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| --- |
| M.Sc.,Pharmaceutical biotechnology |
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| **SYLLABUS** |
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|  **from the acadmic year** **2023-2024** |
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| **TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005** |
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| --- |
| **Programme: M.Sc., Pharmaceutical Biotechnology**  |
| **Programme Code** |
| **Duration PG- 2 years**  |
| **Program Outcomes (PO)** |
| On successful completion of the **M.Sc., Pharmaceutical Biotechnology** program, the students are expected to |
| PO1 | Broad based knowledge in Industrial Biotechnology |
| PO2 | Transforming meaningful applications for better healthcare, industries and economic development |
| PO3 | Constant updation of knowledge |
| PO4 | Empowering skills |
| PO5 | Sole responsibility of contributing the public to lead better life through extension activities |
| PO6 | Development of critical thinking and problem-solving skills |
| PO7 | The provision of an inspiring, exciting and collaborative scientific environment |
| PO8 | To inculcate the values of professionalism and dedication |
| PO9 | Develop intelligent strategies and biochemical approaches in problem solving methods |
| PO10 | To compete globally with confidence in all the sectors of life science |

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| **Program Specific Outcomes (PSO)** |
| On successful completion of the **M.Sc., Pharmaceutical Biotechnology** program, the students are expected to |
| PSO1 | Ability to understand the technical aspects of existing technologies that help inaddressing the biological and medical challenges faced by humankind. |
| PSO2 | Ability to contribute effectively in the development of the ethical practices,societal contributions, and leading to responsible and competent professionals |
| PSO3 | Acquiring the ability of leadership skills to manage projects in multidisciplinaryenvironments |
| PSO4 | Nurture problem solving skills, thinking, creativity through assignments, field work, seminar presentations and project work. |
| PSO5 | Assist students in preparing (personal guidance, research papers, and books) for competitive exams e.g.,NET-JRF, SLET, etc. |

**Template for P.G., Programmes**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester–I** | **Credit** | **Hours** | **Semester-II** | **Credit** | **Hours** | **Semester-III** | **Credit** | **Hours** | **Semester–IV** | **Credit** | **Hours** |
| 1.1. Core-I  | 5 | 7 | 2.1. Core-IV  | 5 | 6 | 3.1. Core-VII | 5 | 6 | 4.1. Core-XI  | 5 | 6 |
| 1.2 Core-II  | 5 | 7 | 2.2 Core-V  | 5 | 6 | 3.2 Core-VIII  | 5 | 6 | 4.2 Core-XII | 5 | 6 |
| 1.3 Core – III  | 4 | 6 | 2.3 Core – VI | 4 | 6 | 3.3 Core – IX | 5 | 6 | 4.3 Project with viva voce | 7 | 10 |
| 1.4 Discipline Centric Elective -I | 3 | 5 | 2.4 Discipline Centric Elective – III | 3 | 4 | 3.4 Core – X  | 4 | 6 | 4.4Elective - VI (Industry / Entrepreneurship) 20% Theory80% Practical  | 3 | 4 |
| 1.5 Generic Elective-II:  | 3 | 5 | 2.5 Generic Elective -IV:  | 3 | 4 | 3.5 Discipline Centric Elective - V  | 3 | 3 | 4.5 Skill Enhancement course / Professional Competency Skill  | 2 | 4 |
|  |  |  | 2.6 NME I | 2 | 4 | 3.6 NME II | 2 | 3 | 4.6 Extension Activity | 1 |  |
|  |  |  |  |  |  | 3.7 Internship/ Industrial Activity | 2 | - |  |  |  |
|  | **20** | **30** |  | **22** | **30** |  | **26** | **30** |  | **23** | **30** |
| **Total Credit Points -91** |

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

**for all Post – Graduate Courses including Lab Hours**

**First Year – Semester – I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – I | 5 | 7 |
| Core – II | 5 | 7 |
| Core – III | 4 | 6 |
| Elective – I | 3 | 5 |
| Elective – II | 3 | 5 |
|  |  | **20** | **30** |

**Semester-II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – IV | 5 | 6 |
| Core – V | 5 | 6 |
| Core – VI | 4 | 6 |
| Elective – III | 3 | 4 |
| Elective – IV | 3 | 4 |
| Skill Enhancement Course [SEC] - I | 2 | 4 |
|  |  | **22** | **30** |

**Second Year – Semester – III**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – VII | 5 | 6 |
| Core – VIII | 5 | 6 |
| Core – IX | 5 | 6 |
| Core (Industry Module) – X | 4 | 6 |
| Elective – V | 3 | 3 |
| Skill Enhancement Course - II | 2 | 3 |
|  | Internship / Industrial Activity [Credits] | 2 | - |
|  |  | **26** | **30** |

**Semester-IV**

|  |  |  |  |
| --- | --- | --- | --- |
| **Part** | **List of Courses** | **Credits** | **No. of Hours** |
|  | Core – XI | 5 | 6 |
| Core – XII | 5 | 6 |
| Project with VIVA VOCE | 7 | 10 |
| Elective – VI (Industry Entrepreneurship)  | 3 | 4 |
| Skill Enhancement Course – III / Professional Competency Skill | 2 | 4 |
| Extension Activity | 1 | - |
|  |  | **23** | **30** |

**Total 91 Credits for PG Courses**

**Method of Evaluation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **External****Marks** |  **Internal** **Marks** | **Total marks** |
| **Theory** | 75 | 25 | 100 |
| **Practical** | 75 | 25 | 100 |

# Marks distribution for internals:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test** | **seminars** | **Assignment** | **Totalmarks** |
| **Theory** | 15 | 05 | 05 | 25 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test** | **Record** | **Totalmarks** |
| **Practical** | 10 | 15 | 25 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***StudyComponents*** | ***Credit*** | ***Hours*** | ***TitleofthePaper*** | ***Maximum Marks*** |
| ***CourseTitle*** | ***CIA*** | ***Uni.Exam*** | ***Total*** |
| **SEMESTERI** |  |
|  | Core 1 | 5 | 7 | Pharmaceutical Biotechnology -  | 25 | 75 | 100 |
|  | Core 2 | 5 | 7 | Advance in Recombinant DNA Technology | 25 | 75 | 100 |
|  | Core 3 | 4 | 6 | Fundamentals of Microbiology, Molecular Biology and Chemical Engineering | 25 | 75 | 100 |
|  | Elective–I  | 3 | 5 | A.Chemistry of Natural product.B.Toxicology and environmental chemistry.C.Basic fundamentals in clinical trails. | 25 | 75 | 100 |
|  | Elective -IIPractical-I | 3 | 5 | A. | 25 | 75 | 100 |
|  |  |  | **20** | **30** |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SEMESTERII** |  | ***CIA*** | ***Uni.Exam*** | ***Total*** |
|  | Core 4 | 5 | 6 | Research Methodology | 25 | 75 | 100 |
|  | Core 5 | 5 | 6 | Pharmaceutical Biotechnology - II | 25 | 75 | 100 |
|  | Core 6 | 4 | 6 | Advanced Analytical Tools in Biotechnology | 25 | 75 | 100 |
|  | Elective III | 3 | 4 | Physical chemistry concepts in Pharmaceuticals. | 25 | 75 | 100 |
|  | Elective IV | 3 | 4 | 1. Organic Chemistry - I
2. Unit operation in Bio process.
3. Advanced Pharmaceutical Biotechnology
 | 25 | 75 | 100 |
|  | NME (Skill Development Course) | 2 | 4 |  |  |  |  |
|  | Total  | **22** | **30** |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | ***StudyComponents*** | ***Credit*** | ***Hours*** | ***TitleofthePaper*** | ***Maximum Marks*** |
| ***CourseTitle*** | ***CIA*** | ***Uni.Exam*** | ***Total*** |
| **SEMESTERIII** |  |
|  | Core 7 |  | 5 | 6 | 1. Bio process and fermentation technology
 | 25 | 75 | 100 |
|  | Core 8 |  | 5 | 6 | 1. Pharmaceuticals biotechnology and drug design.
 | 25 | 75 | 100 |
|  | Core 9 |  | 5 | 6 | 1. Chemistry of drug I
 | 25 | 75 | 100 |
|  | Core 10 |  | 4 | 6 | 1. Chemistry of drug - II
 | 25 | 75 | 100 |
|  | Elective-V |  | 3 | 3 | 1. Drug design and drug development.
2. Basic of Pharmaceuticals Chemistry.

 C.Molecular Pharmaceutics nanotechnology and targeted DDS. | 25 | 75 | 100 |
|  | NME II |  | 2 | 3 |  |  |  |  |
|  | Internship / Industrial Activity  |  | 2 | - |  |  |  |  |
|  |  | **Total** | **26** | **30** |  |  |  |  |
|  |
| **SEMESTER IV** |  | ***CIA*** | ***Uni.Exam*** | ***Total*** |
|  | Core 11 |  | 5 | 6 | 1. Molecular modelling and drug designing.
 | 25 | 75 | 100 |
|  | Core 12 |  | 5 | 6 | A.Research methodology, IPR and Bioethics.B. Bioinformatics and computational biotechnology.C.Biological Evaluation of drugs therapy. | 25 | 75 | 100 |
|  | Project with Viva Voce |  | **7** | 10 | Project with *vivavoice* |  |  |
|  | Elective 6 (Industry Entrepreneurship) 20% Theory 80% Practical  |  | **3** | 4 |  |  |  |
|  | Skill Enhancement Courses / Professional Competency Skill  |  | **2** | 4 |  |  |  |
|  | Extension Activity  |  | **1** | - |  |  |  |
|  |  |  | **23** | **30** |  |  |  |  |
|  |  |  |  | **91** |  |  |  |  |

**Total Credit - 91**

E**xtra credits for\*MOOC course=2**

# \*USSRProject=2

**SEMESTER I**

**CORE PAPER1:Pharmaceutical Biotechnology**

Papercode: Subject: **Pharmaceutical Biotechnology**

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofpharmaceutical biotechnology and also the advances in Recombinant DNA technology and also the fundamentals of microbiology , molecular biology and chemical engineering and also about the research methodology.

**CourseObjectives**

1. Tolearnthebasic concept of Pharmaceutical Industry , fermentation technology.
2. Tolearn the concepts of cloning vectors , gene therapy in genetic disease.
3. Todevelopknowledgeonfundamentals of microbiology , molecular biology and chemical engineering .
4. Tounderstand the basic of research methodologies
5. Todevelopapieceofknowledgeinadvanced analytical tools in biotechnology.

# CourseOutComes

1. Aftercompletingunit1,thestudentswillbeabletoidentifytheconcept in technology in pharmaceutical industry.
2. Aftercompleting unit2,thestudentswillbeabletoknow about the methods in genetic manipulation..
3. Aftercompletingunit3,thestudentswillbe know about the fermentation technology.
4. AfterCompleting unit4,thestudentswillbe know about the Scale up process and fermentation process.
5. Aftercompleting unit5,thestudentswillbe know about the productivity of fermented products.
6. Aftercompleting unit6,thestudentswillbe know about the fermentation process.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | BiotechnologyinthePharmaceuticalIndustry(Pre-biotechnologyproducts,impactof biotechnology, post-biotechnology products: biologics and bio-pharmaceuticals) | **18hours** |
| **Unit-II** | Geneticmanipulationmethods | **18hours** |
| **Unit-III** | Fermentationtechnology | **18hours** |
| **Unit-IV** | Scale-up process (Inoculum: preparation and development of inoculum for industrial fermentation, optimization of the fermentation process (pH, temperature, and oxygen requirements, Determination of the optimized feeding regimen and biomassquantification | **18hours** |
| **Unit-V** | Improvement of selected microorganism with increased productivity of the fermented products | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**MESTER I**

**PAPER2:Advances in Recombinant DNA Technology**

Papercode: Subject: **Advances in Recombinant DNA Technology**

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofVectors,and also the cloning strategies and also the transformation of E.coli and also the detection of nucleic acid sequence and also the genomic DNA libraries.

**CourseObjectives**

1.Tolearnthebasic concept of cloning vectors and introduction to Plasmids.

2.Tolearn the cloning strategies and PCR products. .

3.Todevelopknowledgeon Chemical transformation and Electroporation.

4.Tounderstand the basic labeling and detection of nucleic acid sequence

5..Todevelopapieceofknowledgeingenomic DNA library and genetic disease.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeabletoidentifythevectors and Plasmids.

