# KONGUNADU ARTS AND SCIENCE COLLEGE

**(AUTONOMOUS)**

**COIMBATORE – 641 029**

# DEPARTMENT OF BIOTECHNOLOGY (PG)

**CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)**

**(2018 - 2019 and onwards)**

# KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

**Coimbatore – 641029**

## Vision

Developing the total personality of every student in a holistic way by adhering to the principles of Swami Vivekananda and Mahatma Gandhi.

## Mission

- Imparting holistic and man-making education with emphasis on character, culture and value - moral and ethical.
- Designing the curriculum and offering courses that transform its students into value added skilled human resources.
- Constantly updating academic and management practices towards total quality management and promotion of quality in all spheres.
- Extending the best student support services by making them comprehensive and by evolving a curriculum relevant to student community and society at large.
- Taking steps to make education affordable and accessible by extending scholarships to the meritorious and economically disadvantaged students.
- Moulding the teachers in such a way that they become the role models in promoting Higher Education

# DEPARTMENT OF BIOTECHNOLOGY

## Vision

- To nurture world-class bioengineers with a potential to innovate, invent and disseminate knowledge for the benefit of society and environment.
- To develop the candidate with zeal towards Life Sciences with the spirit of moral, ethics, life and character building required for future Good Human being, a Genuine Scientist, a Hardworking Person, as Entrepreneur and as Bread Earner.
- To produce competent Biotechnologist's who can employ premium processes and applications which will profoundly influence the existing paradigm of agriculture, industry, healthcare and restoration of environment providing sustainable competitive edge to present society.

## Mission

- The Department of Biotechnology of Kongunadu Arts and Science College, a family of Enthusiastic students, Committed teachers and Independent thinkers working and learning together to shape the future.
- We focus on implementing the valued education in the Life Sciences to bring about a new revolution in the field of Biotechnology.
- We encourage and comfort the candidate with the passion to undergo in the future to take the alleyway of education and research to serve the World with new energy of knowledge and beneficial products as life saver.

## M.Sc. BIOTECHNOLOGY

### PROGRAMME OUTCOME (PO)

**PO1:** Explain and properly apply the scientific method by developing valid hypotheses, designing experiments, gathering relevant data using current technology.

**PO2:** To enable understandingof emerging and advanced concept in modern biology and help students to take up their carrier in this field.

**PO3:**Acquire in depth knowledge on the basic concepts of biology of living cellsincluding structural, morphological and physiological features and functions.

**PO4:** Apply the fundamentals of molecular biology theories, and techniques by critically analyzing and interpreting a recent and relevant scientific research paper that has been published in a refereed scientific journal.

**PO5:**Impart a clear vision on the minds about health and environmental crisis and their associated problems.

**PO6:**To impart a keen knowledge on economically important biomolecules and application of different cell culture system for better and improved production.

**PO7:**Encourage the desired interest of students to gain knowledge on latest allied fields with theatrical and technical skills to compete in the growing Biotechnological world.

**PO8:**The student will be able to get familiarized with professional and economic issues in Biotechnology and foster impart job related skills such as communications and experience in working as a team that will help them to become good Entrepreneurs.

### PROGRAMME SPECIFIC OUTCOME (PSO)

**PSO1 :** Apply knowledge of applied science and research fundamentals in the area of biotechnology – cell and molecular biology, microbial technology, genomics, proteomics, genetic engineering, advanced plant and animal sciences, computational biology, etc.

**PSO2 :** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PSO3 :** Understand the impact of the biological solutions / needs in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Apply ethical principles and commit to professional ethics and responsibilities and norms of the current practice.

**PSO4 :** Demonstrate knowledge and understanding of concepts, principles and experimental approaches in Biotechnological to one's own work, as a member and leader in a team. Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

**PSO5 :** Demonstrate an ability to identify careers in biotechnology, domain like Pharmaceutical, Food Industry etc, and skills required to work in a biotechnology laboratory or manufacturing facility.

**PBT01**

# KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)

***COIMBATORE-641 029.***

## M.Sc. BIOTECHNOLOGY

**Curriculum & Scheme of Examination under CBCS**

***(Applicable to Students Admitted from the Academic Year 2018-2019 and onwards)***

| Semester | Subject Code | Title of the Paper | Instruction Hours / cycle | Exam. Marks | | | Duration of Exam. Hrs. | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | CIA | ESE | Total | | |
| I | 18PBT101 | C.P.1 – Biological Chemistry | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT102 | C.P.2 – Biostatistics and Bioinstrumentation | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT103 | C.P.3 - Cell Biology and Molecular Genetics | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT104 | C.P.4 – Microbiology | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT1E1 | Major Elective I | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT1CL | C.Pr.1- Lab in Biochemistry, Molecular Genetics and Microbiology | 5 | 40 | 60 | 100 | 6 | 3 |
| | | **Total** | **30** | **-** | **-** | **600** | **-** | **28** |
| II | 18PBT205 | C.P.5 – Genetic Engineering | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT206 | C.P.6 – Immunotechnology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT207 | C.P.7 - Animal Biotechnology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT208 | C.P.8 - Environmental Biotechnology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT2CM | C.Pr.2 - Lab in Molecular Biology and Genetic Engineering | 5 | 40 | 60 | 100 | 6 | 3 |
| | 18PBT2CN | C.Pr.3 - Lab in Immunotechnology, Animal Biotechnology and Environmental Biotechnology | 5 | 40 | 60 | 100 | 6 | 3 |
| | | **Total** | **30** | **-** | **-** | **600** | **-** | **22** |
| III | 18PBT309 | C.P.9 - Bioprocess Technology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT310 | C.P.10 - Plant Biotechnology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT311 | C.P.11 - Nanobiotechnology and Computational Biology | 5 | 25 | 75 | 100 | 3 | 4 |
| | 18PBT3E2 | Major Elective II | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT3CO | C.Pr.4 -Lab in Bioprocess Technology, Plant Biotechnology and Bioinfomatics | 5 | 40 | 60 | 100 | 6 | 3 |
| | 18PBT3N1 | Non-Major Elective I – (On-line) | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT3ST | Summer Training @ | - | - | - | - | - | - |
| | | **Total** | **30** | **165** | **435** | **600** | **-** | **25** |
| IV | 18PBT412 | C.P.12 - Genomics, Proteomics & Systems Biology | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT4N2 | Non-Major Elective II - (On-line) | 5 | 25 | 75 | 100 | 3 | 5 |
| | 18PBT4Z1 | Project Work * | 20 | 40 | 160* | 200 | 3 | 5 |
| | | **Total** | **30** | **90** | **310** | **400** | **-** | **15** |
| | | | 120 | - | - | 2200 | - | 90 |

Note: CBCS – Choice Based Credit System; CIA – Continuous Internal Assessment;
ESE – End of Semester Examinations; C.P. - Core Paper; C. Pr. – Core Practical

***** Project Report – 140 marks; Viva-voce – 20 marks; Internal – 40 marks

@ The students shall undergo an Internship training/field work for a minimum period of 3 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the faculty members and HoD. According to their marks, the grades will be awarded as given below.

| Marks % | Grade |
|---|---|
| 85-100 | O |
| 70-84 | D |
| 60-69 | A |
| 50-59 | B |
| 40-49 | C |
| <40 | U (Reappear) |

**Major Elective Papers** *(2 papers are to be chosen from the following 4 papers)*

1. Pharmaceutical Biotechnology
2. Bioethics, Biosafety, IPR, Total Quality Management and Bioentrepreneurship
3. Marine biotechnology
4. Medical Biotechnology

**Non-Major Elective Papers** *(2 papers are to be chosen from the following 2 papers)*

1. Competitive Science – I
2. Competitive Science - II
3. Food Technology
4. Cancer Biology

**Tally Table:**

| Part | Subject | No. of Subjects | Total Marks | Credits |
|---|---|---|---|---|
| I | Core – Theory / Practical / Project | 18 | 1800 | 70 |
| | Major Elective Paper | 2 | 200 | 10 |
| | Non Major Elective Paper | 2 | 200 | 10 |
| | **Grand Total** | **22** | **2200** | **90** |

**Advanced Learner's Course (ALC) under self-study scheme (optional)**

| Subject Code | Title of the Paper | Exam Marks | | Duration of Exam (hours) | Credits |
|---|---|---|---|---|---|
| | | ESE | Total | | |
| 18PBTD1 | ALC.1- Frontier Technologies in Biosciences | 100 | 100 | 3 | 2 |
| 18PBTD2 | ALC.2- Stem Cell Technology | 100 | 100 | 3 | 2 |

- 25 % CIA is applicable to all theory subjects. Proportion of CIA and ESE for practical is 40: 60.
- JOCs are optional for earning extra credits and are conducted 4 hours / cycle after college hours.

