oxford.

2 Singh.M.P and Panda .H, (2005). Medicinal Herbs with their formulations, Daya Publishing

House, Delhi

**Web Sources**

1 <https://www.berkeleyherbalcenter.org/herbal-foundations-therapeutics-certification/>

2 <https://www.youtube.com/watch?v=_7RHYEZ5x9c>

3 <https://www.youtube.com/watch?v=DWZJEQv7kqY>

4 <https://www.youtube.com/watch?v=EvZZxDb7VpE>

5 <https://www.youtube.com/watch?v=hOHyIuO20-4>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **MEDICAL CODING** | E-2A | 3 | 1 | - | - | 4 | 4 | 25 | 75 | 100 |

**Pre-requisite** Basic knowledge on Human Physiology gained during HSc. and Semester – II of this programme

**Course Objectives:**

The main objectives of this course are to:

* gain insights on concepts of terminologies in medical coding.
* understand &Identify ICD guidelines.
* impart knowledge on to impart knowledge on assigning diagnosis and procedure codes.
* provide practical application of coding operative reports and evaluation and management services.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

1 Able to know about basics of Medical coding.

2 Gain knowledge about different types of Coding.

3 Explore ICT & CPC coding.

4 Insist different types of procedure codes.

5 Help to predict codes based on anatomy &its ICD guidelines.

**Unit – I**

Industry History and the Codes – The Coder – ICD Coding – CPT Coding – Specialty Coding –

Liability and Legal Issues.

**Unit –II**

The World of Health Care – Introduction to Medical Terminology – Medical Terminology: Dividing and Combining Terms – Medical Terminology: Abbreviations, Symbols and Special

Terms – Documenting Medical Records – Medical Ethics.

**Unit – III**

Diagnostic Coding – ICD-10-CM Coding Manual Introduction – ICD-10-CM Diagnosis Coding: Guidelines and Rules – Infections to Blood Diseases – Mental Disorders to the Respiratory

System – the Digestive System to Pregnancy – Skin – Perinatal Period.

**Unit – IV**

CPT Coding – Integumentary System – Reproductive Systems – Radiology, Pathology, Medicine and Anesthesia – Evaluation and Management Services – Comprehensive Surgery Coding – Comprehensive Musculoskeletal coding – Comprehensive Digestive

System Coding – Comprehensive Urology and Reproductive system coding – Comprehensive Pulmonology and Cardiovascular coding.

**Unit – V**

History of HCPCS Coding – Levels of HCPCS – Medical Coding – Medical Billing – Auditing – Medical Documentation – Compliance – Medical coding tools.

**References**

1 Alok Gha, Priyanka Arora- Medical Transcription Made easy.

2 Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CM- Coding guidelines made easy-2017.

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

4 Karen Smiley- Medical Billing and coding for dummies, 2nd edition.

5 ICD-10-CM Official Guidelines for Coding & Reporting.

**Related Online Contents**

1 [https://www.aapc.com/medical-coding/medical-](https://www.aapc.com/medical-coding/medical-coding.aspx#WhyIsMedicalCodingNeeded)

[coding.aspx#WhyIsMedicalCodingNeeded](https://www.aapc.com/medical-coding/medical-coding.aspx#WhyIsMedicalCodingNeeded)

2 <https://www.medicalbillingandcoding.org/coding-training/>

3 <https://www.rasmussen.edu/degrees/health-sciences/blog/what-is-medical-coder/>

4 [https://revcycleintelligence.com/features/exploring-the-fundamentals-of-medical-](https://revcycleintelligence.com/features/exploring-the-fundamentals-of-medical-billing-and-coding)

[billing-and-coding](https://revcycleintelligence.com/features/exploring-the-fundamentals-of-medical-billing-and-coding)

5 <https://www.ultimatemedical.edu/blog/what-is-a-medical-coding-and-billing-specialist/>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **Elective Course IB Biochemical Pharmocology** | E-2B | 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 .

**Course Outcomes**

**On completion of this course, students will be able to**

* Classify the different routes of drug administration, describe the absorption, distribution, metabolism and excretion of drugs.
* Illustrate the metabolism of drugs, classify the microsomal and non- microsomal reactions and explain the role of cytochromes.
* List out the various adverse response and side effects of drugs.
* Justify the use of synthetic drugs and elucidate its pharmacological actions and its adverse effects for different disease.
* Highlight the importance and explain the mode of action of important antibiotics.