1. Aftercompleting unit2,thestudentswillbeabletoknow about the Cloning strategies
2. Aftercompleting unit3,thestudentswillbe know about the ChemicaltransformationandElectroporation
3. Aftercompleting unit4,thestudentswillbeSelection and screening of recombinant transformants
4. Aftercompleting unit5,thestudentswillbedetection of nucleic acid sequences
5. Aftercompleting unit6,thestudentswillbeGenomic DNA libraries

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **Cours eContents** | **Teaching hours** |
| **UnitI** | Vectors: Cloning vectors: Plasmids, Lambda phages, single stranded DNA vectors (M13, fd, f1); Cosmids, Phasmids and Phagemids, YACs, BACs, PACs; Plant Transformation vectors: Introduction to Ti, Ri plasmids and BIBACs; Expression Vectors for high level protein expression | **18hours** |
| **Unit-II** | Cloning strategies: Vector preparation and diverse cloning strategies viz. blunt end cloning, directional cloning, TA-cloning of PCR products, linkers and adaptors based cloning methodologies | **18hours** |
| **Unit-III** | E colitransformation:ChemicaltransformationandElectroporation | **18hours** |
| **Unit-IV** | Selection and screening of recombinant transformants: Introduction to marker and reporter genes and selection strategies | **18hours** |
| **Unit-V** | Labeling and detection of nucleic acid sequences: End-Labeling (3’- and 5’-), Random priming and Nick translation using radioactive non-radioactive labeling techniques | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER I**

**PAPER3:Fundamentals of Microbiology, Molecular Biology and Chemical Engineering.**

Papercode:Subject:M.sc Subject: **Fundamentals of Microbiology, Molecular Biology and Chemical Engineering**

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts of fundamentals of microbiology,molecular biology and chemical engineering.

**CourseObjectives**

1. Tolearnabout the microbes , cultivation and preservation of micro organisms.
2. Tolearn the structure of DNA , RNA.
3. Todevelopknowledgeon Recombinant DNA technology
4. Tounderstand the basic of fundamental chemical engineering
5. .Todevelopapieceofknowledge based on products on scale up of operations.

# CourseOutComes

1. Aftercompletingunit1,thestudentswillbeableto know about the microbes, importance of sterilization and methods of sterilization.
2. Aftercompleting unit2,thestudentswillbeableto know about the genome organization and overview of transcription in prokaryotes and eukaryotes.
3. Aftercompletingunit3,thestudentswillbe know about the fundamental of chemical engineering .
4. Aftercompletingunit4,thestudentswillbe know about the Agricultural and Environmental Microbiology
5. Aftercompletingunit5,thestudentswillbe know about the Industrial Microbiology
6. Aftercompletingunit6,thestudentswillbe know about the medicinal microbiology .

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Fundamentals of Microbiology **:** Microbes – types, size shape and arrangement of bacterial cells, Nutritional requirements – Common ingredients, culture media and types of media, Sterilization – Importance and various methods of sterilization, Cultivation and Preservation of microorganisms – Isolation, pure culture, study of cultural characteristicsand methods of preservation, Measurement of microbial growth – Total count and viable count methods, Preparation of microbes for microscopic observation – Compound microscope, stains used, simple staining, differential staining and special stainingtechniques. | **18hours** |
| **Unit-II** | Fundamentals of Molecular Biology : The beginnings of Molecular biology,The structure of DNA, Genome organization: Prokaryotes and Eukaryotes., The Versatility of RNA: Types of RNA and their role, DNA replication: Prokaryotic and Eukaryotic, Overview of Transcription in prokaryotes and eukaryotes, From Gene to Protein: Genetic code and Translation, Recombinant DNA technology: An introduction, molecular cloning and some tools for analyzing gene expression | **18hours** |
| **Unit-III** | Fundamentals of Chemical Engineering : Transport phenomenon, Heat transfer, Mass transfer, Process and equipment design for various operations in processing of pharmaceutical biotechnology based products and discussions on scale-up of operations; Prediction of freezing, heating and drying times | **18hours** |
| **Unit-IV** | Microbiology of soil, Air and Aquatic Microbiology, Biofertilizer, Plant endophytes, Microbes in bioremediation and biocontrol agents. | **18hours** |
| **Unit-V** | Microbial processes using yeasts and bacteria (production of alcohol, vinegar, cheese), Microbes as source of protein (SCP), gelatin agents (alginate, xanthin, agar agar) Microbial insecticides, Enzymes from Microbes (amylase, protease), Useful products from microorganisms using recombinant DNA technology (vaccines and antibiotics). | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

1. Stainer R.Y., Ingraham J.L., “General Microbiology”- 5 th Edition Mc.Millan Press, 2010.
2. Madigan, Martinko, Parker, Brock’s, “Biology of Microorganisms” - 10th Edition, Prentice Hall, Pearson Education, 2003.
3. Prescot and Dunn, “Industrial Microbiology”-Agribios India, 2002.
4. J. Salle, “Fundamental Principles of Bacteriology” – 7 th Edition, Tata Macgraw Hill, 2007.

5. E Alcamo I “Fundamentals of Microbiology”6th Ed, Jones & Bartlet, Pub. 2001. 6. Prescott, Harley & Klein, “Microbiology” -7 th Edition, WCB/McGraw Hill, Int. Edition, 2008.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER I**

**CORE ELECTIVE 1:Chemistry of Natural products**

Papercode: Subject: **Chemistry of Natural products**

**Hours/Week:5 Credits:3**

Aim: To enable the students to understand the basic concepts ofStructural elucidation by classical methods.

**CourseObjectives**

1.Tolearnabout the terpenoids

2.Tolearn about the Brevicomin, Eucomin and Eucomol.

3.TodevelopknowledgeonTerpenoids

4.Tounderstand the basic of Alkaloids

5..TodevelopapieceofknowledgeIntroduction to Biogenesis and Biosynthesis.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Structural elucidation by classical methods.

7.Aftercompleting unit2,thestudentswillbeableto know about the Structure elucidation of terpenoids.

8.Aftercompletingunit3,thestudentswillbe know about the Structure elucidation of Brevicomin, Eucomin and Eucomol.

9.Aftercompletingunit4,thestudentswillbe know about the Synthesis of selected natural products

10.Aftercompletingunit5,thestudentswillbe know about the Introduction to Biogenesis and Biosynthesis.

11.Aftercompletingunit6,thestudentswillbe know about the Natural products used as colour pigments

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Structural elucidation by classical methods: Terpenoids: Cedrene, Alkaloids: Morphine, Steroids: Cholesterol | **18hours** |
| **Unit-II** | .Structure elucidation of terpenoids: and  vetinones and hormones: Cecropia JH by combination of physical and chemical methods. | **18hours** |
| **Unit-III** | Structure elucidation of Brevicomin, Eucomin and Eucomol by spectral methods. | **18hours** |
| **Unit-IV** | Synthesis of selected natural products: Terpenoids: Longifolene (Corey Synthesis), Alkaloids: Reserpine (Woodward Synthesis), Hormones: Cecropia JH (Edward Synthesis), Antibiotics: Cephalosporin (Woodward synthesis), Prostaglandins: Prostaglandins-E2 (Corey Synthesis). | **18hours** |
| **Unit-V** | Introduction to Biogenesis and Biosynthesis. Biogenesis of secondary metabolites: Application of tracer techniques in evaluation of biogenetic pathways of secondary metabolites | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

1. K. Natkanish, Natural product chemistry, Acad Press.
2. I. Fleming, Selected organic synthesis, John Wiley and Sons.
3. J. Apsimon, Total Synthesis of natural products, John Wiley and Sons.
4. D.R. Dalton, The Alkaloids, Marcel Dekker.
5. I.L. Finar, Stereochemistry and Chemistry of natural products.
6. Agrawal O.P., Chemistry of Organic Natural Product, Goel Publication House, UP.
7. E. Ramstad, Modern Pharmacognosy, Mc-graw hill Book Company.
8. Pridham J B, Swain T, Biosynthetic pathway in higher plants, Academic Press, New York.
9. Bardon and Oils, Comprehensive organic Chemistry.
10. J. Corey and Xue-men Cheng, Wiley Interscience.

11) K.C. Nicolau and E.J. Sorensen, Classics in Total Synthesis

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER I**

**CORE ELECTIVE 2 : Toxicology and Environmental Chemistry**

Papercode: Subject: **Toxicology and Environmental Chemistry**

**Hours/Week:5Credits:3**

**Aim: To enable the students to understand the basic concepts of Definition ,principles of toxicology**

**CourseObjectives**

1.Tolearnabout the Carcinogenicity, mutagenicity, teratogenicity.

2.Tolearn about the Toxic chemicals in the environment.

3.TodevelopknowledgeonGreen house effect

4.Tounderstand the basic of Sources of water pollution

5..Todevelopapieceofknowledgefertility management of soils

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Basic principles of toxicology,Pre-clinical valuation of drugs.

7.Aftercompleting unit2,thestudentswillbeableto know about Toxic chemicals in the environment.

8.Aftercompletingunit3,thestudentswillbe know about classification of air pollutants

9.Aftercompletingunit4,thestudentswillbe know about Water quality parameters

10.Aftercompletingunit5,thestudentswillbe know about Sources of water pollution

11.Aftercompletingunit6,thestudentswillbe know about Soil and Soil Pollution

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Definition and types of toxicology, Basic principles of toxicology, Carcinogenicity, mutagenicity, teratogenicity, acute, sub acute and chronic toxicity. Pre-clinical valuation of drugs. Drugs and pregnancy. Drug addiction and drug habit/ dependence drug abuse, physical dependence, psychological dependence. (8L) Detailed toxicity( mild/moderate/severe toxicology wherever applicable) and treatment of drugs such as salicylates/ paracetamol, opium, quinine, ethyl alcohol, nicotine/digitalis, barbiturates, etc. | **18 hours** |
| **Unit-II** | Toxic chemicals in the environment, impact of toxic chemicals on enzymes. Biochemical effects of arsenic, lead mercury, cadmium, carbon monoxide, sulphurdioxide, pesticides and carcinogens. | **18hours** |
| **Unit-III** | Green house effect, Acid rain, Ozone hole phenomenon, Source & toxic effects of Pb and Cd. Sources-stationary and transportation sources of air pollution, classification of air pollutants-sources, effects and control of CO, SO2, NOx, HC as gaseous pollutants, suspended particulate matter aerosols, photochemical air pollution, sampling of air pollutants-gaseous and particulate, analysis of air pollutants, stack monitoring. | **18hours** |
| **Unit-IV** | Water quality parameters and their analysis-colour, temperature, transparency, turbidity, pH, TDS, DO, free CO2, total hardness, Ca & Mg hardness, alkalionity, chloride, sulphate, ammonia, nitrite, NO3, organic N. phosphorus (total inorganic-organic), silica, BOD, COD, DO. | **18hours** |
| **Unit-V** | Sources of water pollution-soild waste, industrial, agricultural, oil, radiaoactive waste, thermal pollution, sampling of water pollutants. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

1. A.K. De, Environment Chemistry, Wiley Eastern Ltd., New Delhi.
2. R.K. Trivedy and P.K. Goel, Chemical and Biological Methods for Water Pollution Studies, Environment Publications, Karad (India)
3. S.L. Chopra and J.S. Kanwar, Analytical Agricultural Chemistry, Kalyani Publishers, New Delhi.
4. Thad Godish, Air Quality.
5. S.P. Mahajan, Pollution control in Process Industries, 1994.
6. Harry Freeman, Hazardous Waste Minimization, 1990.
7. Metcalf and Eddy, Waste Water Engineering, 1993

8. Herfindale.E.T. and Hirschmann,J.L.; Clinical Pharmacy and Therapeutics.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER I**

**CORE ELECTIVE 3 : Basic Fundamentals in Clinical Trials**

Papercode: Subject: **Basic Fundamentals in Clinical Trials**

**Hours/Week:5Credits:3**

**Aim: To enable the students to understand the basic concepts ofclinical trial in new drug developments.**

**CourseObjectives**

1.Tolearnabout the Introduction to clinical Trial

2.Tolearn about the .supervision of ethics

3.TodevelopknowledgeonDesigns used in clinical trials

4.Tounderstand the basic of Stakeholders of clinical trials

5..TodevelopapieceofknowledgeGood Clinical Practice.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Introduction to clinical Trial

7.Aftercompleting unit2,thestudentswillbeableto know about Ethical issues in clinical trials

8.Aftercompletingunit3,thestudentswillbe know about Clinical trial design

9.Aftercompletingunit4,thestudentswillbe know about Clinical trial protocol Development

10.Aftercompletingunit5,thestudentswillbe know about Good Clinical Practice

11.Aftercompletingunit6,thestudentswillbe know about Management of Clinical trials.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | History, terminologies, types of clinical research, phases of clinical research, role of clinical trial in new drug developments | **18hours** |
| **Unit-II** | .Principal, responsible conduct, supervision of ethics, (Informed Consent, Institutional Review Board (Role responsibility, members and auditing), Protection of participants, The Nuremberg Code, The Declaration of Helsinki, The Belmont Report. | **18hours** |
| **Unit-III** | Designs used in clinical trials with their advantages and disadvantages, hypothesis, risks and benefits, subject selection, inclusion and exclusion criteria, randomization, blinding and controls. | **18hours** |
| **Unit-IV** | Required Documentation including Investigator's Brochure, Case Report Forms, Serious Adverse Event (SAE) Reports, Laboratory Certification, data collection and quality control of data, closing out of clinical trial. | **18hours** |
| **Unit-V** | Concept, importance, and GCP guidelines including ICH guidelines | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

# Dipiro, Joseph L.; Pharmacotherapy: A Pathophysiological Approach, Elsevier

# Davidson’s Principles of Internal Medicine, Vol-I And II, 14 th Edition, Mc Graw-Hill

# Harrison’s Principle And Practice Of Medicine, 18 th Edition, Churchill, Livingston, London

# Roger and Walker; Clinical Pharmacy and Therapeutics, Churchill, Livingston, London

# Herfindal, E.T. and Hirschman, J L.; Clinical Pharmacy and Therapeutics

# 6. Tussle, T.G.: Pathology and Therapeutics for Pharmacists: A Basis for Clinical Pharmacy Practice, Chapman and Hall, New York.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**PRACTICALS - I (10 credits)**

**Microbiology & Molecular Biology Laboratory and Instrumental methods of nalysis / NDDS**

1. Study of bacteria, yeasts, moulds, algae, viruses and other microorganisms
2. Morphology, structure, reproduction, isolation, and cultivation
3. Principles of taxonomy and classification, Mutants, Control of microorganisms
4. Laboratory experiments in use of microscopy for identification of microorganisms by morphology and staining technique. Isolation of pure culture
5. Study of growth and optimisation of conditions
6. Preparation of culture media, Sterility test
7. Basic methods in Molecular Biology, including PCR, Blotting techniques, DNA purification, DNA sequencing etc.
8. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds.
9. Estimation of sulphanilamide by colorimetry.
10. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy.
11. Estimation of quinine sulphate by fluorimetry.
12. Study of quenching of fluorescence.
13. Determination of sodium by flame photometry.
14. Determination of potassium by flame photometry.
15. Determination of chlorides and sulphates by nephelo-turbidimetry.
16. Separation of sugars by thin layer chromatography.
17. . Separation of plant pigments by column chromatography.