**Job Oriented Courses (JOC):**

1. JOC 1 – Plant Tissue Culture and Organic Farming (18PBTJ1)
2. JOC 2 – Herbal Biotechnology (18PBTJ2)

*Note: JOC and ALC which are offered at present will be applicable for the students admitted during the academic year 2018-2019 and will be considered as extra credit courses.*

## BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

**K1**-Remember; **K2**-Understanding; **K3**-Apply; **K4**-Analyze; **K5**-Evaluate

### 1. Theory Examination - Part I, II & III

**(i) CIA I & II and ESE: 75 Marks**

| Knowledge Level | Section | Marks | Description | Total |
|---|---|---|---|---|
| K1 Q1 to 10 | A (Answer all) | 10 x 1 = 10 | MCQ | 75 |
| K2 Q11 to 15 | B (Either or pattern) | 5 x 5 = 25 | Short Answers | |
| K3 & K4 Q16 to 20 | C (Either or pattern) | 5 x 8 = 40 | Descriptive / Detailed | |

**(ii) CIA I & II and ESE: 55 Marks**

| Knowledge Level | Section | Marks | Description | Total |
|---|---|---|---|---|
| K1 Q1 to 10 | A (Answer all) | 10 x 1 = 10 | MCQ | 55 |
| K2 Q11 to 15 | B (Either or pattern) | 5 x 3 = 15 | Short Answers | |
| K3 & K4 Q16 to 20 | C (Either or pattern) | 5 x 6 = 30 | Descriptive / Detailed | |

### 2. Practical Examination:

| Knowledge Level | Section | Marks | Total |
|---|---|---|---|
| K3 | Experiments | 50 | 60 |
| K4 | Record Work | 10 | |
| K5 | | | |

### 3. Project Viva Voce:

| Knowledge Level | Section | Marks | Total |
|---|---|---|---|
| K3 | Project Report | 160 | 160 |
| K4 | Viva voce | 20 | |
| K5 | | | |

**PBT04**

**Components of Continuous Internal Assessment**

| Components | | | Marks | Total |
|---|---|---|---|---|
| **Theory** | CIA 1 | 75 | (75+75 = 150/10) 15 | 25 |
| | CIA 2 | 75 | | |
| | Assignment/Seminar | | 5 | |
| | Attendance | | 5 | |
| **Practical** | CIA Practical | | 25 | 40 |
| | Observation Notebook | | 10 | |
| | Attendance | | 5 | |
| **Project** | Review | | 15+15 | 40 |
| | Regularity | | 5+5 | |

**18PBT101**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT101 | | C.P.1 – Biological chemistry | | |
| Batch<br>2018-2019 | Semester<br>I | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. On the successful completion of the subject, the student get an overall understanding of structure of atoms, molecules and chemical bonds
2. Gains knowledge on enzyme kinetics
3. Understands biopolymers and metabolic reaction in the living systems.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Defining the terms Water and buffers |
| K2 | CO2 | Classifying and summarize Carbohydrates, proteins, amino acids and lipids structure and properties |
| K3 | CO3 | Applying the concept of Enzyme |
| K4 | CO4 | Distinguishing the different types of Vitamins |

## Syllabus

**UNIT I** (15 Hours)

*Water*: **Structure of water*,** Hydrogen bonding and solubility, physical properties, cellular reactions of water, ionization of water. pH, pKa, acids, bases and Buffers of biological systems, Henderson – Hasselbalch Equation. Molecular interactions, Hydrogen, hydrophobic, disulphide, glycosidic, Phosphodiester, electrostatic and Vander Waal's.

**UNIT II** (15 Hours)

*Carbohydrates*: Definition, classification, purifications, properties and biological importance, Mono-, di- and tri- saccharides, Polysaccharides and mucopolysaccharides of biological importance. Methods for compositional analysis. Blood group substances glycoproteins & peptidoglycans. Glycolytic Pathway, TCA Cycle, Oxidative Phosphorylation, Electron Transport Chain, **Gluconeogenesis***

**UNIT III** (15 Hours)

*Proteins:* Amino acids and peptides-classification, chemical reactions and physical properties. Peptide bond - stability & formation. Proteins - physico-chemical properties, structure [primary, secondary, tertiary and quaternary]. Purification and criteria of homogeneity: protein folding-

biophysical and cellular aspects. Amino acid catabolism (Transamination, deamination and decarboxylation)

**UNIT IV** (15 Hours)

*Lipids:* Definition and classification of lipids, Structure, classification and properties of fatty acids, Steroids- Structure and functions of cholesterol. B - Oxidation of fatty acids. Fatty acid biosynthesis. *Nucleic acids:* Component, Structure and Different forms of DNA and RNA. Nucleotide metabolism.

**UNIT V** (15 Hours)

*Biochemistry of Small Molecules:* Physiological function of vitamins (Vitamin A & C), hormones (Insulin). *Enzymes*: Basic concept, Enzyme Classification, active site, specificity, kinetics (Negative and positive co-operativity) inhibitors (reversible and irreversible), isoenzymes, allosteric enzymes, co-enzymes (NAD), Industrial uses of enzymes (Amylase, protease).

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Textbook**

1. Michael.M.Cox., David.L.Nelson, (2011), Leninger Principles of Biochemistry, W.H. Freeman and Company.
2. Jain, J.L., Sunjay Jain, Nithin Jain, (2009), Fundamentals of Biochemistry, S. Chand and Company, Ltd.

**Reference Books**

1. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, Trevor Palmer, Published by Horwood Publishing Limited, 2001, Edition: 5.
2. Biochemistry, Donald Voet, Judith G. Voet, Published by J. Wiley & Sons, 2010, Edition: 4.
3. Harper's Illustrated Biochemistry, Robert K. Murray, Darryl K. Granner, Peter A. Mayes, Victor W. Rodwell, Published by McGraw-Hill Professional, 2012, Edition: 29.

**18PBT101**

## MAPPING

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | H | M | M | M |
| **CO2** | H | M | H | H | M |
| **CO3** | M | H | M | M | M |
| **CO4** | H | M | H | M | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT102**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT102 | | C.P.2 – Biostatistics and Bioinstrumentation | | |
| Batch<br>2018-2019 | Semester<br>I | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To make the student to understand the methods and tools in biostatistics
2. To obtain knowledge on working principles of different instruments
3. To learn the usage of instruments in experiments for future research

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | To recollect the concepts of biostatistics and bioinstrumentation |
| K2 | CO2 | To understand the formula and principles used in biology |
| K3 | CO3 | To apply different data used in biological samples |
| K4 | CO4 | To analyse the importance about instruments in biological laboratory |

## Syllabus

**UNIT I** (15 Hours)

*Biostatistics* –Scope of Biostatistics Measures of Central tendency: Arithmetic Mean, Median and Mode Measures of dispersion: Absolute and relative measures. Mean deviation, standard deviation and variance. Graphical and diagrammatic representations (Scale diagram, line diagram, Histogram), Theory of errors, measure of precision, Probable errors of function, rejection of observation, Correlation: Definition, types and Karl Pearson's coefficient of correlation. Regression: definition, regression of Y on X and X on Y.

**UNIT II** (15 Hours)

*Testing of Hypothesis:* Student's t test. Chi-square test and its applications. ANOVA and its significance (theory). Designing of experiments and statistical analysis. Use of software for statistical analysis (SPSS,'R')

**UNIT III** (15 Hours)

*Centrifugation*: Types of centrifuges, Principles and applications of analytical and preparative centrifuge, density gradient and ultra-centrifuge. Photometry: Beer Lambert's law, Extinction coefficient, Principles and application of UV-VIS, Mass, IR and NMR spectrophotometry, Flourimetry and flame photometry – working and applications.