**Unit 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.

**Unit 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.

**Unit 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.

**Unit 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.

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

**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 Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **ENTREPRENEURIAL MICROBIOLOGY** | E-2C | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Pre- requisite** Basic knowledge on microorganisms gained from courses learned in this

programme.

**Course Objectives:**

The main objectives of this course are to:

* develop as an entrepreneur by imparting knowledge on industrial production of economically important products using microorganisms.
* learn about fermentation, brewing and their types.
* acquire knowledge on the commercial production of health care products using microorganisms.
* familiarize about national and international patent / patenting processes.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

1 Understand the basics of entrepreneur development

2 Comprehend that microorganisms play a vital role to all forms of life on earth.

3 Acquire theoretical and technical knowledge on production of mushrooms andbiofertilizers.

4 Attain acquaintance about national and international patent / patenting processes.

5 Acquire technical understanding of brewing process.

**Unit–I**

Entrepreneur development activity – Institutes involved, Government contributions toentrepreneurs, risk assessment. Industrial Microbiology– Definition, scope and historical development.

**Unit–II**

Microbial cells as fermentation products – Bakers yeast, food and feed yeasts, Bacterial Insecticides, Legume Inoculants, Mushrooms, Algae. Enzymes as fermentation products – Bacterial and Fungal Amylases, Proteases, Pectinases, Invertases and other enzymes.

**Unit–III**

Mushroom cultivation and Composting – Cultivation of *Agaricus campestris*, *Agaricus bisporus,* and *Volvariella volvaciae;* Preparation of compost, filling tray beds, spawning, maintaing optimal temperature, casing, watering, harvesting and storage. Biofertilizers – Historical background – Chemical fertilizers versus biofertilizers – Organic farming – *Rhizobium sp, Azospirillum sp*, *Azotobacter sp,* as Biofertilizers.

**Unit–IV**

Patents and secret processes – History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent – Patents in India and other countries. Fermentation Economics.

**Unit–V**

Brewing – Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of Industrial alcohol.

**Text books**

**1.** Entrepreneurial Development in India- By Arora.

**2.** Sathyanarayana. U, Biotechnology. (2005) 1stEd. Books and Allied (P) Ltd.

**References**

1 Stanbury P T and Whitaker, (1984). Principles of Fermentation Technology, Pergamon Press. NY

2 Casida, L E JR, (2019). Industrial Microbiology. New Age International Publishers

3 K.R.Aneja, Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production technology, 6thEd.S Chand Publication.

4 Nduka Okafor. Modern Industrial Microbiology and Biotechnology. 2007. CRC Press

5 Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton. Industrial Microbiology:An Introduction. 2013. Wiley Blackwell Publishers.

6 A.H. Patel. Industrial Microbiology.2016. 2ndEd. Laxmi Publications, New Delhi.

7 Dubey R C. A Textbook of Biotechnology. (2014). S Chand Publishers.

8. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship Development”, Tata McGraw Hill

**Related Online Contents**

1 <http://www.simbhq.org/>

2 htt[ps://www.rapidmicrobiology.com/](http://www.rapidmicrobiology.com/)

3 <http://rapidmicromethods.com/>

4 swayam.gov.in › nd1\_noc20\_bt21

5 sites.google.com>site>microbiology-courses-in-swayam

6 [www.classcentral.com>Subj](http://www.classcentral.com/)ects>Sciences>Biology

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**S**

**tStrong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

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

**Course Objectives:**

The main objectives of this course are to:

* Through knowledge on biological databases
* Drug designing and docking protocols

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to understand :

1. the concepts and applications of biological databases
2. the principle and applications of various search tools
3. the concepts of drug designing
4. the concepts of terminologies in medical coding

**Unit:1 Bioinformatics**

Introduction, definition, objectives and scope. Application of BioInformatics. Biological databases:Primary protein database – SWISS PROT, TrEMBL, PIR, PDB. Primary nucleic acid database – EMBL, GEN BANK, DDBJ.

**Unit:2 Tools for database search**

FASTA- Histogram, Sequence listing, Search and Programs. BLAST – Algorithm, Services, MEGA BLAST, PHI BLAST, PROTEIN BLAST, GAPPED BLAST, PSI BLAST

**Unit:3 Protein Primary structure analyses and prediction**

Protein Primary structure analyses and prediction, Proteomics – Structure of Protein; Nomenclature of Protein Sequences ; Protein Database Swiss- PROT, SCOP, CATH. Protein visualization tools – RASMOL, Swiss PDB viewer.