**SEMESTER I**

**VALUE ADDED COURSE 1 : SOCIAL AND PREVENTIVE PHARMACY**

Papercode:Subject: **SOCIAL AND PREVENTIVE PHARMACY**

# Hours/Week:5 Credits:2

**Aim: To enable the students to understand the basic concepts is to introduce to students**

**a number of health issues and their challenges. This course also introduced a number**

**of national health programmes.**

**CourseObjectives**

1.Tolearnabout the current issues related to health and pharmaceutical problems within the country and worldwide.

2.Tolearn about the critical way of thinking based on current healthcare development

3.Todevelopknowledgeonsolving problems related to health and pharmaceutical issues.

4.Tounderstand the basic of f prevention and control of disease

5..TodevelopapieceofknowledgeMalnutrition and its prevention.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Concept of health and disease ; Social and health education

7.Aftercompleting unit2,thestudentswillbeableto know about Sociology and health;Hygiene and health

8.Aftercompletingunit3,thestudentswillbe know about Preventive medicine

9.Aftercompletingunit4,thestudentswillbe know about National health programs

10.Aftercompletingunit5,thestudentswillbe know about National health intervention programme

11.Aftercompletingunit6,thestudentswillbe know about Health promotion and education

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. | **18hours** |
| **Unit-II** | Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health. Hygiene and health: personal hygiene and health care; avoidable habits. | **18hours** |
| **Unit-III** | Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse. | **18hours** |
| **Unit-IV** | HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme. | **18 hours** |
| **Unit-V** | National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

• Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010,

ISBN: 9789380704104, JAYPEE Publications.

• Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath,

 Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications.

• Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014,

ISBN: 9789351522331, JAYPEE Publications.

• Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A,

2nd Edition, 2018, ISBN: 9789350250440, JAYPEE Publications.

 • Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190188285,

Banarasidas Bhanot Publishers.

 • Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad.

• Sociology for Pharmacist by Kevin Taylor, Sarah Nettleton and Geoffery Harding

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER I**

**VALUE ADDED COURSE 2 : PHARMA MARKETINGMANAGEMENT**

Papercode: Subject: **PHARMA MARKETINGMANAGEMENT**

# Hours/Week:5 Credits:2

**Aim: To enable the students to understand the basic concepts needs highly qualified researchers,**

**chemists and, technical people, but also requires skilled managers who can take the industry**

**forward by managing and taking the complex decisions which are imperative for the growth**

**of the industry**.

**CourseObjectives**

1.Tolearnabout the marketing management groom

2.Tolearn about the role in Sales and Product management.

3.Todevelopknowledgeonunderstanding of marketing concepts

4.Tounderstand the basic of techniques and their applications in the pharmaceutical industry

5..Todevelopapieceofknowledgemarket research.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about general concepts and scope of marketing

7.Aftercompleting unit2,thestudentswillbeableto know about Quantitative and qualitative aspects

8.Aftercompletingunit3,thestudentswillbe know about Product decision

9.Aftercompletingunit4,thestudentswillbe know about Methods, determinants of promotional mix

10.Aftercompletingunit5,thestudentswillbe know about Pharmaceutical marketing channels

11.Aftercompletingunit6,thestudentswillbe know about Pricing.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Definition, general concepts and scope of marketing, distinction between marketing & selling. Marketing environment. Industry and competitive analysis. Analysing consumer buying behaviour and industrial buying behaviour. | **18hours** |
| **Unit-II** | Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patient's choice of physician and retail pharmacist. Analysing the Market; Role of market research. | **18hours** |
| **Unit-III** | Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry. | **18hours** |
| **Unit-IV** | Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products. | **18hours** |
| **Unit-V** | .Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

 Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi.

• Walker, Boyd and Larreche: Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.

• Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill.

 • Arun Kumar and N Meenakshi: Marketing Management, Vikas Publishing, India.

 • Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition).

 • Ramaswamy, U.S & Nanakamari, S: Marketing Management: Global Perspective, Indian Context, Macmillan

India, New Delhi.

 • Shanker, Ravi: Service Marketing, Excel Books, New Delhi.

 • Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

• Pharmaceutical marketing in India by Subba Rao Chaganti.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER I**

**VALUE ADDED COURSE 3 : PHARMACEUTICAL REGULATORY SCIENCE**

Papercode:Subject: **PHARMACEUTICAL REGULATORY SCIENCE**

**Hours/Week:5 Credits:2**

**Aim: To enable the students to understand the basic concepts**  e is designed to impart the

fundamental knowledge on the regulatory requirements for approval of new drugs, and

 drug products in regulated markets of India & other countries like US, EU, Japan, Australia,

UK etc.

**CourseObjectives**

1.To Know about the process of drug discovery and development

2.Tolearn about the role in the regulatory authorities and agencies governing the manufacture and

sale of pharmaceuticals.

3.Todevelopknowledgeonunderstanding of approval process and their registration in Indian

and international markets.

4.Tounderstand the concept of Drug Discovery

5..Todevelopapieceofknowledgen Investigational New Drug

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about general New Drug Discovery and development

7.Aftercompleting unit2,thestudentswillbeableto know about Regulatory Approval Process

8.Aftercompletingunit3,thestudentswillbe know about Regulatory authorities and agencies

9.Aftercompletingunit4,thestudentswillbe know about Registration of Indian drug product in overseas market

10.Aftercompletingunit5,thestudentswillbe know about Clinical trials

11.Aftercompletingunit6,thestudentswillbe know about Regulatory Concepts

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development. | **18hours** |
| **Unit-II** | Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. | **18hours** |
| **Unit-III** | Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications). | **18 hours** |
| **Unit-IV** | Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research. | **18 hours** |
| **Unit-V** | .Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# ReferenceBook:

Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.

 • The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs

 and the Pharmaceutical Sciences, Vol. 185. Informa Health care Publishers.

 • New Drug Approval Process: Accelerating Global Registrations by Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences, Vol. 190.

• Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.

 • FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by

Douglas J. Pisano, David Mantus.

• Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER II**

**\PAPER1: Research Methodology**

Papercode: Subject: **Research Methodology**

**Hours/Week:5Credits:4**

# Aim: To enable the students to understand the basic concepts of Research, Literature survey, Documentation,Research report, presentation , protection of patent and trade marks, Design and copyrights, Industrial Institution Interaction.

**CourseObjectives**

1.Tolearnabout objective of research , literary survey, and also to learn about preparing research

proposal for different types of research .

2. Tolearn about the tools used in research

3. Todevelopknowledgeon paper writing , thesis writing,

4. Tounderstand the basic of protection of patent and trade marks , design and copy rights.

5. .Todevelopapieceofknowledge on industrial - institutional interaction.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know the meaning and purpose and types of Research.

7. Aftercompleting unit2,thestudentswillbeableto know about how to take a Literature survey.

8. Aftercompletingunit3,thestudentswillbe know about how to prepare proposal for diferent types of research .

9.Aftercompletingunit4,thestudentswillbe know about the the Qualitative and Quantitavive studies .

10. Aftercompletingunit5,thestudentswillbe know about the Importance and techniques of Documentation.

11.Aftercompletingunit6,thestudentswillbe know about how to write a research paper and also to know about the importance of spell check.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .MeaningofResearch,PurposeofResearch,TypesofResearch(Educational,Clinical, Experimental, Historical, Descriptive, Basic applied and Patent Oriented Research) –Objective of research- | **18hours** |
| **Unit-II** | Literaturesurvey–UseofLibrary,Books,&Journals–Medline–Internet,getting patents and reprints of articles as sources for literature survey | **18hours** |
| **Unit-III** | Selectingaproblemandpreparingresearchproposalfordifferenttypesofresearch mentioned above. | **18hours** |
| **Unit-IV** | Methodsandtoolsusedin Research* + - Qualitativestudies,QuantitativeStudies
		- Simpledataorganization,Descriptivedataanalysis
		- LimitationsandsourcesofError
		- InquiriesinformofQuestionnaire,Opinionnaireorbyinterview
		- Statisticalanalysisofdataincludingvariance,standarddeviation,students‘t’testand annova, correlation data and its interpretation, computer data analysis
 | **18hours** |
| **Unit-V** | Documentation* + - “How”ofDocumentation
		- Techniquesof Documentation
		- ImportanceofDocumentation

Usesofcomputerpackagesin Documentation | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**PAPER2: Pharmaceutical Biotechnology II**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts of Animal Cell culture , Plant tissue culture, Omics, physical aspects of the genome, Integrons ad transposons, Regular aspects of biotechnology based products.

**CourseObjectives**

1. Tolearnabout Historical background, Importance, Biology of Animal Cell Culture.

2. Tolearn about the evolution of plat tissue culture and also the use of plant growth regulators.

3. Todevelopknowledgeon Proteomics, Genomics and Metabolomics .

4. Tounderstand the basic of Physical aspects of the genome.

5. .Todevelopapieceofknowledge on Integrns and Transposons.

# CourseOutComes

6...Aftercompletingunit1,thestudentswillbeableto know the Importance of Animal Cell Culture, Cell Differentiation and Cloning .

7. Aftercompleting unit2,thestudentswillbeableto know about the basic sspects of Plant tissue culture and Plant growth regulators and secondary metabolites.

8. Aftercompletingunit3,thestudentswillbe know about the methods used in analyzing gene expression and their applications.

9.Aftercompletingunit4,thestudentswillbe know about the physical aspects of the genome.

10. Aftercompletingunit5,thestudentswillbe know about the basic concept of Integrons and Transposons.

11.Aftercompletingunit6,thestudentswillbe know about the Regulatory aspects of biotechnology based products.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .Animal Cell Culture: Historical Background, Importance of and progress in Animal Cell Culture,Technology,BiologyofAnimalCell;CellularInteractions,ImportanceofSerum and Serum Free Media, Culturing and Sub-Culturing of Animal Cells, InVitro Transformation of Animal Cells, Cell Differentiation & Cell Movement, Cloning of Animal Cells, Cell Line Preservation, Cell Line Characterization, ChromosomeSpreading and Karyotype Analysis, Mycoplasma: Detection and Control, Monoclonal Antibody Production, Insect Cell Culture: An Overview | **18hours** |
| **Unit-II** | Plant cell culture: History and evolution, Basics of aseptic culture, In vitro propagation, use of plant growth regulators in tissue culture, plant regeneration, organogenesis,somatic embryogenesis, protoplast isolation and culture, somaclonal variation, in vitro mutagenesis, in vitro selection, secondary metabolite production and cell transformation techniques (including protoplast fusion, direct DNA uptake and plant/ bacterial co-cultivation), use of in vitro techniques for crop improvement. | **18hours** |
| **Unit-III** | Omics: Proteomics, Genomics and Metabolomics: Introduction to the definitions of various‘omics’,introductiontothegeneralfieldofgenomicsandproteomics, introduction to some methods used in analyzing gene expression at the mRNA and protein level, basic principles of DNA/Protein microarrays and their applications | **18 hours** |
| **Unit-IV** | Physical aspects of the genome. Construction and studyof various types of genome maps and large-scale sequencing. The human genome project and the plant genome program. Structural genomics and gene discovery, isolation, localization and characterization. Developing diagnostic tests for plant, animal and human diseases. Identification of biomarkers. Finding genetic markers for plant breeding purposes. Environmental impacts on gene expression. Protein complex structures and amino acids. Protein shapes as affecting its function. Amino acid sequencing. Cellular proteome changes in response to environmental and neighbouring cells conditions. Cataloguing the proteins produced by different cells. Discovering the function of a protein. Determining three-dimensional structure of proteins. Protein crystallography | **18hours** |
| **Unit-V** | Integronsand transposons | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**PAPER3: Advanced Analytical Tools in Biotechnology**

Papercode: Subject: **Advanced Analytical Tools in Biotechnology**

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts of Diagnostic methods and Genome and Post Genomic Analytical Biotechnology and also the Immunological methods and also the Introduction to Bio informatics.