**18PBT102**

**UNIT IV** (15 Hours)

*ELISA reader:* Working and applications. Microscopy: Phase contrast microscope, SEM and TEM- instrumentation. Chromatography: Principle and types- ion exchange, HPLC, HPTLC and Gas Liquid chromatography. Lyophilizer, **Sonication*** and X-ray crystallography.

**UNIT V** (15 Hours)

Electrophoresis: Principle, factors affecting electrophoresis, **AGE***, PAGE, 2 D-Gel, isoelectric focusing, pulse field electrophoresis, gel documentation – Application. PCR: Principle, types, instrumentation, and applications, Nucleotide sequencing and X-ray crystallography.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**


1. Boyer, R., (2000), Modern Experimental Biochemistry, III Edition, Addison Wesley Longman, New Delhi.
2. Wilson, K. and J. Walker., (2000), Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge.
3. Pillai R. S. N. and Bhagavathi V., (2000), Statistics, Sultan Chand & Co., New Delhi.
4. Gupta, S.P., 2001. Statistical Methods, Sultan Chand & Co, New Delhi.


**Reference Books**


1. Sundar Rao, P.S.S., and J. Richard, (2006), Introduction to Biostatistics and Research methods, PHI Publication, New Delhi.
2. Holme and Peck., (1998), Analytical Biochemistry, 3rd Edition, Longman Scientific.
3. Skoog and Leary., (1992), Principles of Instrumental analysis, 4th Ed. Saunder's College publishing, New York.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | M | S | H | S |
| **CO2** | H | M | H | H | M |
| **CO3** | M | S | M | M | M |
| **CO4** | M | H | M | M | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT103**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT103 | | C.P.3 – Cell Biology and Molecular Genetics | | |
| Batch<br>2018-2019 | Semester<br>I | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

- To understand and apply the principles and techniques of molecular biology
- To make the students to understand the concept of gene, modulation of gene its regulation, modes of transmission and defects
- To teach the advanced knowledge in a specialized field of molecular and cell biology

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Recalling the principles and basic mechanisms of metabolic control and molecular signaling |
| K2 | CO2 | Extending the knowledge and understanding of the molecular machinery of living cells |
| K3 | CO3 | Applying the knowledge gained through the understanding of Molecular Screening for disease diagnosis |
| K4 | CO4 | Analyzing the causes, genetics and recent treatment strategies of cancer |

## Syllabus

**UNIT I** (15 Hours)

Cell Transport: Passive transport - Osmosis, Diffusion, Active transport-$Na^+$, $K^+$ pump. Cell signaling: Juxtacrine, Paracrine and Endocrine Signaling-Neurotransmitters & Hormones. G Protein Coupled receptors, their secondary messengers and signal transduction pathway. Cell Signaling pathways that control gene activity-Notch signaling; TGF-Beta and activation of Smads, Jak-STAT pathway.

**UNIT II** (15 Hours)

Extracellular matrix components, Cell-cell interactions and cell matrix interactions, Cell differentiation: hormones and growth factors, Apoptotic pathways, Cell cycle Control mechanisms: Role of cyclins and Cdks, Cell cycle check points, Molecular events in *S. cerevisiae*

**18PBT103**

**UNIT III** (15 Hours)

*Replication*: DNA (prokaryotes and eukaryotes) and RNA replication – mechanism and enzymology. Gene expression: Transcription, RNA processing, Translation, Posttranslational modifications, Intracellular protein transport, Protein turnover and degradation.

**UNIT IV** (15 Hours)

Chromatin structure and remodeling in relation to gene expression, DNase hypersensitivity, DNA methylation. Control of gene expression in prokaryotes and eukaryotes: operon model- trp operon, gene battery model (eukaryotes), Lytic cascades and lysogenic repression in lambda. Molecular biology of Cancer: Causes and Genetics of cancer, Tumor suppressor genes and oncogenes (p53 and pRB).

**UNIT V** (15 Hours)

Inherited disorders - Autosomal and allosomal-molecular and cytogenetics, Teratology, Molecular Screening– Haematological malignancies, Cancer; Pharmacogenetics (Her2 and breast cancer), *Population Genetics* - Hardy-Weinberg principle, Quantitative genetics and multifactorial interactions, causes of variation and artificial selection, **genetic load and genetic counseling***. Genotoxicity and detection assays.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**

1. Peter J Russell. (2009). iGenetics: A Molecular Approach (3rd Edition), Benjamin Cummings publication.
2. Lodish, D., Berk, A., Chris A. Kaiser. (2007). Molecular Cell Biology, 6th edition, Scientific American Books, Inc

***References***

1. Lewin. (2009). Genes X. Oxford University Press, U.K.
2. Hartl, DL. (2000). A Primer of Population Genetics. 3rd Edition, Sinauer Associates Inc., Sunderland.
3. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., Walter, P. (2007). Molecular Cell Biology, 5th Edition. Garland Publishing, Inc, NY.
4. Cooper, GM. (2009). The Cell - A Molecular Approach.5th edition. ASM and Sinauer Press, Washington.
5. Strachan, T., Read, A. (2010). Human Molecular Genetics. 4th edition, Garland Science.

**18PBT103**

## MAPPING

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | M | H | M | M |
| **CO2** | M | H | S | H | H |
| **CO3** | H | S | M | S | S |
| **CO4** | S | M | S | M | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT104**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT104 | | C.P.4 – Microbiology | | |
| Batch<br>2018-2019 | Semester<br>I | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

- To make the students to understand the basic concepts of the biology of microorganisms and its mechanism of action in host cells.
- To learn the microbiological techniques used for the classification of microorganisms
- To understand the microbe-host interaction and their metabolic activities

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Recollecting the early development and physiology of microbes |
| K2 | CO2 | Understanding the microbial taxonomy and classification methods. |
| K3 | CO3 | Applying the knowledge of microbiological methods to study about the microbes by phenotypic and genotypic methods |
| K4 | CO4 | Applying the knowledge to learn about the food spoilage due to cause of microbial contamination and food preservation methods |

## Syllabus

**UNIT I** (15 Hours)

History of microbiology- Development of microbiology in $20^{th}$ century. Morphology, ultra structure of bacteria. General characters of Fungi, Algae and Protozoa. Virus: Discovery, structure and classification – Baltimore cultivation of viruses – detection and enumeration, viral assays.

**UNIT II** (15 Hours)

Microbial taxonomy – classification systems– Molecular systematics: Polyphasic approach – 16S rRNA gene sequencing, Phylogenetic grouping. Mol % G+C analysis, DNA-DNA hybridization, Fatty Acid Methyl Ester (FAME) analysis. Principles and nutritional requirements for the growth of bacteria - culture media and types. Sterilization - principles and applications of physical and chemical methods. Methods of staining - bacteria and fungi.

**UNIT III** (15 Hours)

Soil Microbiology: Microbial flora of soil – bacteria, fungi, algae and protozoa. Microbial interactions among soil microorganisms - microbial populations and with plants ($N_2$ fixation) - **Biogeochemical cycles (C, N, P and S cycles)*.** Plant growth promoting bacteria.

**18PBT104**

**UNIT IV** (15 Hours)

Principles of food preservation - High temperature, low temperature, drying, radiation, Canning and packaging; Contamination and spoilage of meat, fish, milk, egg, vegetables and fruits. - **Food quality and control*.** Preservation and maintenance of microbes.

**UNIT V** (15 Hours)

Medical Microbiology: Host parasite relationship, epidemiology, pathogenesis, prevention and treatment - *Staphylococcus, Streptococcus, Aspergillosis, Salmonella, Clostridium, Rubella, Rabies* and *Mycoplasma*.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**


1. Willey, J., L. Sherwood, C. Woolverton, 2013, Prescott's Microbiology, 9th Edition. McGraw-Hill Higher Education.
2. Pelczar, M. J. JR. *et al*. Microbiology: Concepts and Applications. Tata McGraw-Hill Publishing Co. Ltd., New Delhi. 1993.