**Unit:4 Introduction to medical terminology**

Medical terminology -root words, prefix, suffix, abbreviations, symbols. Documentation of medical records, ICD (International classification of Diseases)

**Unit:5 Drug design:**

Gene finding, protein prediction, phylogenetic analysis. BioInformatics and drug design: Introduction, approaches – ligand based, target based. Methods of drug designing – CAMD, docking program

**Reference Books**

* 1. Westhead D.R, Parish J.H and Twyman R.M. (2003) Instant notes in BioInformatics, Ist

Edition

* 1. Attwood.T.K. Parry D.J. and Smith (2001). Introduction to BioInformatics, Ist Indian Report.
  2. Alok Gha, Priyanka Arora- Medical Transcription Made easy.
  3. Terry Tropin M Shai, RHIA, CCS-P, AHIMAICD-10-CM- Coding guidelines made easy-2017.
  4. Besty J Shiland- Medical terminology and anatomy for ICD-10.
  5. Karen Smiley- Medical willing and coding for dummies, 2nd edition.

**Text Books**

1. Rastogi.S.C, Namita – Mendiratta and Parag Rastogi, (2004) BioInformatics – Concepts, Skills and applications
2. Mani.K and Vijayraja (2005), BioInformatics – A practical approach

**Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]**

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 Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**S**

**SStrong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **NANOMATERIALS AND NANOMEDICINE** | E-3B | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Course Objectives:**

The main objectives of this course are to:

1. To foundational knowledge of the nanomedicine and related fields.
2. To make the students acquire an understanding the nanomaterials and applications
3. To help them understand in broad outline of nanomaterials and nanomedicine.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

1 Learn about the background on Nanomaterials and Nanomedicine

2 Understand the synthesis of nanomaterials and their application and the impact of nanomaterials on environment

3 Apply their learned knowledge to develop Nanomaterials

**Unit:1 Biological Materials**

Structure property relationship of Biological materials: tissues, bones and teeth, collagen rich tissues, elastic tissues, nanostructured collagen mimics in tissue Engineering. Biopolymers: Preparation of nanobiomaterials – Polymeric scaffolds collagen, Elastins: Mucopolysaccharides, proteoglycans, cellulose and derivatives; Dextrans; Alginates; Pectins; Chitin

**Unit:2 Cardiovascular Implants**

Cardiovascular implants: Role of nanoparticles and nanodevices in blood clotting; Blood rheology; Blood vessels; Geometry of blood circulation; Vascular implants; Cardiac pacemakers; blood substitutes; Biomembranes.

**Unit:3 Polymeric Implant Materials**

Polymeric implant materials: Polyolefin; polyamides (nylon); Acrylic polymers (bone cement) and hydrigels; Fluorocarbon polymers; Natural and synthetic rubbers, silicone rubbers; High strength thermoplastics; deterioration of polymers. Biomaterials for Ophthalmology: Contact lenses; Optical implants for glaucoma; adhesives; artificial tears; Protection gears.

**Unit:4 Metallic and Ceramic Implant Materials**

Metallicand ceramic implant materials: Bone regeneration, Nano crystalline structures of Bone and Calcium phosphate cements. Cobalt-based alloys; Titanium and its alloys, Nanoparticles relating to Aluminium oxides: Hydroxyapatite; Glass ceramics; ceramic implants; carbon

implants. Nano dental materials.

**Unit:5 Nanoparticles**

Metallicand ceramic implant materials – metal nanoparticles and drug delivery vehicles – Nanoshells – Tectodentrimers Nanoparticle drug systems – Diagnostic applications of nanotechnology.

**Text Book(s)**

1 SV Bhat, Biomaterials (2nd Edition), Narosa Publishing House, New Delhi – 2005.

2 JB Park, Biomaterials Science and Engineering, Plenum Press, New York, 1984

ChallaS.S.R.Kumar, Joseph Hormes, CarolaLeuschmal

**Reference Books**

1 Nanofabrication towards biomedical applications Willey – VCHVerlag GmbH &Co,

KGaA.