**CourseObjectives**

1. Tolearnabout Molecular Methods and also PCR related Techniques.

2. Tolearn about the Gene purification and sequencing and its applications.

3. Todevelopknowledgeon Immunological methods and techniques for measurements.

4. Tounderstand the basic introduction to bio informatics.

5. .Todevelopapieceofknowledge about the databases and sequence alignments.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know the Molecular methods, blotting techniques, Sequencing and also the PCR techniques.

7. Aftercompleting unit2,thestudentswillbeableto know about the basic of gene sequencing and purification and also the goal and application of genomic and proteomics.

8. Aftercompletingunit3,thestudentswillbe know the Immunological Methods and Immuno chemical techniques for separation.

9.Aftercompletingunit4,thestudentswillbe know about the biological databases, primer designing , gene finding and protein sequencing analysis.

10..Aftercompletingunit5,thestudentswillbe know about the law of absorption fluorimetry

11..Aftercompletingunit6,thestudentswill electrophoresis.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Diagnostic Methods - Molecular Methods: Isolation and purification of nucleic acid and protein, Electrophoresis and visualization of nucleic acid and protein, Blotting techniques, Sequencing and amplification techniques, PCR and related techniques | **18hours** |
| **Unit-II** | Genomic and Post-Genomic Analytical Biotechnology: Gene purification and sequencing, Protein sequencing and purification, The goal and applications of genomics and proteomics, Techniques in use for gene and protein analysis, e.g. crystallography, magnetic resonance | **18hours** |
| **Unit-III** | Immunological Methods:Antibody production and labeling, Immuno chemical techniques for in situ analyses (ICC and IHC), Immuno-chemical techniques for measurement (ELISA, etc), Immuno chemical techniques for separation (Immunoprecipitation, etc) | **18hours** |
| **Unit-IV** | Introduction to Bio-informatics: organization of biological data, databases (raw and processed), quering in databases, primer designing, gene finding, motif finding, sequence alignment, protein sequence analysis | **18hours** |
| **Unit-V** | Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infrared), Centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**PAPER4: Physical Chemistry Concepts in Pharmaceuticals**

# Papercode: Subject: Physical Chemistry Concepts in Pharmaceuticals

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofImportance of chemistry in pharmacy. Important terminologies: Pharmacodynamics, Pharmacokinetics,Pharmacopoeia(IP,BP,USP)

**CourseObjectives**

1. Tolearnabout :Colloids, Colloidal System and their pharmaceutical applications

2. Tolearn about the Importance of studying physical properties

3. Todevelopknowledgeonconcept of viscosity

4. Tounderstand the Micromeritics

5. .Todevelopapieceofknowledge about the Neutron activation analysis.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know Surface Chemistry

7. Aftercompletingunit2,thestudentswillbeableto know Physical properties of drug molecule

8. Aftercompletingunit3,thestudentswillbe know the Rheology of pharmaceutical systems

9.Aftercompletingunit4,thestudentswillbe know about Chemical Kinetics

10..Aftercompletingunit5,thestudentswillbe know about the Isotopic Dilution analysis

11..Aftercompletingunit6,thestudentswillradio pharmaceuticals

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .Colloids, Colloidal System and their pharmaceutical applications. Types of solutions and their properties, Solid and Crystalline State-Formation of solids, types of solids, nature of amorphous and crystalline solids, crystal systems, determination of crystal structure, polymorphism | **18hours** |
| **Unit-II** | Importance of studying physical properties.Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, PPL, optical activity, angle of rotation, specific rotation & its examples, measurement of optical activity & its importance. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination, Importance of Dielectric constant. Induced polarization. Permanent dipole moment- explanation & importance | **18hours** |
| **Unit-III** | Introduction, Definition, Applications, concept of viscosity, Newton’s law offlow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, Non- Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Thixotropy, Brief explanation of Bulges & Spurs, rheopexy, measurement of thixotropy and its applications, Negative thixotropy. Viscosity measurements- selection of viscometer for Newtonian and non Newtonian system , Viscoelasticity & its applications | **18hours** |
| **Unit-IV** | Rates and order of reactions, pharmaceutical applicationsMicromeritics-Introduction to fundamental and derived properties, methods to determine particle size, shape and surface area, density and bulkiness, flow properties compaction. Interfacial phenomenon: Surface tension and surface free energy. | **18hours** |
| **Unit-V** | principle and applications, Neutron activation analysis : Principle, advantages and limitations, Scintillation counters :Body scanning. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Practical Pharmaceutical Chemistry Vol I &II by Beckett and Stenlake.

 2) Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins.

3) Cooper and Gunn’s Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd.

4) Instrumental method of Analysis : Hubert H ., Willard ,7th edition.

5) Physical Chemistry- Bahl and Tuli

6)Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-.C.V.S. Subramanyam.

7) Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house.

8) Radiopharmaceuticals in modern pharmacy and nuclear medicine, Richard J. Kowalsky, Steven W. Falen, Oct.2004, 2nd edn., Amer Pharmacists association.

9) Radiopharmaceuticals-Adrian D. Nunn, Marcel Dekker Publishers.

10) Physical Pharmacy- Physical Chemical principles in the pharmaceutical sciences, Alfred Martins, James Swarbrick, Arthur Cammarata ,3rd edition Indian edition, K.M.Varghese Publishing House.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER II**

**ELECTIVE PAPER 1: Organic Chemistry I**

Papercode: Subject: **Organic Chemistry I**

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofChemical Bonding,.Molecular Properties of organic molecules.

**CourseObjectives**

1. Tolearnabout the concept of Vander waals, ion-dipole bonds

2. Tolearn about the concept of Electronic effects

3. TodevelopknowledgeonStereochemical Principles

4. Tounderstand the concept of Classification of reactions

5. .Todevelopapieceofknowledge about Organic Reaction Mechanisms

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the Chemical Bonding in Organic Molecules

7. Aftercompletingunit2,thestudentswillbeableto know Molecular Properties of organic molecules

8. Aftercompletingunit3,thestudentswillbe know the Stereochemistry

9.Aftercompletingunit4,thestudentswillbe know about reaction intermediate

10..Aftercompletingunit5,thestudentswillbe know about theOrganic Reaction Mechanisms

11..Aftercompletingunit6,thestudentswill Electrophilic Aromatic Substitution

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Covalent, Ionic, Hydrogen, Vander waals, ion-dipole bonds with examples. | **18hours** |
| **Unit-II** | Hydrophilicity, Hydrophobicity, acidity, basicity, Electronic effects-(Inductive, resonance, mesomeric), Steric effec | **18 hours** |
| **Unit-III** | Stereochemical Principles – Enantiomeric relationships, diastereomeric Relationships, R and S, E and Z nomenclature, dynamic stereochemistry, prochiral relationships,Stereospecific and stereoslective reactions. Stereochemistry of compounds containing phosphorus, sulphur and nitrogen. Introduction of optical activity in the absence of chiral carbon (biphenyl, allenes, spiranes and helical structures). Conformation of acyclicmolecules and shape of six membered rings | **18 hours** |
| **Unit-IV** | .Homolysis, Heterolysis, Classification of reactions (addition, elimination, substitution etc.), generation structure, stability and reactivity of carbocation, Carbanions, free radicals, Carbenes and nitrenes | **18hours** |
| **Unit-V** | Aliphatic Nucleophilic substitution-The SN2, SN1, mixed SN1 and SN2 and SET mechanism. Nucleophilic substitution at an allylic aliphatic trigonal and vinylic carbon. Reactivity effects of structure, attacking nucleophile, leaving group, and reaction. Medium, phase transfer catalyst and ultrasound, ambident nucleophile, Regioselectivity | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Modern Synthetic Reaction, by H.O.House, W.A. Benjamin INC 1972.
2. Modern methods of Organic Synthesis , by W. Carruthers, Cambridge University Press.
3. Organic Synthesis, by Michael B Smith , 2nd edition, London, McGraw Hill 2002.
4. Modern Organic Synthesis An Introduction, George S. Zueifel, Michael H . Nantz , New York.
5. Oxidation & Reduction in Organic Synthesis, Timothy T. Donohoe, OxfordOxford University Press 2000.
6. Sterochemistry – Conformation and mechanism, P.S. Kalsi, New age International(P), Ltd Publishers.
7. J. March (Ed. V) Adv. Organic Chemistry.

 8) Stereochemistry of organic compounds by D. Nasipuri.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER II**

**ELECTIVE PAPER 2:Unit Operation in Bioprocesses**

# Papercode:Subject : Unit Operation in Bioprocesses

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofDownstream Processing,Cell disruption methods.

**CourseObjectives**

1. Tolearnabout the concept of bioprocess designing.

2. Tolearn about the concept of Cell disruption methods

3. TodevelopknowledgeonEnrichment operations

4. Tounderstand the concept of electrophoretic separations

5. .Todevelopapieceofknowledge about Ultracentrifugation.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the Ultracentrifugation

7. Aftercompletingunit2,thestudentswillbeableto know Primary separation and recovery processes.

8. Aftercompletingunit3,thestudentswillbe know the Enrichment operations

9.Aftercompletingunit4,thestudentswillbe know about Product resolution / fractionation

10..Aftercompletingunit5,thestudentswillbe know about the Product finishing

11..Aftercompletingunit6,thestudentswillbe know about the Process Analytical Technology

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Downstream Processing in Biotechnology, Selection of unit operation with due consideration of physical, chemical and biochemical aspect of biomolecules, basic review of bioprocess designing | **18hours** |
| **Unit-II** | Primary separation and recovery processes: Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods. | **18hours** |
| **Unit-III** | Enrichment operations: Membrane – based separations (micro and ultrafiltration, precipitation methods, extractive separation, aqueous two-phase extraction, supercritical extraction, insitu product removal, integrated bioprocessing. | **18hours** |
| **Unit-IV** | Product resolution / fractionation: Adsorptive chromatographic separations processes, electrophoretic separations, hybrid separation technologies (electrochromatography). | **18hours** |
| **Unit-V** | Product finishing: precipitation/crystallization, mixing, dialysis, distillation and drying. Ultracentrifugation as a separation technique for fractionation of cells and proteins. | **18 hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**ELECTIVE PAPER 3:ADVANCED PHARMACEUTICAL BIOTECHNOLOGY**

# Papercode: Subject: ADVANCED PHARMACEUTICAL BIOTECHNOLOGY

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts of isolation and purification of enzymes, to enrich students with current status of development of vaccines and economic importance of biotechnology products.

**CourseObjectives**

1. Tolearnabout the concept of the latest technology development in biotechnology technique,

tools and their uses in drug and vaccine development.

2. Tolearn about the concept to Identify appropriate sources of enzymes.

3. TodevelopknowledgeonUnderstand and perform genetic engineering techniques in

gene manipulation, rDNA technology and gene amplification.

4. Tounderstand the concept of Understand the overview of pharmacogenomics

5. .Todevelopapieceofknowledge about the regulatory approval process and key regulatory agencies for new drugs, biologics, devices, and drug-device combinations.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the impact of genetic engineering in modern society, the students should be endowed with strong theoretical knowledge of this technology.