***References***


1. Stainer *et al*., 1992. General Microbiology, 5th edition. Macmillan Education Ltd., London.
2. Tortora, G.J. *et al*., 1995. Microbiology - An Introduction, 5th edition. The Benjamin/Cummings Publishing Co. Inc., USA.
3. Frazier, W. C. and D. C. Westhoff. 2003. Food Microbiology. 4th Edition. Tata McGraw-Hill Publishing Co. Pvt. Ltd., New York.
4. Ananthanarayan and Paniker, 2013. Textbook of Microbiology Ed. Arti Kapil Orient Black Swan; 9th edition.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | M | H | M | M |
| **CO2** | M | H | S | H | H |
| **CO3** | H | S | M | S | S |
| **CO4** | S | M | S | M | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT1CL**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT1CL | | C.Pr.1 - Lab in Biochemistry, Molecular Genetics and Microbiology | | |
| Batch<br>2018-2019 | Semester<br>I | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>3 |

## Course Objectives

- To get hands on experience and to learn the principles behind molecular and microbiological techniques
- To give hands on experience in estimation of nucleic acids and isolation of cell organelles
- To train the students on microbiological media preparation, isolation of microbes and staining techniques

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 | CO1 | Extending the hands on experience on standard solution preparation, Demonstrating the various pure culture as well as the staining techniques of microbiology and methods in Molecular Genetics |
| K4 | CO2 | Developing and applying the skills gained through the molecular and microbiological techniques for research as well as for in the various fields of applied science |
| K5 | CO3 | Examining and to analyze the results behind the molecular and microbiological techniques for the development of new techniques in future |

## Syllabus

1. Estimation of total sugars by Anthrone method
2. Estimation of total free amino acids by Ninhydrin method
3. Estimation of protein by Lowry's method
4. Estimation of Ascorbic acid by DNPH method
5. Estimation of cholesterol by modified Zak's method
6. Estimation of total phenolics and flavonoids
7. Estimation of albumin

   (a)Qualitative analysis of purines and pyrimidines

   (b) Quantitative estimation of Nucleic Acids

a. DNA by Diphenylamine method

8. (ii)RNA by Orcinol method.
9. Paper chromatography
10. Thin Layer Chromatography
11. Isolation, purification of enzyme amylase
    - Ammonium sulphate precipitation
    - Dialysis

**MOLECULAR GENETICS**

1. Estimation of DNA by diphenylamine method
2. Estimation of RNA by Orcinol method
3. Mounting of polytene chromosomes
4. Mitosis onion root tip, Meiosis – flower buds of *Rheo discolor*
5. Barr body identification in buccal cavity of females

**MICROBIOLOGY**

1. Microbiological culture media preparation and sterilization techniques
2. Pure culture techniques - Pour, Spread and Streak plate methods
3. Staining techniques - Simple, Negative, Gram, Spore and fungal staining
4. Bacterial motility determination assay
5. Bacterial growth curve by spectrophotometric method
6. Biochemical test for identification of bacteria
7. Isolation of microbes (bacteria, fungi and actinomycetes) from soil, air and water
8. Antibiotic sensitivity test
9. MBRT test for milk quality analysis
10. Isolation of *Rhizobium* from root nodules of legumes / soil

**Teaching Methods**

- Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | H | H | M | S |
| **CO2** | S | M | S | M | M |
| **CO3** | M | S | H | M | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT205**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT205 | | C.P. 5 – Genetic Engineering | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To demonstrate the innovative utilization of manipulating enzymes, various cloning and expression vectors and analysis of genomic sequences.
2. To interpret the applications of genetic engineering in biotechnological research.
3. To educate the students in strategizing research methodologies employing recombinant DNA techniques.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | The students recall the principles of genetic engineering and the vectors used in cloning, methods of introduction of gene and expression |
| K2 | CO2 | The students appreciate the different cloning strategies and their expression |
| K3 | CO3 | The students also know about implementation of genetic engineering for different purposes |
| K4 | CO4 | The students will investigate the different strategies of recombinant DNA technology and resolve the problems encountered |

## Syllabus

**UNIT I** (15 Hours)

*Genetic Engineering:* Introduction and applications, Steps involved in gene cloning, types of Hosts, DNA manipulative enzymes – Types, Properties and applications of Restriction enzymes, Restriction mapping, DNases, Polymerases, Modifying enzymes and Ligases. Linkers, Adaptors and Homopolymer tailing.

**UNIT II** (15 Hours)

*Cloning Vectors and cloning strategies:* Plasmids (pBR322 and pUC18), Phages (λ phage and M13 vectors), Phagemids (pBluescript, pGEM), Cosmids (pJB8), Shuttle vector, Yeast episomal plasmids, Yeast integrative plasmids, Yeast replicative plasmids, and Artificial Chromosomes (BAC and YAC).

**UNIT III** (15 Hours)

*Functional analysis:* Production of recombinant protein (Insulin), recombinant vaccines (Hepatitis B). Physical, Chemical and Biological methods of transformation. Expression vectors (pET) for prokaryotes, Choice of promoters used in expression vectors, Gene cassettes and gene fusion, advantages of fusion proteins, Problems encountered in expressing foreign gene in *E. coli.* DNA analysis in **forensics, medicine and Agriculture***.

**18PBT205**

**UNIT IV** (15 Hours)

*In vitro* transcription and *in vitro* translation. Cell free translation systems: HRT and HART selection. Transposons - Types, mechanism of transposition, Transposon tagging, Operon and gene fusions. Site directed Mutagenesis - Types and uses. RNA interference, siRNA, miRNA, Metagenomic libraries.

**UNIT V** (15 Hours)

Alternative cloning strategies: Shot gun cloning. Construction of genomic and cDNA library, RT-PCR, Real Time PCR. Probes-Types (DNA and RNA), properties and methods of labeling. Strategies for construction of cDNA libraries. Screening of libraries - Plaque and colony hybridization. Southern and **Northern hybridization***, Antibody based screening.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**


1. Brown, T.A., (2010). Gene cloning and DNA analysis, An Introduction. John Wiley & Sons
2. Primrose, S.B., and Twyman. R., (2006). Principles of gene manipulation and genomics, 7th edition, Wiley.com
3. Verma P.S., Agarwal V.K., (2010). Genetic Engineering. S Chand & Company.


**Reference Books**


1. Winnacker, E.L., (2003). From Genes to Clones. Panima Publishing Corporation, New Delhi.
2. Primrose, S.B., Twyman, R.M., Old, R.W., (2001). Principles of Gene Manipulation, 6th Edition. Blackwell Science, London.
3. Glick, B. R., Pasternak, J.J., Patten, C.L., (2010). Molecular Biotechnology: principles and applications of recombinant DNA, 4th Edition, ASM Press, Washington.
4. Watson et al. (1992). Recombinant DNA, 2nd Edition. W.H. Freeman and Co., New York.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | S | H | S | M |
| **CO2** | H | S | H | M | M |
| **CO3** | S | H | H | S | S |
| **CO4** | S | S | M | S | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT206**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT206 | | C.P. 6 - Immunotechnology | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

- To provide the students with a foundation in immunological processes
- To understand the immune response made in humans to foreign antigens including microbial pathogens
- To give the description of cells involved in the immune response as well to understand how the immune system recognizes self from non-self

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Defining the role of the immune system |
| K2 | CO2 | Demonstrating the basic knowledge of the organization and function of the immune system |
| K3 | CO3 | Developing immunological concepts and methods to diagnose immune disorders |
| K4 | CO4 | Distinguishing the mechanisms that lead to beneficial immune responses and immune disorders |

## Syllabus

**UNIT I** (15 Hours)

*Immunity:* Types of Immunity, Immune system**:** Innate (NK cells, phagocytes and their killing mechanisms (oxygen dependent and independent mechanisms), PAMP, TLR, **complement Biology (pathways)***; acquired immunity concepts (B, T cells and their activation & differentiation) and organs (primary and secondary lymphoid organs), Primary and Secondary immune responses, APCs

**UNIT II** (15 Hours)

*Antigen biology:* **Antigen properties***, haptens, adjuvants. *Antibodies:* Structure, classification and Functions. *Antibody diversity:* Gene rearrangement (heavy and light chain). Antigen-antibody interactions (bonding, cross reactivity, affinity and avidity)