2 Freshney; Animal cell culture; IRL press.

**Web Sources**

1 <https://nptel.ac.in/courses/102/106/102106057/>

2 <https://nptel.ac.in/courses/113/104/113104009/>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**S**

**tStrong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Course Name** | **Category** | **L** | **T** | **P** | **S** | **Credits** | **Inst. Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
|  | **DAIRY MICROBIOLOGY** | E-3C | 3 | 1 | - | - | 4 | 5 | 25 | 75 | 100 |

**Pre- requisite** Basic knowledge on Microbiology and Food Microbiology gained from this programme.

**Course Objectives:**

The main objectives of this course are to:

* learn the basics of dairy processing units.
* impart knowledge on fermented milk products.
* be acquainted with food quality standards.

**Expected Course Outcomes:**

On the successful completion of the course, student will be able to:

1 Understand the dairy processing unit operations.

2 be acquainted with various types of dairy products.

3 Emphasize the role microorganisms on fermented milk products and milk borne diseases.

4 Gain information about hygienic manufacturing of dairy products.

5 Get the knowledge about Government regulatory practices and policies for quality assurance of dairy products.

**Unit–I**

Milk - Introduction, composition, Microorganisms in Milk – Bacteria, Yeasts, Moulds. Starter Cultures – Starter cultures their biochemical activities. (*Streptococcus thermophillus, Lactobacillus bulgaricus*) Dairy processing unit operations: Pasteurization, UHT treatment,

homogenization, Membrane processing, storage, transportation and distribution of milk. Judging and grading of milk and its products.

**Unit–II**

Dairy Products Production : Overview and Fluid Milk Products, Concentrated and Dried Milk Products, condensed milk, evaporated milk, whole and skimmed milk powder, cultured Dairy Products: Whipped Cream, Ice Cream, Butter, Whey Products.

**Unit–III**

Microbiology of fermented milk products – Acid fermented milks (acidophilus milk, yoghurt). Slightly acid fermented milks (Cultured butter milk), Acid-alcoholic fermented milk (Kefir). Fermented milk production with extended self-life (labneh)). Milk borne diseases, antimicrobial systems in milk, sources for contamination of milk – bacterial with examples of infective and toxic types – Clostridium, *Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria*. Mycotoxins in milk with reference to *Aspergillus sp*.

**Unit–IV**

Hygiene in Manufacturing Milk Products: Cleaning of Dairy Equipment – Instantization of milk and milk products. In-plant cleaning system. Dairy Processing Plant Sanitation. Probiotic utilization and disposal of dairy by product – whey.

**Unit–V**

Quality assurance: Microbiological quality standards of food. Government regulatory practices

and policies. FDA, WHO, EPA, HACCP, ISI. HACCP – Food safety, safety of dairy products, control of hazards.

**Text books**

Milk & Milk Products – Clarence Henry Eckles, Tata McGraw Hill publishing company

Ltd, New Delhi.

Jay,J.M , (2005). Modern Food Microbiology 4thEd. , Van Nostra and Rainhokdd Co.

**References**

1 Dairy Microbiology by Robinson R.K, (1990). Volume I and II. Elsevier Applied Science,

London.

2 Roday. S, (1998). Food Hygeine and Sanitation. Tata Mcgraw Hill Publications.

3 Fundamentals of Dairy Microbiology by Prajapati.

4 Dey, S, (1994). Outlines of Dairy Technology. Oxford Univ. Press, New Delhi.

5 Rosenthal, I, (1991). Milk and Milk Products. VCH, New York.

6 Warner, J.M, (1976). Principles of Dairy Processing. Wiley Eastern Ltd. New Delhi.

7 Yarpar, WJ. and Hall, C.W, (1975). Dairy Technology and Engineering AVI, Westport.

**Related Online Contents**

1 <https://www.agrifarming.in/dairy-processing-plant-project-report-setup>

2 <https://www.youtube.com/watch?v=6Tkx3PTz9Pc>

3 <https://www.youtube.com/watch?v=_2z8iXU8dO0>

4 <https://www.cdc.gov/foodsafety/food-poisoning.html>

# **Mapping with Programme Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |

**S**

**Strong - 3, Medium – 2, Low - 1**

# **Mapping with Programme Specific Outcomes**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO/PSO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 |
| **Weightage** | 15 | 15 | 15 | 15 | 10 |
| **Weighted percentage (rounded of) Course Contribution to Pos** | 3 | 3 | 3 | 3 | 2 |

**Strong - 3, Medium – 2, Low - 1**