7. Aftercompletingunit2,thestudentswillbeableto know The basics of enzyme technologies used in pharmaceutical industry

8. Aftercompletingunit3,thestudentswillbe know the Understand the overview of pharmacogenomics.

9.Aftercompletingunit4,thestudentswillbe know about Therapeutic peptides

10..Aftercompletingunit5,thestudentswillbe know about the Signal transduction

11..Aftercompletingunit6,thestudentswill Microbial Biotransformation

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Classification, general properties of enzymes, dynamics of enzymatic activity, sources of enzymes, extraction and purification, pharmaceutical, therapeutic and clinical application. Production of amyloglucosidase, glucose isomerase, amylase and trypsin. | **18hours** |
| **Unit-II** | Techniques of gene manipulation, cloning strategies, procedures, cloning vectors expression vectors, recombinant selection and screening, expression in E. coli and yeast. Site directed mutagenesis, polymerase chain reaction, and analysis of DNA sequences. Gene library and cDNA Applications of the above technique in the production of, a) Regulatory proteins: Interferon, Interleukins b) Blood products: Erythropoietin c) Vaccines: Hepatitis-B d) Hormones: Insulin | **18 hours** |
| **Unit-III** | Study on controlled and site specified delivery of therapeutic peptides and proteins through various routes of administration. • Transgenic animals • Production of useful proteins in transgenic animals and gene therapy. • Human Genome • The human genome project-a brief study, Human chromosome – Structure and classification, chromosomal abnormalities – Syndromes | **18hours** |
| **Unit-IV** | Introduction, cell signalling pathways, Ion channels, Sensors and effectors, ON and OFF mechanisms, Spatial and temporal aspects of signaling, cellular process, development, cell cycle and proliferation, neuronal signaling, cell stress, inflammatory responses and cell death, signaling defects and diseases | **18hours** |
| **Unit-V** | Oncogenes, Introduction, definition, various oncogenes and their proteins. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Biotechnology-The biological principles: MD Trevan, S Boffey, KH Goulding and P.F. Stanbury.
2. Immobilization of cells and enzymes: Hosevear Kennadycabral & Bicker staff
3. Principles of Gene Manipulating: RW Old and S. B. Primrose.
4. Molecular Cell Biology: Harvey Lodish, David Baltimore, Arnold Berk, S Lawence Zipursky, Paul Matsudaira, James Darnell.
5. Modern Biotechnology: S.B Primros.
6. Gene transfer and expression protocols-methods in Molecular Biology, vol. VII, Edit E.T. Murray
7. Current protocols in Molecular Biology, Vo1. I & II F.M. Asubel, John Wiley Publishers
8. Current protocols in cellular biology, Vo1.1 & II John Wiley publishers.

 9. Principles of human genetics; by Curt Stern, published by W.H. Freeman

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**PRACTICAL -II**

**PHARMACEUTICAL BIOTECHNOLOGY - I**

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on Gas Chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. Isolation and Purification of microorganism from the soil
8. Microbial contamination of Water and biochemical parameters.
9. Determination of Minimum Inhibitory concentration by gradient plate technique and serial dilution method.
10. UV- survival curve and Dark repair

**PHARMACEUTICAL BIOTECHNOLOGY - II**

1. Synthesis of organic compounds by adapting different approaches involving (3 experiments)

a) Oxidation b) Reduction/hydrogenation c) Nitration

1. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)
2. Assignments on regulatory requirements in API (2 experiments)
3. Comparison of absorption spectra by UV and Wood ward – Fieser rule
4. Interpretation of organic compounds by FT-IR
5. Interpretation of organic compounds by NMR
6. Interpretation of organic compounds by MS
7. Determination of purity by DSC in pharmaceuticals
8. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra

10. To carry out the preparation of following organic compounds

**SEMESTER II**

**OPEN ELECTIVE 1: Biochemical Engineering Fundamentals**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofthermodynamics, Reaction yield; Reaction rate.

**CourseObjectives**

1. Tolearnabout the concept of Kinetics of microbial growth.

2. Tolearn about the concept of Monitoring and control of bioreactors

3. TodevelopknowledgeonContinuous operation of a mixed reactor;

4. Tounderstand the concept of types of agitational methods

5. .Todevelopapieceofknowledge about Mechanisms of heat transfer.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the Homogenous reactions

7. Aftercompletingunit2,thestudentswillbeableto know about the Microbial growth

8. Aftercompletingunit3,thestudentswillbe know the Reactor design-I

9.Aftercompletingunit4,thestudentswillbe know about Reactor design-II

10..Aftercompletingunit5,thestudentswillbe know about the Agitation

11..Aftercompletingunit6,thestudentswill Heat transfer in bioreactors

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .Reaction thermodynamics; Reaction yield; Reaction rate; Reaction kinetics; Calculation of reaction rates from experimental data; General reaction kinetics for biological systems; Zero-order kinetics; Michaelis-Menten kinetics; Determining enzyme kinetic constants from batch data | **18 hours** |
| **Unit-II** | : Kinetics of microbial growth; substrate utilization and product formation; Structured and unstructured model for growth | **18hours** |
| **Unit-III** | Bioreactor configurations; Stirred tank; Airlift reactor; Packed bed; Monitoring and control of bioreactors; Ideal reactor operation | **18hours** |
| **Unit-IV** | Batch operation of a mixed reactor; Total time for batch reaction cycle; Continuous operation of a mixed reactor; Chemostat cascade; Continuous operation of a plug flow reactor | **18hours** |
| **Unit-V** | Need of agitation in aerobic fermentation; Effect of agitation; How agitation helps aeration; different types of agitational methods; impeller design | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Bioprocess engineering: Basic concept by Michael L. Shuler, Fikret Karg
2. Bioprocess engineering Principles by Pauline M. Doran
3. Biochemical Engineering Fundamentals by James Edwin Bailey, David F. Ollis
4. Principles of Fermentation Technology by Peter Stanbury, Allan Whitaker, Stephen Hall

5. Biotol series (This series has many books pertaining to all fields of Biotechnology, students have to select the books as per the topic of interest)

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**OPEN ELECTIVE 2:Biotechnology in Pharmaceutical Sciences**

# Papercode:Subject:M.scPharmaceutical Biotechnology

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofdrug discovery,Genomics,Cloning and characterization of biopharmaceuticals.

**CourseObjectives**

1. Tolearnabout the concept of target based drug design and target discovery

2. Tolearn about the concept of genome sequencing and sequence comparison methods

3. TodevelopknowledgeonIsolation and validation of targets,

4. Tounderstand the concept of Protein expression systems

5. .Todevelopapieceofknowledge about Enzyme purification and assay.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the the application of molecular biology and genetic engineering tools in research, therapeutics, industries and forensics.

7. Aftercompletingunit2,thestudentswillbeableto know the interpretation of molecular research published in the scientific research literature.

8. Aftercompletingunit3,thestudentswillbe know the the genetic machinery of cells, gene transcription, translation, and regulation, along with technical understanding of gene editing tools and its applications.

9.Aftercompletingunit4,thestudentswillbe know about e the advances in immunology towards biotechnology, development of hybridoma, vaccines, peptides, lymphokines, antibodies.

10..Aftercompletingunit5,thestudentswillbe know about theVarious protein purification methods

11..Aftercompletingunit6,thestudentswill Introduction to microbial growth.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .Biology in drug discovery; Traditional drug discovery vs. rational drug discovery, rational drug discovery pipeline, concept of target based drug design and target discovery, role of plant biotechnology in edible vaccine development | **18hours** |
| **Unit-II** | Concept of genome, genes and gene expression, genome sequencing and sequence comparison methods (e.g. BLAST), gene expression comparison methods (microarray). Comparative genomics and expression genomics for target discovery of communicable diseases and lifestyle disease. | **18hours** |
| **Unit-III** | Isolation and validation of targets, PCR, RT-PCR nucleic acid isolation, cloning vectors (some examples), enzymes used in molecular cloning methods (some examples). Cloning and characterization of biopharmaceuticals. | **18hours** |
| **Unit-IV** | Gene expression in bacteria, yeast, insect and mammalian cells. | **18hours** |
| **Unit-V** | Various protein purification methods, enzyme based assay for small molecule screening. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER II**

**OPEN ELECTIVE 3:Analysis, Diagnostics and Cell based Screening**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofdiagnostic immunoassays,biochemical and cellular assays.

**CourseObjectives**

1. Tolearnabout the basic concept of homogeneous immunoassays

2. Tolearn about the basic concept of DNA probe based diagnostics

3. TodevelopknowledgeonBiomarkers

4. Tounderstand the concept of Requirements and parameters

5. .Todevelopapieceofknowledge about Assays compatible with cell membranes

# Course OutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the Principles, methods and applications of immuno-diagnostics

7. Aftercompletingunit2,thestudentswillbeableto know Principles, methods and applications of DNA-based diagnostics

8. Aftercompletingunit3,thestudentswillbe know the Diagnostics

9.Aftercompletingunit4,thestudentswillbe know about High-throughput screening

10..Aftercompletingunit5,thestudentswillbe know about theScreening assays

11..Aftercompletingunit6,thestudentswill Yeast two-hybrid system:

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .: Principles and methods of some clinically used diagnostic immunoassays, e.g., homogeneous immunoassays, fluorescence, chemiluminescence and bioluminescence enzyme immunoassays, immunoblot, immunoaffinity, immunoprecipitation, biotinylation, immunosensors | **18hours** |
| **Unit-II** | DNA probe based diagnostics, sample preparation, hybridization, separation, detection, PCR-RFLP in paternity and forensic cases SNP detection MALDI and DHPLC | **18hours** |
| **Unit-III** | Biomarkers and NGS in Diagnostics, human retroviral diseases specially AIDS, Role of enzymes in diagnostics | **18 hours** |
| **Unit-IV** | Requirements and parameters, Advantages and disadvantages of biochemical and cellular assays; miniaturization and automation | **18 hours** |
| **Unit-V** | Advantages over in vitro assays. Formats: radioactive, luminescence, fluorescence, etc. Assays compatible with cell membranes: GTPyS, cAMP accumulation | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. The immunoassay Handbook by David Wild
2. High Throughput Screening: The Discovery of Bioactive Substances by John P. Devlin
3. Practical Biochemistry: Principles and Techniques, by K. Wilson and J. Walker
4. Experimental Biochemistry, by R. L. Switzer and L. F. Garrity W. H.
5. Principles of Biochemistry by Lehinger.

 6. Biochemistry by L. Stryer Atul Prakashan

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER II**

**COMPULSORY PAPER 1:Introduction to Cancer Biology**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofCarcinogenesis.

**CourseObjectives**

1. Tolearnabout the concept of stages of carcinogenesis

2. Tolearn about the concept of role of transcription factors and miRNA

3. Todevelopknowledgeondysregulation in cancer

4. Tounderstand the concept of Cancer stem cells

5. .Todevelopapieceofknowledge about chemotherapy,

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about thethe molecular and cellular process that leads to cancer

7. Aftercompletingunit2,thestudentswillbeableto know the recent advances and methods involved in cancer research

8. Aftercompletingunit3,thestudentswillbe know the the tools and techniques involved in cancer diagnostics and research

9.Aftercompletingunit4,thestudentswillbe know about cancer therapies and the scientific rationale for developing new treatments

10..Aftercompletingunit5,thestudentswillbe know about thePreclinical molecular imaging

11..Aftercompletingunit6,thestudentswillchemo prevention

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | .Define cancer, various types, hallmarks of cancer, stages of carcinogenesis, Tumor microenvironment, importance of extracellular matrix, immunosurvelliance and immunoediting with respect to tumorigenesis | **18hours** |
| **Unit-II** | Mutations, oncogenes, tumor suppressor genes, mutagens, gene dysregulation, DNA damage and repair, epigenetic alterations, role of transcription factors and miRNA | **18hours** |
| **Unit-III** | Role of receptors (GPCRs, TRKs), cell cycle dysregulation in cancer, altered metabolism, warburg effect. | **18hours** |
| **Unit-IV** | Cancer stem cells, their role in cancer progression, cancer stem cell markers, extracellular vesicle (exosomes etc.), in-vitro tumor models (2D, 3D, patient-derived models), pre-clinical mouse models. | **18 hours** |
| **Unit-V** | Preclinical molecular imaging, biopsy (tissue and liquid), laboratory investigations, tumor and circulating biomarkers, therapeutic targets, TNM staging, NGS based diagnostics | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. The Cell: A Molecular Approach by Geoffrey M. Cooper, Robert E. Hausman
2. Molecular Biology of the Cell, by Bruce Albert
3. Hallmarks of Cancer: The Next Generation by Douglas Hanahan, Robert A. Weinberg

 4. Relevant review & research papers.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**CORE PAPER 1:BIOPROCESS & FERMENTATION TECHNOLOGY**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofBioprocess Technology.