**UNIT III** (15 Hours)

Cell mediated immune responses. *MHC:* Structure of MHC, antigen processing and presentation strategies, MHC and predisposition to diseases, HLA typing; Immune regulation (T suppressor cells)

**18PBT206**

**UNIT IV** (15 Hours)

*Hypersensitivity reactions*: Types and mechanisms. Autoimmune disorders - types. Immunodeficiency diseases: Primary (B cell deficiencies: X linked immunodeficiency, T- cell deficiencies (DiGeorge's syndrome), combined B and T cell deficiencies (SCID) and Secondary (SARS). *Transplantation Immunology:* Immune suppression, Graft Vs Host disease

**UNIT V** (15 Hours)

*Tumor immunology:* Tumor antigens, tumor immune response and tumor Immuno therapy.
*Vaccines:* Recombinant vaccines, anti-idiotype vaccines, Hybridoma technology: Production of clones, monoclonal antibodies and applications: catalytic, chimeric and humanized antibodies. *Immunotechnology:* Immunoprecipitation, Immunohisto-chemistry and Flow cytometry, Immunodeficient mouse models: SCID, nude mouse.

**Teaching Methods**

| |
|---|
| Board teaching, Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |

**Textbooks**


1. Owen, J., Punt, J., Stranford, S., (2013). Kuby's Immunology, 7th Edition. W. H. Freeman and company, New York.
2. Chakravarthy, A. (2009). Immunology and Immunotechnology, Oxford University Press, India


**References**


1. Rao, CV. (2002). An introduction to Immunology, Narosa Publishing House, Chennai.
2. Khan, Fahim Halim. (2009). The elements of Immunology, Pearson Education (I) Pvt. Ltd.
3. Tizard, I.R. (1995). Immunology: An Introduction. 4th Edition. Saunder's College Publishing, NY.
4. Roitt, I. (1994). Essential Immunology. Blackwell Science, Singapore.
5. Peter J. Delves., Seamus J. Martin., Dennis R. Burton., Ivan M. Roitt. (2016). Roitt's Essential Immunology, 13th edition. Wiley-Blackwell.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | S | S | S |
| **CO2** | S | M | H | M | H |
| **CO3** | M | H | S | S | H |
| **CO4** | S | S | M | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT207**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT207 | | C.P. 7 – Animal Biotechnology | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To make students understand about the basics of animal science
2. To equip students with culture techniques and scope of animal biotechnology
3. To provide knowledge on genetic engineering in the improvement of animal for human welfare

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students are trained to relate and recall the subject in topic wise |
| K2 | CO2 | Lecture topic is summarized to easy understanding of the topic taught |
| K3 | CO3 | By applying the specific methods problems identified and rectified |
| K4 | CO4 | The outcome of each topic is analyzed critically and made easy to study |

## Syllabus

**UNIT I** (15 Hours)

Animal cell culture: Culture media, balanced salt solution (BSS) and simple growth medium. Role of carbon dioxide, serum and glutamine in cell culture, Protein free defined media and their applications. Contamination: sources, types, monitoring and eradication.

**UNIT II** (15 Hours)

Types of cell culture: Primary and established culture, Cell separation, Biology and characterization of cultured cells, Cell synchronization and cryopreservation, Measuring parameters of growth, Measurement of cell death (Cytotoxicity tests: MTT and Clonogenic assay), Organotypic culture: Bone tissue engineering.

**UNIT III** (15 Hours)

Molecular techniques in cell culture. Cell transformation: Physical, Chemical and Biological methods of gene transfer. **Stem cells and gene therapy (iPSCs for Sickle cell anemia)***. Manipulation of genes: Gene silencing (transcriptional and post-transcriptional) and Gene targeting (Knock-in and knock-out).

**18PBT207**

**UNIT IV** (15 Hours)

Expression vectors for animal cells: Viral; SV40, Adeno, AAV, Vaccinia, Retro and hybrid viral vectors, Baculo virus as biocontrol and foreign gene expression, Plasmid expression vectors in animal cells: Classes and common modular components; pSV and pRSV.

**UNIT V** (15 Hours)

Transgenics: Transgenic animals as models for human diseases, **Applications of transgenic animals and their products** *. Reproductive and Therapeutic cloning. *In vitro* fertilization and embryo transfer: Composition of IVF media, steps involved in IVF, fertilization by means of micro insemination, PZD and ICSI. Ethical and religious issues.

** denotes Self study*

**Textbook**

1. Ranga, M.M.2004 Animal Biotechnology. 2nd Edition. Agrobios Publishers, Jodhpur, India.
2. Singh, B., Gautam, S.K. Chauhan, M.S. and Singla, S.K. 2013. Text book of animal biotechnology. The Energy and Resource Institute Press, New Delhi, India.

**References**

1. Freshney, R.I. 2015. Culture of Animal Cells: Manual of basic technique and specialized applications, 7th edition. John Wiley Publications, New Jersey, USA.
2. Masters, J.R.W.2000. Animal cell culture: A practical approach series. 3rd Edition. Oxford University Press, London.
3. Primrose, S.B. and Twyman R.M. 2006. Principles of gene manipulation and genomics.7th edition. Wiley Publications, New Jersey, USA.
4. Bernard R. Glick and Jack G/Pasternak. 2010. Molecular Biotechnology. 4th edition. ASM Press, Washington, USA.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | H | H | M |
| **CO2** | H | M | H | H | H |
| **CO3** | H | H | H | H | H |
| **CO4** | S | H | H | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT208**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT208 | | C.P.8–Environmental Biotechnology | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To reveal the current status and basics of environmental condition
2. To make the students to understand the concepts of ecology and conservation of environment
3. To provide knowledge of current perspectives in ecological issues

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students are trained to relate and recall each and every topic |
| K2 | CO2 | Students accept and understand the ecological status and their conservation |
| K3 | CO3 | Qualitative application are employed by the students to ensure the quality (good or bad) of the environmental samples for the betterment of society |
| K4 | CO4 | Reported data and observed results are analyzed and interpreted by students |

## Syllabus

**UNIT I** (15 Hours)

Water Pollution and control – Introduction- Need for water management, measurement and sources, water pollution. Physio-chemical characteristics of wastewater, Effluent treatment - aerobic and anaerobic (UASB), Use of GEO for waste water treatment.

**UNIT II** (15 Hours)

Removal of specific pollutants: Use of aquatic plants including transgenics in biotechnology, biodegradable and eco-friendly products. Phytoremediation. Microbial system for heavy metal accumulation, Biosorption, Bioleaching (Copper, Uranium). Bioremediation: Types, applications and examples. Bioindicators, Biosensors and Environmental impact assessment.

**UNIT III** (15 Hours)

Xenobiotic compounds - recalcitrants, hazardous wastes, genetic engineering approach for biodegradation, degradative plasmids detoxification methods. Solid-waste management (4R principle) and sewage-sludge disposal and utilization. Biodegradation of wastes from pesticide, textile, tannery, paper, food and allied, and distillery industries.

**18PBT208**

**UNIT IV** (15 Hours)

Biodegradation of wastes from pesticide, textile, tannery, paper, food and allied, and distillery industries. Biomass from wastes- ethanol from lignocellulosic wastes and SCP. Biofuels and sources, Advantages, Genetic improvement through metabolic engineering.

**UNIT III** (15 Hours)

Use of aquatic plants including transgenics in biotechnology, biodegradable and eco-friendly products. Phytoremediation. Green chemicals, Nanoparticles and composts for waste water treatment and management. **Current status of Environmental Biotechnology and future***. Consequences of deliberate release of GMOs into environment. Controversies and knowledge gaps concerning environmental biotechnology.

** denotes Self study*

***Textbook***

1. Jogdand, S. N. 1995. Environmental Biotechnology. Himalaya Publishing House, New Delhi.
2. Singh, K., 2000. Intellectual Property Rights on Biotechnology, BCll, New Delhi.