**CourseObjectives**

1. Tolearnabout the concept of bioprocess engineering

2. Tolearn about the concept of fermentation processes

3. TodevelopknowledgeonMedia formulation

4. Tounderstand the concept of sugar conversion processes and their downstream processing

5. .Todevelopapieceofknowledge about Fermented foods and beverages

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Basic principles of Bioprocess Technology

7. Aftercompletingunit2,thestudentswillbeableto know the Concepts of basic mode of fermentation processes

8. Aftercompletingunit3,thestudentswillbe know the the Upstream and downstream processing

9.Aftercompletingunit4,thestudentswillbe know about Applications of enzymes in food processing

10..Aftercompletingunit5,thestudentswillbe know about Applications of Microbes in food process operations and production

11..Aftercompletingunit6,thestudentswill Fermenter Design & types

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction to concepts of bioprocess engineering, Overview of bioprocesses with their various components, Isolation, screening and maintenance of industrially important microbes; Strain improvement for increased yield and other desirable characteristics, Microbial growth and death kinetics with respect to fermenters, optimization of bioprocesses, yield coefficient, doubling time, specific growth rate, metabolic and biomass productivities, effect of temperature, pH and salt concentration on product formation. | **18hours** |
| **Unit-II** | Bioreactor designs; Types of fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Solid substrate, surface and submerged fermentation; Fermentation media; Design and types of culture/production vessels- Batch, Fed batch, CSTBR, airlift, packed bed and bubble column fermentor; Impeller, Baffles, Sparger. | **18hours** |
| **Unit-III** | Media formulation; Inocula development and Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process. Bioseparation techniques; Cell disruption methods; Liquid-liquid extraction; Purification by chromatographic techniques; Reverse osmosis and ultrafiltration, drying, crystallization, storage and packaging; Treatment of effluent and its disposal | **18hours** |
| **Unit-IV** | Mechanism of enzyme function and reactions in process techniques; Enzymic bioconversions e.g. starch and sugar conversion processes and their downstream processing; baking by amylases, deoxygenation and desugaring by glucose oxidase, beer mashing and chill proofing; cheese making by proteases | **18hours** |
| **Unit-V** | Fermented foods and beverages; cheese and bread production, food ingredients and additives prepared by fermentation and their purification; fermentation as a method of preparing and preserving foods; Microbes and their use in pickling, producing colours and flavours, alcoholic beverages and other products; Process wastes-whey, molasses, starch substrates and other food wastes for bioconversion to useful products, probiotics, prebiotics and symbiotics. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. .Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.  Crueger W and Crueger A. (2000).
2. Biotechnology: A textbook of Industrial Microbiology. 2nd edition, Panima Publishing Co. New Delhi.  Patel AH. (1996).
3. Industrial Microbiology. 1st edition, Macmillan India Limited.  Jackson AT.,
4. Bioprocess Engineering in Biotechnology, Prentice Hall, Engelwood Cliffs, 1991.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**CORE PAPER 2:PHARMACEUTICAL BIOTECHNOLOGY AND DRUG DESIGNING**

# Papercode:Subject:M.scPharmaceutical Biotechnology

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofDrug discovery methods.

**CourseObjectives**

1. Tolearnabout the concept of metabolic enzymes involved in nucleic acid synthesi

2. Tolearn about the concept of Drug Discovery Process

3. Todevelopknowledgeon, Validation techniques of Pharmaceutical targets

4. Tounderstand the concept of drug delivery and drug targeting

5. .Todevelopapieceofknowledge about Formulation of Biotechnological Products

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about metabolic enzymes involved in nucleic acid synthesis

7. Aftercompletingunit2,thestudentswillbeableto know the Drug discovery methods

8. Aftercompletingunit3,thestudentswillbe know the the Concepts of Bio availability

9.Aftercompletingunit4,thestudentswillbe know about : Pharmacology of drugs

10..Aftercompletingunit5,thestudentswillbe know about Formulations

11..Aftercompletingunit6,thestudentswillbe known aboutRegulation of Pharmaceutical Biotechnological Products.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction and History, DNA, RNA, post-translational processing, metabolic enzymes involved in nucleic acid synthesis, G-protein coupled receptors (monomeric transmembrane proteins), small molecule receptors, ligand-gated ion channels (oligomeric transmembrane proteins), transporters (multi-transmembrane proteins). | **18hours** |
| **Unit-II** | Meaning of drugs, Drug Discovery Process, biological activity directed and other types of screening, natural products, combinatorial chemistry; General overview of validation techniques, Methods of Drug Discovery and development, QSAR and SAR | **18 hours** |
| **Unit-III** | Concepts of Bio availability, Process of drug absorption, Pharmacokinetic processes, Timing for optimal therapy, Drug delivery considerations for the new biotherapeutics. | **18hours** |
| **Unit-IV** | Physicochemical Properties in Relation to Biological Action, Effects of route of administration, Drug Targets, Validation techniques of Pharmaceutical targets, Pharmacokinetics and pharmacodynamics of drugs, Drug Toxicity. Basic terminologies in drug delivery and drug targeting, Doses forms, Various routes of administration of drugs (just introduction), Strategies for enhanced therapeutic efficacies (Basic principles) DNA vaccines, Vaccines & Monoclonal antibody based pharmaceuticals, Antibiotics, Characterization and Bioanalytical aspects of Recombinant proteins as pharmaceutical drugs. | **18hours** |
| **Unit-V** | Formulation of Biotechnological Products, Drug Delivery, Examples of some Biotechnological products in clinical development. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Drug Delivery and Targeting, A.M. Hillery, A.W. Lloyd and J. Swarbrick, Harwood Academic Publisher 
2. Pharmaceutical Dosage Forms and Drug Delivery Systems, H.C. Ansel, L.V. allen and N.G. Popovich, Lippincott Williams and Wilkins Publisher  3.Applications of Targeted Nano Drugs and Delivery Systems, Shyam Mohapatra, Shivendu Ranjan, Nandita Dasgupta, Raghvendra Mishra and Sabu Thomas (EDs.), Elsevier, 2019. 

4.Introduction to Biophysical Methods for Protein and Nucleic Acid Research, J.A. Glasel and M.P. Deutscher, Academic Press.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**CORE PAPER 3:Chemistry of Drugs**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:4**

# Aim: To enable the students to understand the basic concepts ofIntroduction to Pharmaceuticals.

**CourseObjectives**

1. Tolearnabout the concept of Nomenclature of Pharmaceuticals

2. Tolearn about the concept of Sex hormones and related compounds

3. Todevelopknowledgeon: Fat soluble vitamins

4. Tounderstand the concept of Cholinergic agents

5. .Todevelopapieceofknowledge about Adrenergic and cholinergic drugs

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Introduction to Pharmaceuticals

7. Aftercompletingunit2,thestudentswillbeableto know the biosynthesis of naturally occurring compounds

8. Aftercompletingunit3,thestudentswillbe know the Sex hormones and related compounds

9.Aftercompletingunit4,thestudentswillbe know about Vitamins

10..Aftercompletingunit5,thestudentswillbe know about Adrenergic and cholinergic drugs

11..Aftercompletingunit6,thestudentswillbe known about Cholinergic agents

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction to Pharmaceuticals, Historical development, Classification drugs, Nomenclature of Pharmaceuticals & Drug metabolism reactions. | **18hours** |
| **Unit-II** | Structure, stereochemistry, nomenclature, mode of action, specific clinical applications and structure activity relationships, biosynthesis of naturally occurring compounds and synthesis of prototypical drugs in each category. (Chemical & Pharmacological) for the following classes of drugs | **18hours** |
| **Unit-III** | ) Hormones: Sex hormones and related compounds (Estrogens, Androgens, Progestational agents, Anabolic steroids, Contraceptives), Adrenal cortex hormones, Thyroid hormones and antithyroid drugs, pancreatic hormones, Hypothalamus hormones | **18hours** |
| **Unit-IV** | Vitamins: Fat soluble vitamins (A,D,E and K), water soluble vitamins (Folic acid, B18 and C). | **18hours** |
| **Unit-V** | Adrenergic and cholinergic drugs (Agonist & antagonists): | **18 hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceuticals Chemistry, 8th edition, edited by R.F. Doerge, J.B. Lippincott Company, Philadelphia, 1982.
2. Pharmaceutical Chemicals in Perspective, B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.

3 W.C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia, U.S.A.

 4. H. Singh and V. K. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi 2005 (Latest edition)

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**CORE PAPER 4:CHEMISTRY OF DRUGS -II**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5Credits:4**

# Aim: To enable the students to understand the basic conceptsStructure, stereochemistry (wherever involved), nomenclature, mode of action, specific clinical applications and structure activity relationships, and synthesis of prototypical drugs.

**CourseObjectives**

1. Tolearnabout the concept of unclassified antibiotics.

2. Tolearn about the concept of . Antimycobacterials

3. Todevelopknowledgeon, Anthelmintics

4. Tounderstand the concept of Antiamoebic and antiprotozoal drugs

5. .Todevelopapieceofknowledge about Antiviral agents

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about unclassified antibiotics.

7. Aftercompletingunit2,thestudentswillbeableto know the . Antimycobacterials

8. Aftercompletingunit3,thestudentswillbe know the the Anthelmintics

9.Aftercompletingunit4,thestudentswillbe know about Antiamoebic and antiprotozoal drugs

10..Aftercompletingunit5,thestudentswillbe know about Antiviral agents

11..Aftercompletingunit6,thestudentswillbe known about Antineoplastic agents

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Antibacterials: Penicillines, Cephalosporins, Tetracyclines, Aminoglycosides, Chloramphenicol, Macrolides, Lincomycins, Polypeptide antibiotics, Polyene antibiotics. Sulfonamides and Sulfones, fluoroquinolines, Trimethoprim and other unclassified antibiotics. | **18 hours** |
| **Unit-II** | Antimycobacterials: Sulfanilamides, p-Aminosalicyclic acid derivatives , Thioamides, Thiourea derivatives, Thiosemicarbonazones, Isoniazid, Kanamycin sulfate, Capreomycin, Rifampin, Pyrazinamide, Anthionamide, Clofazimine, Cyclosporin, Dapsone, Sulfazem. & Antileprotic agents. | **18 hours** |
| **Unit-III** | Anthelmintics: Introduction. Tetrachloroethylene, Piperazines, Gentian violet, Pyrantel pamoate, Thiabendazole, Mabendazole, baphenium hydroxynaphthoate, Dichlophene, Niclosamide, levamisole hydrochloride, Tetramisole, Niridazole, Biothional, Antimonypotassium tartarate, Stibiophen, Sodium Stibiocaptate. | **18 hours** |
| **Unit-IV** | Antiamoebic and antiprotozoal drugs: Emetine hydrochloride, 8-Hydroxyquinoline, Iodochlorohydroxyquinol, Metronidazole, Diloxanide furoate, Bilamical hydrochloride, Hydroxystilbamidine isothinate, Pentamidine isothionate, Nifurtimox, Suramin sodium, Carbarsone, Glycobiarsol, Melarsoprol, Sodium stibogluconate, Dimercaprool, Diethycarbamazine citrate, Centarsone, Acetarsone, Antimony potassium tartarate, Bismuth sodium thioglycollate, Sulphonamide, Stibiophen, Bismuth sodium thioglycollamate, Furazolidone. | **18 hours** |
| **Unit-V** | . Antiviral agents: Introduction, Screening methodology, Admantane derivatives (Amantadine, Rimantadine), Idozuridine, Trifluridine, Vidarabine, Ribavarain, Acycloguanosine, Inospiplex, Methisazone, Zidovudine, Acyclovir, Ganciclovir, Foscarnet, Human interferon. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

Strategies of Organic Drug Synthesis and Design, D. Lendnicer, John Wiley and Sons, New York. 1998

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**ELECTIVE PAPER 1:DRUG DESIGN AND DRUG DEVELOPMENT**

# Papercode:Subject:M.sc Pharmaceutical Biotechnology

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofDrug Design & Drug Development

**CourseObjectives**

1. Tolearnabout the concept of Quantum Mechanics

2. Tolearn about the concept of QSAR Analysis

3. TodevelopknowledgeonMolecular interactions and interactive graphics

4. Tounderstand the concept of Single and two compartment pharmacokinetics

5. .Todevelopapieceofknowledge about Peptidomimetics

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Introduction to Drug Design & Drug Development

7. Aftercompletingunit2,thestudentswillbeableto know the Drug Receptor Interactions

8. Aftercompletingunit3,thestudentswillbe know the Computer Aided Drug Designing:

9.Aftercompletingunit4,thestudentswillbe know about Pharmacokinetics in Drug designing

10..Aftercompletingunit5,thestudentswillbe know about Peptidomimetics

11..Aftercompletingunit6,thestudentswillbe known about Prodrug Approach

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Definition, History (Chronological Evolution), Drug design approaches, Lead optimization, de Novo drug design. Quantum Mechanics: Introduction to quantum mechanics, postulates of quantum mechanics, Schrodinger equation, Perturbation theories of drug action, Pullman’s dispositive bond theory, Role of charge transfer process in drug action, conformational aspects & molecular orbital calculations , molecular orbital approach to drug design with examples. | **18hours** |
| **Unit-II** | Historical background, Receptor theories, Forces involved in drug receptor interactions; covalent & non-covalent interactions; Agonist & Antagonists. QSAR Analysis: Parameters & Biological data for QSAR, Design of Test series in QSAR: Craig plot, Topliss operational scheme, cluster analysis. Quantitative models: Hansch (Extrathermodynamic) , Free Wilson (Additivity model) , Mixed approach. Statistical method for QSAR: Regression analysis, multiple regression, stepwise multiple regression, Partial least square analysis. Validation of QSAR models. | **18hours** |
| **Unit-III** | Computer requirement hardware, software, Data base and information retrieval techniques. Graphical description of chemical structure. Molecular interactions and interactive graphics. Introduction of molecular mechanics, molecular dynamics & quantum mechanics (semiempirical & ab initio methods).Modelling in medicinal chemistry-uses and limitations. Logico structural approaches. Activity feature selection within a group of compounds, Activity profile selection. | **18hours** |
| **Unit-IV** | Pharmacokinetics, Environmental pharmacokinetics. Single and two compartment pharmacokinetics. Pharmacokinetics of drug metabolism. Dissection of a drug molecule in to biofunctional moieties. Modulation of pharmacokinetics by molecular manipulations, Modulation of distribution of pharmacea over various compartments, Modulation of time-concentration relationship . Lipinski Rule, QSPR, Biopharmaceutics. Generic equivalence and non-equivalence. Role of biopharmaceutics in Drug designing | **18hours** |
| **Unit-V** | Peptidomimetics research, Rational design of Peptidomimetics, nonpeptide, Ligands for peptide receptors, Applications of oligonucleotides in antiviral and antitumoral chemotherapy. Antisense nucleotides designing. Carbohydrate based Therapeutics. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. The Organic Chemistry of Drug Design and Drug Action. by R.B. Silverman, Academic Press,1992.
2. Drug Designs- A series of monographs in medicinal chemistry edited by A.J. Ariens. Ist edition. Vol. I, II, V, VIII & IX (only relevant chapters).
3. Comprehensive medicinal chemistry. Peragmon Press. 1990, Vol.4.