***References***

1. Cheremisinaff, N.P., 2003. A textbook for waste and waste water treatment. Prentice Hall of India Pvt. Ltd., New Delhi.
2. Cruger, W. and A. Cruger 2003. A Textbook of Industrial Microbiology. Panima Publishing Corporation, New Delhi.
3. Glick, B.R. and J.J. Pasternak 1998, Molecular Biotechnology. 2nd Edition, ASM Press, Washington.
4. Glazer, A.N. and H. Nikaido, 1995. Microbial Biotechnology, W.H. Freeman and Co., NY

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | H | H | M |
| **CO2** | H | M | H | H | H |
| **CO3** | H | H | H | H | H |
| **CO4** | S | H | H | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT2CM**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code: 18PBT2CM | | C.Pr.2 – Lab. in Molecular biology and Genetic Engineering | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>3 |

## Course Objectives

1. To enrich the students to have practical experience on molecular biology and genetic engineering
2. To have hands on experience in isolation, manipulation of DNA, RNA, protein and identification of gene and its expressions
3. To execute the applications of molecular biology, recombinant DNA technology, environmental biotechnology in research and industries

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 | CO1 | The students gain the technical skills involved in extraction, manipulation of biomolecules and identification of gene and its expressions |
| K4 | CO2 | The students develop and apply the modern technology of molecular biology and genetic engineering in industries and research |
| K5 | CO2 | The students will examine the results obtained using molecular biology and genetic engineering |

## Syllabus

***I - MOLECULAR BIOLOGY***

1. Isolation of genomic DNA-Bacteria, Blood, Plant
2. Agarose gel electrophoresis
3. Isolation of plasmid DNA from bacteria
4. Bacterial transformation
5. Isolation of RNA
6. Polyacrylamide gel electrophoresis

**18PBT2CM**

## *II - GENETIC ENGINEERING*

1. Phage titration
2. Restriction digestion and Ligation
3. Southern blotting
4. Northern blotting
5. Amplification by Polymerase Chain Reaction - Colony PCR, Differential temperature PCR and touch-down PCR
6. cDNA synthesis
7. *in vitro* site directed mutagenesis by using PCR method
8. Gene Expression - Real time PCR (Demo only)

**Teaching Methods**

Board teaching; Demonstration of experiments, Providing hands on training in all the experiments as well as the preparation of reagents;Discussion and Interpretation of results

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO3** | H | S | M | H | M |
| **CO4** | M | H | H | S | S |
| **CO5** | H | M | M | S | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT2CN**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT2CN | | C.Pr.3 - Lab in Immunotechnology, Animal Biotechnology and Environmental Biotechnology | | |
| Batch<br>2018-2019 | Semester<br>II | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>3 |

## Course Objectives

- To teach students the latest techniques and principles in Immunotechnology, animal biotechnology and environmental biotechnology
- To give hands on experience in immunological techniques
- To provide hands on training on animal cell culture techniques and environmental biotechnology

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 | CO3 | Defining the fundamental concepts of immunology, disease diagnosis and animal tissue culture techniques |
| K4 | CO4 | Developing and applying the recent technology involved in diagnostic techniques of immunology and animal cell culture |
| K5 | CO5 | Examining and analyzing the results involved in immune techniques animal biotechnology and environmental biotechnology |

## Syllabus

***I – IMMUNOTECHNOLOGY***

1. Production and purification of IgG.
2. Immunoassay for particulate antigens.
3. Qualitative and Quantitative haemagglutination.
4. Radial immunodiffusion.
5. Ouchterlony double diffusion.
6. Immunoelectrophoresis.
7. Rocket immunoelectrophoresis.
8. Immunodiagnosis (ELISA).
9. Western blotting.
10. Peripheral Blood mononuclear cell separation.

**18PBT2CN**

***II – ANIMAL TISSUE CULTURE***

1. Preparation of tissue culture medium and membrane filtration
2. Chick fibroblast cells isolation
3. Preparation of primary cells
4. Cell counting and cell viability
5. Trypsinization of monolayer and subculturing
6. Cytotoxicity test-MTT assay
7. DNA fragmentation analysis
8. Demonstration of animal handling for experimental purposes, cervical dislocation, dissection of mice, cardiac puncture, blood sample preparation and its handling

***III – ENVIRONMENTAL BIOTECHNOLOGY***

1. Estimation of biological oxygen demand in water / sewage samples
2. Estimation of chemical oxygen demand in water / sewage samples
3. Determination of total dissolved solids in water / sewage samples
4. Water Quality analysis by MPN test
5. Isolation xenobiotic degrading bacteria by selective enrichment technique

**Teaching Methods**

Board teaching; Demonstration of experiments; Providing hands on training in all the experiments as well as the preparation of reagents; Discussion and Interpretation of results

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO3** | M | S | M | S | M |
| **CO4** | H | S | H | M | H |
| **CO5** | S | M | M | H | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT309**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT309 | | C.P.9 - Bioprocess Technology | | |
| Batch<br>2018-2019 | Semester<br>III | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To learn the concepts of screening, optimization and maintenance of cultures and to introduce the students to the various concepts of microbial growth kinetics, fermentation and bioprocess engineering
2. To understand the basics of fermentation techniques and to enable the students to learn about the design of fermentors
3. To know about the principles involved in transport mechanisms and techniques involved in Upstream and downstream bioprocessing.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Recognizing the basic principles of bioprocess technology and different types of fermenters |
| K2 | CO2 | Understanding the different processes involved in bioprocess technology |
| K3 | CO3 | Integrating scientific and technological knowledge on the use of bioprocesses for industrial products on the cell and process level |
| K4 | CO4 | Developing and assessing the conditions for efficient and sustainable design of bioprocesses |

## Syllabus

**UNIT I** (15 Hours)

*Introduction:* Basic principles, **scope and advantages of bioprocess technology***. *Fermentation systems:* Batch, fed batch and continuous. Kinetics of microbial growth, specific growth rate, substrate utilization and product formation; Phases of cell growth, Factors affecting cell growth, Kinetic model for cell growth: Monod's model, and yield coefficients.

**UNIT II** (15 Hours)

*Bioreactor:* Components design and mode of operations. Mass balances, Energy balances. *Types of bioreactors:* CSTR, packed bed, batch, Air lift bioreactor, Bioreactors for immobilized cells, animal cells, waste water and effluent treatment. Specialized bioreactors: pulsed, fluidized and photobioreactors.

**18PBT309**

**UNIT III** (15 Hours)

*Upstream processing:* Introduction, principles of microbial nutrition, Media formulation and optimization. Sterilization: Methods of sterilization- Batch and continuous sterilization. Air sterilization, design and air filters, aseptic operation of fermentor. Inocula development for Industrial fermentations- Inoculum source – Seed culture; development of inocula for yeast, bacteria and fungi. Scale up and scale down.

**UNIT IV** (15 Hours)

*Transport phenomena:* Mass and heat transfer mechanism. Mass, heat and oxygen transfer coefficients. Rheological properties of a fermentation broth.

*Bioprocess monitoring and control:* On-line and Off-line analysis. *Monitoring variables:* pH, temperature, $DO_2$, agitation and foam level. PID control and computer aided control.

**UNIT V** (15 Hours)

*Downstream processing:* Introduction. Primary separation - Cells, Solid matter and foam- precipitation, filtration, centrifugation, cell disruptions (Mechanical, enzymatic and chemical). Product isolation - solvent extraction, adsorption, aqueous two-phase system and precipitations (Ammonium Sulfate, solvent). Purification techniques: Chromatography (ion-exchange, gel-permeation and affinity), membrane separation (microfiltration, Ultrafiltration, nanofiltration, and reverse osmosis). Product recovery; product polishing (drying– spray driers, drum driers and freeze driers and crystallization).

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Textbooks**

1. Stanbury, P. F., Whitaker, A., Hall, S. J., (2016). Principles of Fermentation Technology, Third edition. Butterworth-Heinemann Elsevier Ltd, Oxford, United Kingdom.
2. Sathyanarayana, U., (2008), Biotechnology, Books & Allied (P) Ltd.
3. W. Cruger and A. Cruger. (2003) A Textbook of Industrial Microbiology. Panima Pub. Corp., New Delhi.