4. Burger’s Medicinal Chemistry & Drug Discovery . Fifth edition vol-.I, Willey Interscience.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**ELECTIVE PAPER 2: Basics of Pharmaceutical Chemistry**

Papercode: Subject: **Basics of Pharmaceutical Chemistry**

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts Origin, development and scope of chemical sciences, pharmaceutical sciences.

**CourseObjectives**

1. Tolearnabout the concept of Pharmacy, pharmacology, pharmacophore, pharmacodynamics

2. Tolearn about the concept of hydrocolloids

3. Todevelopknowledgeon, drug formulations

4. Tounderstand the concept of drug molecules

5. .Todevelopapieceofknowledge aboutorganoleptic additives.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Drugs & Pharmaceuticals

7. Aftercompletingunit2,thestudentswillbeableto know the Formulations , Properties & their influence

8. Aftercompletingunit3,thestudentswillbe know the the additives in formulation of different dosage forms

9.Aftercompletingunit4,thestudentswillbe know about Physical, chemical and biological properties of drug molecules

10..Aftercompletingunit5,thestudentswillbe know about Impurities & sources of impurities in drug formulations

11..Aftercompletingunit6,thestudentswillbe known about Development of Pharmaceuticals

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Origin, development and scope of chemical sciences, pharmaceutical sciences, introduction to the fundamentals of pharmaceutical sciences,Drug and disease (definition).Historical evolution. Sources-plant, Animal and synthetic Biotechnology and human gene therapy. Terminology: Pharmacy, pharmacology, pharmacophore, pharmacodynamics, Pharmacokinetic- (ADME, Receptors- brief treatment), Metabolites and Anti-metabolites. Nomenclature: Chemical name, Generic name, and Trade names with examples. Classification: Classification based on structures and therapeutic activity with one example each | **18hours** |
| **Unit-II** | Introduction: Need of conversion of drugs into medicine. Classification: Classification of formulations-(form wise, dose wise) with example. | **18hours** |
| **Unit-III** | classification and uses of following additives in formulation of different dosage forms: preservatives, antioxidants, surfactants, hydrocolloids, emulsifying agents, suspending agents, diluents, binders, lubricants, and organoleptic additives. Physical, chemical and biological properties of drug molecules and their influence on drug formulation. | **18hours** |
| **Unit-IV** | Physical, chemical and biological properties of drug molecules and their influence on drug formulation. | **18hours** |
| **Unit-V** | Purity-Broad based highest attaninable standard, Biological response VS. Chemical purity and Official standard VIS-VIS manufacturing standards. Specific tests for identifying impuritiesegs. Presence of salicylic acid in Aspirin, 4- aminophenol in Paracetamol, (+)-2-amino-Butan-1- ol in Ethambutol Hydrochloride , Digitonin in Digitoxin etc. Limit tests: Introduction, specificity, sensitivity and Personal errors. Types of limit tests for quantitative determinartion- Limit for insoluble matter,limits for soluble matter,limits for moisture, volatile matter and residual solvents. Limit tests for Acid radical impurities: For Chlorides, Sulphates, Arsenate, arbonate, Cyanide, Nitrate , Oxalate and Phosphate. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Pharmaceutical Drug analysis by Ashtoshkar
2. Pharmaceutical Chemistry by Chatwal.
3. Drugs by David Subramanyam.
4. British Pharmacopoeia vol I,II
5. Indian Pharmacopoeia vol I,II
6. Bentley's Text book of pharmaceutics by Rowlins
7. The science and practice of pharmacy by Remington

8. Introduction to pharmaceuticals by Mittal

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**ELECTIVE PAPER 3:MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS)**

Papercode:Subject: **MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS)**

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts to impart knowledge on the area of advances in novel drug delivery systems.

**CourseObjectives**

1. Tolearnabout the concept involved in drug targeting

2. Tolearn about the concept of Micro Spheres

3. Todevelopknowledgeon, Pulmonary Drug Delivery System

4. Tounderstand the concept of therapeutic delivery system

5. .Todevelopapieceofknowledge about Pharmacokinetics

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Targeted Drug Delivery Systems

7. Aftercompletingunit2,thestudentswillbeableto know the Targeting Methods:

8. Aftercompletingunit3,thestudentswillbe know the Micro Capsules / Micro Spheres

9.Aftercompletingunit4,thestudentswillbe know about Pulmonary Drug Delivery Systems

10..Aftercompletingunit5,thestudentswillbe know about Nucleic acid based therapeutic delivery system

11..Aftercompletingunit6,thestudentswillbe known about Biodistribution and Pharmacokinetics.

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** |  Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery. | **18hours** |
| **Unit-II** | Introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation | **18hours** |
| **Unit-III** | Types, preparation and evaluation , Monoclonal Antibodies ; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes | **18hours** |
| **Unit-IV** | Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation. | **18hours** |
| **Unit-V** | Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded,Marcel Dekker, Inc., New York, 1992.

2.S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Ballabh Prakashan,

New Delhi, First edition 2002.

3.N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, NewDelhi, First edition 1997 (reprint in 2001

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**OPEN ELECTIVE 1 :Separation Techniques**

Papercode:Subject: **Separation Techniques**

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofseparation techniques,chromatographic techniques.

**CourseObjectives**

1. Tolearnabout the concept of separation techniques

2. Tolearn about the concept of drug discovery

3. Todevelopknowledgeon, bonded phase chromatography

4. Tounderstand the concept of Hyphenated Techniques

5. .Todevelopapieceofknowledge about Biochromatography

# CourseOutComes

6.After completing unit1,thestudentswillbeableto know about Separation Techniques

7. Aftercompletingunit2,thestudentswillbeableto know the principles, classification of chromatographic techniques

8. Aftercompletingunit3,thestudentswillbe know the Column Chromatography and Short Column Chromatography

9.Aftercompletingunit4,thestudentswillbe know about Flash Chromatography and Vacuum Liquid Chromatography

10..Aftercompletingunit5,thestudentswillbe know about Biochromatography

11..Aftercompletingunit6,thestudentswillbe known about Hyphenated Techniques

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Need for learning separation techniques, separation techniques in natural product research and drug discovery, extraction techniques. | **18 hours** |
| **Unit-II** | General principles, classification of chromatographic techniques, normal and reverse phase, bonded phase chromatography, stationary phases, activity of stationary phases, elutropic series, and separation mechanisms. | **18hours** |
| **Unit-III** | Column packing, sample loading, column development, detection. | **18 hours** |
| **Unit-IV** | Objectives, optimization studies, selecting column and stationary phases, selecting suitable mobile phases, automated flash chromatography, and reverse phase flash chromatography. | **18hours** |
| **Unit-V** | Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles, stationary phases and mobile phases. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1.Methods in Biotechnology, Natural Product Isolation by Sarker, Latif, Gray

1. Methods in Biotechnology, Natural Product Isolation by Richard Canell

3. Various Reviews and Research Papers

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**OPEN ELECTIVE 2 :Biostatistics**

Papercode: Subject: **Biostatistics**

**Hours/Week:5 Credits:2**

# Aim: To enable the students to understand the basic concepts ofConcepts of hypothesis testing and types of error.

**CourseObjectives**

1. Tolearnabout the concept of Measures of central tendencies and dispersion

2. Tolearn about the concept of Common probability distributions and probability distributions

3. Todevelopknowledgeon, Simple random

4. Tounderstand the concept of Hypothesis testing

5. .Todevelopapieceofknowledge about Post- hoc procedures

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Statistics

7. Aftercompletingunit2,thestudentswillbeableto know the Probability

8. Aftercompletingunit3,thestudentswillbe know the Sampling

9.Aftercompletingunit4,thestudentswillbe know about Estimation and Hypothesis testing

10..Aftercompletingunit5,thestudentswillbe know about Experimental design and analysis of variance

11..Aftercompletingunit6,thestudentswillbe known about Correlation and regression

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction, its role and uses. Collection; Organization; Graphics and pictorial representation of data; Measures of central tendencies and dispersion. Coefficient of variation. | **18hours** |
| **Unit-II** | Basic concepts; Common probability distributions and probability distributions related to normal distribution | **18hours** |
| **Unit-III** | : Simple random and other sampling procedures. Distribution of sample mean and proportion. | **18hours** |
| **Unit-IV** | Point and interval estimation including fiducial limits. Concepts of hypothesis testing and types of errors. Student- t and Chi square tests. Sample size and power. | **18hours** |
| **Unit-V** | Completely randomized, randomized blocks. Latin square and factorial designs. Post- hoc procedures | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Fundamentals of Biostatistics by Bernard Rosner
2. Pharmaceutical Statistics: Practical and Clinical Applications by Bolton and Bon

3. Statistical Misconceptions by Huck

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**OPEN ELECTIVE 3: Immunology and Immunotechnology**

Papercode: Subject: **Immunology and Immunotechnology**

# Hours/Week:5 Credits:2

# Aim: To enable the students to understand the basic concepts Cells and organs of the immune system.

**CourseObjectives**

1. Tolearnabout the concept of Antigen-antibody interactions

2. Tolearn about the concept of : T cell subsets and surface markers

3. Todevelopknowledgeon, synthetic peptides and immune response

4. Tounderstand the concept of Lymphoidcells

5. .Todevelopapieceofknowledge about structure and function of MHC.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Immunity

7. Aftercompletingunit2,thestudentswillbeableto know the Cells and organs of the immune system

8. Aftercompletingunit3,thestudentswillbe know the Humoral immunity

9.Aftercompletingunit4,thestudentswillbe know about Cell mediated immunity

10..Aftercompletingunit5,thestudentswillbe know about Natural immunity

11..Aftercompletingunit6,thestudentswillbe known about Naturalkiller cells

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Innate and adaptive, immune response memory, specificity and recognition of self and non-self, immunogenicity, antigenicity, physiology of immune response, epitope analysis, synthetic peptides and immune response, immunity to virus, bacteria, fungi. | **18hours** |
| **Unit-II** | Lymphoidcells, T-cells, B-cells, monocytes, phagocytes, mast cells and basophils, primary and secondary lymphoid organs, interplay between cells. | **18hours** |
| **Unit-III** | Antigen-antibody interactions, affinity, avidity, immunoglobulins, molecular mechanism of generation of antibody diversity, molecular biology of IgG. | **18hours** |
| **Unit-IV** | T cell subsets and surface markers, T cell-dependent andindependent markers, structure and function of MHC, association of MHC with disease susceptibility, structure of T cell antigen receptor. | **18hours** |
| **Unit-V** | Inflammation, stimuli, chemotaxis, arachidonic acid metabolite and cytokines, vascular modifications,healing and fibrosis | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**References**

1. Cellular and Molecular Immunology by Abdul K. Abbas, Andrew H. Lichtman and Shiv Pillai 1.

 2. Kuby Immunology by Thomas J. Kindt, Barbara A. Osborne, and Richard A. Goldsby

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

 **PRACTICALS- III (credits 4 )**

**PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL**

1. Protein identification
2. Protein characterization
3. Protein biochemistry
4. Recombinant DNA Technology
5. Protein expression
6. Protein formulations
7. Database searching
8. Sequence analysis methods
9. Protein structure prediction

10. Gene annotation methods

11.Phylogenetic analysis

18. Protein, DNA binding studies

13. Preparation of DNA for PCR applications – Isolation, Purity and Quantification

14. Introduction to PCR – working of PCR, Programming.

15. Introduction to RT-PCR – working, programming.

16. Primer design using software.

17. Gene DNA amplification by random / specific primers.

18. Southern Hybridization

19. Western Blotting

20. Gene transformation

**SEMESTER IV**

**CORE PAPER 1 : MOLECULAR MODELLING AND DRUG DESIGNING**

# Papercode:Subject: MOLECULAR MODELLING AND DRUG DESIGNING

# Hours/Week:5 Credits:4

# Aim: To enable the students to understand the basic concepts ofmolecular modeling.

**CourseObjectives**

1. Tolearnabout the concept of quantum mechanics

2. Tolearn about the concept of Bond stretching

3. Todevelopknowledgeon, Molecular Dynamics

4. Tounderstand the concept of Homology

5. .Todevelopapieceofknowledge about drug action

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Quantum mechanics & concepts in molecular modeling

7. Aftercompletingunit2,thestudentswillbeableto know the : Molecular mechanics and energy minimization

8. Aftercompletingunit3,thestudentswillbe know the Molecular Dynamics and Monte Carlo simulation

9.Aftercompletingunit4,thestudentswillbe know about Homology modeling

10..Aftercompletingunit5,thestudentswillbe know about Drug design

11..Aftercompletingunit6,thestudentswillbe known about Protein Structure Prediction

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction – coordinate systems – potential energy surfaces – introduction to quantum mechanics – postulates – Schrodinger wave equation – hydrogen molecule – Born-Oppenheimer approximation, introduction to computer hardware and software | **18hours** |
| **Unit-II** | Empirical force field models – Bond stretching – angle bending – torsional term – nonbonding interactions – thermodynamics properties using a forcefield – derived and non derived energy minimization method – simplex – sequential univariate method – steepest descent method – conjugate gradient method- Newton-Rapson method | **18hours** |
| **Unit-III** | Introduction – Using single Model – time steps – Multiple steps – Setting up MD – energy conservation in MD Simulation Examples – Monte Carlo – Random number generation – Difference in MD & MC. | **18 hours** |
| **Unit-IV** | Comparative modeling of proteins – comparison of 3D structure – Homology – steps in homology modeling – tools – databases – side chain modeling – loop modeling. | **18hours** |
| **Unit-V** | General approach to discovery of new drugs - lead discovery – lead modification – physiochemical principles of drug action – drug stereo chemistry –drug action - 3D database search – computer aided drug design – docking - molecular modeling in drug design – structure based drug design – pharmacophores - QSAR. | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

TEXT BOOKS:

1. A. R.Leach - Molecular Modeling Principles and Application, 2nd edition, Longman Publications, 1996.
2. D. Baxivanis and Foulette - Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Wiely Indian Edition, 2001.

 REFERENCE BOOK:

1. T K Attwood, D J parry-Smith, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11th Reprint 2005

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**ELECTIVE PAPER 1:RESEARCH METHODOLOGY, IPR & BIOETHICS**

Papercode:Subject: **RESEARCH METHODOLOGY, IPR & BIOETHICS**

# Hours/Week:5 Credits:3

# Aim: To enable the students to understand the basic concepts to provide fundamental theoretical knowledge about Research Methodology, IPR & Bioethics.

**CourseObjectives**

1. Tolearnabout the concept involved in Significance of Research

2. Tolearn about the concept of experimental designs

3. Todevelopknowledgeon, Qualitative research

4. Tounderstand the concept of r intellectual property right

5. .Todevelopapieceofknowledge about bioethics

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Basics of research

7. Aftercompletingunit2,thestudentswillbeableto know the Research design

8. Aftercompletingunit3,thestudentswillbe know the Methods of data collection

9.Aftercompletingunit4,thestudentswillbe know about Qualitative and Quantitative Research

10..Aftercompletingunit5,thestudentswillbe know about IPR

11..Aftercompletingunit6,thestudentswillbe known about Bioethics

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Objectives- Types- Significance of Research- Steps in research process Criteria for good research. Defining and formulating a research problem- Literature survey- Development of working hypothesis | **18hours** |
| **Unit-II** | Definition and related concepts, Basic principles of experimental designs- Informal and formal experimental designs; Sampling design: Steps in sample design, Non-probability sampling and Probability sampling -random sampling; Measurement and scaling techniques | **18 hours** |
| **Unit-III** | Methods of data collection - Execution of project -Processing and analysis of dataHypothesis testing - Interpretation and report writing- Steps and layout of research reportTypes of report, review paper writing and presentation. | **18 hours** |
| **Unit-IV** | Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication.Merging the two approaches. | **18 hours** |
| **Unit-V** | .Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**SEMESTER III**

**ELECTIVE PAPER 2:BIOINFORMATICS AND COMPUTATIONAL BIOTECHNOLOGY**

# Papercode:Subject: BIOINFORMATICS AND COMPUTATIONAL BIOTECHNOLOGY

**Hours/Week:5 Credits:3**

# Aim: To enable the students to understand the basic concepts to provide the advanced knowledge to the biotechnology students in invaluable areas of advanced bioinformatics which plays a crucial role in determining its future use and applications in medicine, drug discovery and in pharmaceutical industry

**CourseObjectives**

1. Tolearnabout the concept involved in Use of computers in developing a new drug

2. Tolearn about the concept of Biological concepts for bioinformatics

3. Todevelopknowledgeon, Proteins and their diversity

4. Tounderstand the concept of Various gene finding methods

5. .Todevelopapieceofknowledge about Searching the biological databases

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about Develop an understanding of the basic theory of these computational tools

7. Aftercompletingunit2,thestudentswillbeableto know the Develop required database extraction, integration, coding for computational tools and methods necessary for all Omics

8. Aftercompletingunit3,thestudentswillbe know the Create hypothesis for investigating specific contemporary biological questions, provide help to experiment with or develop appropriate tools, Searching the biological databases and understanding various methods of drug designing

9.Aftercompletingunit4,thestudentswillbe know about Protein structure prediction

10..Aftercompletingunit5,thestudentswillbe know about Diversity of Genomes

11..Aftercompletingunit6,thestudentswillbe known about Target searching and Drug Designing

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Introduction to Bioinformatics Definition and History of Bioinformatics, Internet and Bioinformatics, Introduction to Data Mining, Applications of Data Mining to Bioinformatics, Biological DatabaseProtein and nucleic acid databases. Structural data bases. Collecting and storing the sequence and Applications of Bioinformatics. | **18hours** |
| **Unit-II** | Sequence alignment, pair wise alignment techniques, multiple sequence analysis, multiple sequence alignment; Flexible sequence similarity searching with the FAST3 program package, the use of CLUSTAL W and CLUSTAL X for the multiple sequence alignment. Tools used for sequence analysis. | **18hours** |
| **Unit-III** | Protein informatics Introduction; Force field methods; Energy, buried and exposed residues, side chains and neighbours; Fixed regions, hydrogen bonds, mapping properties onto surfaces; Fitting monomers, R & S fit of conformers, assigning secondary structures; Sequence alignmentmethods, evaluation, scoring; Protein completion, backbone construction and side chain addition; Small peptide methodology, software accessibility, building peptides; Protein displays; Substructure manipulations, annealing. | **18hours** |
| **Unit-IV** | Protein structure prediction Protein folding and model generation; Secondary structure prediction, analyzing secondary structures; Protein loop searching, loop generating methods, loop analysis; Homology modeling, concepts of homology modeling, potential applications, description, methodology, homologous sequence identification; Align structures, align model sequence; Construction of variable and conserved regions, threading techniques, Topology fingerprint approach for prediction, evaluation of alternate models; Structure prediction on a mystery sequence, structure aided sequence techniques of structure prediction, structural profiles, alignment algorithms, mutation tables, prediction, validation, sequence based methods of structure prediction, prediction using inverse folding, fold prediction; Significance analysis, scoring techniques, sequence- sequence scoring. | **18hours** |
| **Unit-V** | Docking problems, methods for protein- ligand docking, validation studies and applications; Screening small molecule databases, docking of combinatorial libraries, input data, analyzing docking results. | **18 hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**REFERENCES**

1. David W. Mount, Bioinformatics Sequence and Genome Analysis, CBS Publishers and Distributors
2. S. C. Rastogiet. al. Bioinformatics- Concepts Skill and Applications, CBS Publishers and Distributors
3. T. E. Creighton, Protein Structure and Molecular Properties, W. H.Freeman and Company
4. Andreas D. Baxevanis, B. F. Francis Ouellette, Bioinformatics; A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons,Inc.
5. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press.
6. Shui Qing Ye. Bioinformatics: A Practical Approach, Chapman &Hall/CRC.
7. David Posada, Bioinformatics for DNA Sequence Analysis, Humana press.
8. Lesk, A.M. Introduction to Bioinformatics. Oxford University Press.
9. Letovsky, S.I. Bioinformatics. Kluwer Academic Publishers.

10. Baldi, P. and Brunak, S. Bioinformatics. The MIT Press.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# 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**

**SEMESTER III**

**ELECTIVE PAPER 3:BIOLOGICAL EVALUATION OF DRUG THERAPY**

Papercode:Subject: **BIOLOGICAL EVALUATION OF DRUG THERAPY**

**Hours/Week:5 Credits:3**

# Aim: To enable the students to understand the basic concepts to provide the knowledge to the biotechnology students to understand the importance of biological and evaluation of drug therapy of biological medicines.

**CourseObjectives**

1. Tolearnabout the concept involved in the general concept of standardization of biological

2. Tolearn about the concept of the importance of transgenic animals and knockout animals

3. Todevelopknowledgeon, the biological medicines in development of various diseases

4. Tounderstand the concept of the biological evaluation of drugs in vitro and in vivo

5. .Todevelopapieceofknowledge about drug therapy of biological medicines.

# CourseOutComes

6.Aftercompletingunit1,thestudentswillbeableto know about the importance of biological and evaluation of drug therapy of biological medicines.

7. Aftercompletingunit2,thestudentswillbeableto know the t the general concept of standardization of biological.

8. Aftercompletingunit3,thestudentswillbe know the the importance of transgenic animals and knockout animals

9.Aftercompletingunit4,thestudentswillbe know about the biological medicines in development of various diseases.

10..Aftercompletingunit5,thestudentswillbe know about Biological evaluation of drugs in vitro and in vivo

11..Aftercompletingunit6,thestudentswillbe known about Pharmacokinetics

# Matching Table (Put Yes/Nointheappropriatebox)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Unit | i.Remembering | ii.Understanding | iii.Applying | iv.Analyzing | v.Evaluating | vi.Creating |
| 1 | Yes | Yes | Yes | Yes | Yes | Yes |
| 2 | Yes | No | Yes | Yes | Yes | No |
| 3 | No | Yes | No | Yes | Yes | Yes |
| 4 | No | Yes | Yes | Yes | Yes | Yes |
| 5 | Yes | Yes | Yes | Yes | Yes | Yes |

|  |  |  |
| --- | --- | --- |
| **Units** | **CourseContents** | **Teaching hours** |
| **UnitI** | Biological Standardization • General principles, Scope and limitation of bio-assay, bioassay of some official drugs. • Preclinical drug evaluation • Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED50 and LD50 determination, special toxicity test like teratogenecity and mutagenecity. • Guidelines for toxicity studiesVarious guidelines for toxicity studies. Animal experiments assessing safety of packaging materials. | **18hours** |
| **Unit-II** | Pyrogens: Sources, Chemistry and properties of bacterial pyrogens and endotoxins, Official pyrogen tests. • Microbiological assay • Assay of antibiotics and vitamins. • Biological evaluation of drugs • Screening and evaluation (including principles of screening, development of models for diseases: In vivo models / In vitro models / cell line study) | **18hours** |
| **Unit-III** | Biologic Medicines in Development for various diseases - By Therapeutic Category a) Genetic Disorders b) Eye related Disorders c) Digestive Disorders d) Diabetes/Related Conditions e) Cardiovascular Disease f) Cancer/Related Conditions g) Blood Disorders h) Autoimmune Disorders | **18hours** |
| **Unit-IV** | Biologic Medicines in Development for various diseases –by Product Category a) Antisense b) Vaccines c) Recombinant Hormones/Proteins d) Monoclonal Antibodies (mAb) 31 e) Interferons f) Growth Factors | **18hours** |
| **Unit-V** | Regulatory aspects of drugs, biologics and medical devices An introduction to the regulations and documents necessary for approval of a medical product. Regulatory consideration Regulatory consideration for pre-clinical testing and clinical testing of drugs, biologics and medical devices. New Drug Applications for Global Pharmaceutical Product Approvals | **18hours** |
| **TotalTeachinghours** | **90** |

**InternalAssessmentMethods:(25 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distributionforinternals | Test(CIAI+CIAII+CIAIII) | Seminars | Assignment | Totalmarks |
| Marks | 15 | 05 | 05 | 25 |

**REFERENCES**

1. Perkins F.T., Hennessen W. Standardization and Control of Biologicals Produced by Recombinant DNA Technology, International Association of Biological Standardization
2. J.H. Burn., Biological Standardization, Oxford University Press
3. Drug Discovery and Evaluation in Pharmacology assay: Vogel
4. Chow, Shein, Ching, Design and analysis of animal studies in pharmaceutical development,

5. Nodine and Siegler, Animal and Clinical pharmacologic Techniques in Drug Evaluation.

# 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 |

**PO– Programme Outcome, CO– Course outcome, 3–Strong, 2–Medium, 1– Low**

# Mapping with Programme Specific Outcomes

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

 **Strong - 3, Medium – 2, Low - 1**

**PROJECT**

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