**References**

1. Shuler, M.L., Kargi, F., (2003) Bioprocess engineering: Basic Concepts Prentice Hall, Engelwood Cliffs.
2. Heat and Mass Transfer in SI units R.K. Rajput. S., Chand and Co. Ltd., New Delhi. 2003.
3. Industrial Microbiology. L.E. Casida., (2002) John Wiley & Sons Inc., United States

4. Primrose, S.B., (2001) Molecular Biotechnology, 2nd edition, Panima Publishing Corporation, New Delhi.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | S | H | M | M |
| **CO2** | H | M | S | M | S |
| **CO3** | M | H | M | S | S |
| **CO4** | M | M | H | S | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT310**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT310 | | C.P.10 - Plant Biotechnology | | |
| Batch<br>2018-2019 | Semester<br>III | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To make students understand about the basics of plant science
2. To equip students with culture techniques and scope of plant biotechnology
3. To provide knowledge on genetic engineering in the improvement of plants for human welfare

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students are practiced to remember the specific terminologies by label the scientific words |
| K2 | CO2 | Students are explained wit neat diagrams to understand the topic easily |
| K3 | CO3 | Students are allowed to apply and utilize the scientific models for every topic |
| K4 | CO4 | Students are triggered to assume and analyze the each chapter in detail |

## Syllabus

**UNIT I** (15 Hours)

Genome organization: Nucleus, Chloroplast and Mitochondria. Quantitative trait loci (QTL) and Linkage analysis. Molecular markers: RFLP, RAPD, AFLP, STS, Microsatellites (SSR/STR), SCAR (Sequence Characterized Amplified Regions) and SSCP. Map based cloning.

**UNIT II** (15 Hours)

Plant cell and tissue culture: Sterilization*, Tissue culture media (types and preparation) and Growth regulators. In vitro propagation techniques: Micropropagation, Callus culture, Cell culture; suspension and single cell culture, Protoplast isolation; culture and somatic hybridization, Somatic embryogenesis and Synthetic seed preparation, Anther/pollen and embryo culture. Somaclonal variation. Production of secondary metabolites through plant cell culture.

**UNIT III** (15 Hours)

Direct and indirect gene transfer, Binary and cointegrate vector systems, Agrobacterium characteristics; Ti and Ri plasmids, mechanism of T-DNA transfer. Chloroplast transformation. Gene tagging.

**18PBT310**

**UNIT IV** (15 Hours)

Plant viral vectors: CaMV and Gemini viruses. Gene constructs, Markers genes for selection of transformants, Gene silencing. Applications of plant transformation: Nutraceuticals (Golden rice and Flavr Savr), Herbicide resistance, Insect and Virus resistance, Terminator technology, Pathogenesis related proteins and Marker free transgenics.

**UNIT V** (15 Hours)

Transgenic plants for abiotic stress resistance (salt, drought and cold), Recombinant proteins; Plantibodies and Plantigens, Biodegradable plastic. Metabolic engineering for plant secondary metabolites: Introduction, Alkaloid and Flavonoid biosynthesis. Genome editing; CRISPR/Cas-9

** denotes Self study*

**Text books**


1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
3. Dubey, R.C., 2013. A text book of Biotechnology (Revised Edition), S. Chand & Company Ltd. New Delhi.
4. Razdan, M. K., 2003. Introduction to Plant Tissue Culture. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.


**Reference Books**


1. Slater, Scott and Fowler, 2008. Plant Biotechnology, 2nd Edition, Oxford University Press.
2. Primrose, S.B. and Twyman, R. 2006. Principles of Gene Manipulation and Genomics. 7th Edition, Blackwell Publishing, Malden, MA, USA.
3. Buchanan, Gruissem and Jones.2000. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | H | H | H |
| **CO2** | S | H | H | H | H |
| **CO3** | H | S | M | H | H |
| **CO4** | H | H | H | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT311**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT311 | | C.P.11- Nanobiotechnology and Computational Biology | | |
| Batch<br>2018-2019 | Semester<br>III | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>4 |

## Course Objectives

1. To understand the new concept of nanotechnology applied to the area of biotechnology.
2. To build the knowledge in computational methods in biotechnology.
3. To acquire requisite skills for the design and development of high throughput screening and to retrieve and submit the data, genome database and other databases and analysis.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Understanding the basic concepts of Nanobiotechnology |
| K2 | CO2 | Differentiating various methods of synthesis of nanoparticles and obtain the skills in characterization methods of the nanomaterials. |
| K3 | CO3 | Understanding the scope and applications of nanomaterials |
| K4 | CO4 | Utilizing the computational tools for applying biotechnology in research |

## Syllabus

**UNIT I** (15 Hours)

Basic concepts of Nano science and technology - Quantum wire – Quantum well – Quantum dots. Superior properties of nano-compared with bulk materials. Introduction to nanoparticles. Use of Bio-molecules such as Proteins, DNA, RNA, Aptamers, Peptides, Antibody, Virus as nanoparticles for drug targeting and therapy.

**UNIT II** (15 Hours)

Strategies for synthesis of nanoparticles: top-down & bottom-up approach. Physical, chemical and biological), Physical methods- Microwave Synthesis, Physical Vapour deposition, Laser pyrolysis. Chemical methods- Co-precipitation, Sol-gel Processing, Microemulsions. Biological method-bacteria, fungi, virus, plants.

**18PBT311**

**UNIT III** (15 Hours)

Bionanostructures: Characterization of nanomaterials: SEM, Scanning Tunneling*, TEM and Atomic Force Microscopy, Structural and Functional principles of bionanotechnology, microbial systems for assembly of nanostructures.

**UNIT IV** (15 Hours)

Synthesis, Characterization, and Functionalization of nanoparticles for targeted Cancer Theranostics. Scope and applications of nanobiotechnology. Nanoparticles for waste water treatment and management. Nanoparticle synthesis in plants, Bacteria and yeast.

**UNIT V** (15 Hours)

Bioinformatics: Nucleic acid sequence databases: Genbank, Protein sequence databases - Swiss-Prot, PDB; Databank search: File formats - EMBL, **FASTA***, GCG and ClustalW. BLAST: types, steps involved in use, interpretation of results, multiple sequence alignment, Phylogenetic analysis. *Emerging areas of Bioinformatics:* Gene expression analysis: DNA microarrays- concept and design, analysis, visualization of data. Medical informatics, Disease genes identification and drug targets, Pharmacogenomics: Drug designing, Genetic tests.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**

1. Lee S and Savage, LM (2010) Biological Molecules in Nanobiotechnology.
2. Shanmughavel, P. (2005). Principles of Bioinformatics, Pointer Publishers, India.

**Reference Books**

1. Goodsell, DS (2004) Bionanotechnlogy: Lessons from Nature, Wiley-Liss, Inc., NY.
2. Strocio, MA and Dutta, M (2004) Biological Nanostructures and Applications of Nanostructures in Biology: Electrical, Mechanical, and Optical properties, Kluwer Academic / Plenum Publishers, USA.
3. David E. Reisner (2009). Bionanotechnology Global prospects. CRC Press. Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300.
4. Arthur M. Lesk, (2002). Introduction to Bioinformatics, Oxford University Press.

**18PBT311**

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | S | H | H | H |
| **CO2** | H | M | S | M | S |
| **CO3** | S | H | H | M | M |
| **CO4** | H | S | S | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT3CO**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT3CO | | C. Pr. 4 – Lab. in Bioprocess Technology, Plant Biotechnology and Bioinformatics | | |
| Batch<br>2018-2019 | Semester<br>III | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>3 |

## Course Objectives

1. To gain hands-on experience and to learn the principles behind bioprocess technology, plant biotechnology and bioinformatics
2. To know the process involved in isolation, separation, manipulation of bioprocessing, plant cell culture techniques
3. To apply the technology in pharmaceutical industries and plant tissue culture based industries

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 | CO1 | Applying the concepts involved in bioprocess technology, plant biotechnology and bioinformatics and demonstrating the techniques involved in Fermentation technology, plant cell culture and bioinformatics |
| K4 | CO2 | Executing the recent technology involved in bioinformatics, bioprocessing and plant cell culture |
| K5 | CO3 | Evaluating and analyzing the results involved in bioprocess technology, plant biotechnology and bioinformatics |

## Syllabus

***I - BIOPROCESS TECHNOLOGY***

1. Parts and design of a bioreactor.
2. Isolation of Protease producing bacteria
3. Optimization of culture condition for growth and protease production (media, pH & temperature).
4. Wine production and estimation of ethanol.
5. Production of organic acid- Lactic acid.
6. Immobilization of cells and test for its activity
7. Purification of fermentation product by Ion exchange Chromatography
8. Preparation of Biofertilizer
9. Mushroom cultivation

**18PBT3CO**

## *II - PLANT BIOTECHNOLOGY*

1. Laboratory organization
2. Preparation of media and sterilization
3. Micropropagation- Nodal and shoot tip culture
4. Callus culture- DPPH assay
5. Cell suspension culture
6. Synthetic seed preparation
7. Somatic Embryogenesis
8. Anther culture
9. Regeneration and Hardening
10. *Agrobacterium* mediated transformation – hairy root culture

## *III - BIOINFORMATICS*

1. File Formats of Nucleic acid and aminoacid sequences
2. Sequence similarity searching using NCBI (BLAST)
3. Protein Data banks (SWISPROT and ExPASy)
4. Multiple sequence alignment (ClustalW)
2. Phylogenetic analysis
3. Docking

**Teaching Methods**

- Board teaching
- Demonstration of experiments
- Providing hands on training in all the experiments as well as the preparation of reagents
- Discussion and Interpretation of results

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | S | H | S | M |
| **CO2** | H | M | S | M | S |
| **CO3** | M | H | H | S | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBT412**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT412 | | C.P.12- Genomics, Proteomics and Systems Biology | | |
| Batch<br>2018-2019 | Semester<br>IV | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To study and deduce the molecular characterization of human genome
2. To study the techniques involved in structural and functional proteomics
3. To utilize the bioinformatic tools to design and development of novel drugs

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Commemorating the molecular techniques involved in characterization of genomes and proteomes |
| K2 | CO2 | Recognizing and interpret the techniques involved in genomics, proteomics, bioinformatics |
| K3 | CO3 | Administering the principles of genomics, proteomics, bioinformatics to discovery novel drug development |
| K4 | CO4 | analyzing the molecular markers and its applications |

## Syllabus

**UNIT I** (15 Hours)

Genomics: Genomes of bacteria and eukaryotes- topology, organization. Human Genome Project: Historical background; Human genome features-protein coding regions repetitive sequences and pseudogenes. **Ethical, legal, social implications of HGP*.**

**UNIT II** (15 Hours)

Mapping and Sequencing: Molecular markers for genome analysis - RFLP and SNP, Genetic and Physical maps- Pedigree analysis, Restriction mapping, STS mapping with radiation hydrid panels; DNA and Genome sequencing- Automated sequencing of DNA, Shotgun sequencing; Contig assembly.

**UNIT III** (15 Hours)

Proteomics: Structural proteomics- NMR, X-ray crystallography and Mass spectroscopy. Functional Proteomics - 2D analysis of cell proteins, Yeast two hybrid system, Protein micro arrays.

**18PBT412**

**UNIT IV** (15 Hours)

Introduction to Systems Biology: Developmental biology and differential gene expression – regulation of genes – microarray, tagging – documentation – Stanford microarray database – data normalization – self-organizing maps. Tools and data formats for modeling - simulation techniques, simulation tools, data formats – SMBL, BioPAX, standard for systems biology, data resources – pathway databases, kinetic database, model database and biomodels.

**UNIT V** (15 Hours)

Analysis of high-throughput data: High-throughput experiments, Next generation sequencing, image analysis and data quality control, grid finding, spot quantification, linear models, **analysis of gene expression data***, DNA arrays, ROC curve analysis, clustering algorithms, hierarchical clustering, self-organizing map (SOMs).

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**

1. Brown, T.A. 2017, *Genomes 4*, CRC Press is a member of Taylor & Francis Group.
1. Lesk, AM., 2002 Introduction to Bioinformatics, Oxford University Press, UK.

**References**

1. Sandy B. Primrose, Richard Twyman 2007, Principles of Gene Manipulation and Genomics, 7th edition, Willey-Blackwell.
2. Daniel. C. Liebler, 2002. Introduction to Proteomics. Humana Press.
3. Tsai, C.S. 2002. An Introduction to Computational Biochemistry, Wiley-Liss, Inc., NY.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| CO1 | H | S | H | M | S |
| CO2 | H | S | S | M | M |
| CO3 | S | H | S | S | M |
| CO4 | S | M | M | H | S |

S – Strong H – High M – Medium L – Low

**18PBT4Z1**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Course code : 18PBT4Z1 | | Project work and viva-voce | | |
| Batch<br>2018-2019 | Semester<br>IV | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>3 |

## Course Objectives

1. To develop independence in experimental design and interpretation and to develop research skills
2. To promote education and research in biotechnology and provide academic and professional excellence for immediate productivity in industrial, governmental, or clinical settings for an ultimate benefit of society and environment

## Course Outcomes (CO)

| | | |
|---|---|---|
| K3 | CO1 | Developing and executing the knowledge by planning and coordinating a project. |
| K4 | CO2 | Inducing the students to become scientist |
| K5 | CO3 | Have gained practical experience in planning of projects and project management in biotechnological industry |

**DIRECTIONS**

- Students are allocated a dissertation topic individually under the supervision of faculty of the department.
- The dissertation must be similar to the thesis style and encompass:

  (i) Introduction / Rationale and Review of Literature

  (ii) Materials and Methods

  (iii) Results

  (iv) Discussion

  (v) Bibliography

- The dissertation should be submitted in type-written, bound form to the department for record.
- While evaluation of dissertation, 40 marks (20+20 as internal) should be based on oral presentation before the faculty members of department in the presence of concerned supervisor during the period of CIA examinations by submitting the reports, and 160 marks (external) should include:

  (i) Evaluation of project work (100 marks) based on:

  (a) Scientific content (25marks)

  (b) Experiments and final outcome (50 marks)

(c) Presentation (25 marks)

(ii) Viva-voce by external examiner (20 marks)

(iii) Assessment through presentation by internal examiner (40 marks) at the time of examination.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | S | S | S | S | H |
| **CO2** | M | S | H | H | S |
| **CO3** | S | M | H | M | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT43**

**Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Major Elective – Pharmaceutical Biotechnology | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To enable the students to learn about various drugs, its effects, drug metabolism, drug receptors, drug tolerance, dependence and resistance with therapeutic monitoring of drugs.
2. To offers the students comprehensive information and insights in pharmaceutical biotechnology and the development of biopharmaceuticals in pharmaceutical industry.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Recollecting the concept, classification production and application of pharmaceutical substances |
| K2 | CO2 | Imparting a comprehension of basic skills necessary for employing biotechnology principles |
| K3 | CO3 | The knowledge gained in this course would be used to understand and evaluate the different pharmaceutical parameters of the current and future biotechnology related products on the market |
| K4 | CO4 | Understanding in both scientific knowledge of designing and mechanism of action of drugs |

## Syllabus

**UNIT I** (15 Hours)

Drugs – sources, dosage forms and routes of administration. Drugs – structural features and pharmacological activity, Prodrug concept. Absorption and factors modifying drug absorption. Distribution, metabolism and excretion of drugs – phase I, II reactions, and action of cytochrome P450.

**UNIT II** (15 Hours)

Drug receptors – localization, types and subtypes, models and theories. G-protein coupled receptor and ion-channel linked receptors. **Examples of drug-receptor interactions*.** Agonists and antagonists.

**Major Elective**

**UNIT III** (15 Hours)

Drug tolerance and drug dependence. Principles of basic pharmacokinetics. Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, vaccination against infection, factors modifying drug action and effect. Assay of drug potency: chemical, bioassay and immunoassay.

**UNIT IV** (15 Hours)

Biotechnology and Pharmacy: Genetically engineered protein and peptide agents. Drug delivery systems: Non-conventional routes of administration, anti-AIDS drug development, oncogenes as targets for drugs, multidrug resistance and production of secondary metabolites.

**UNIT V** (15 Hours)

Mechanism of action of drugs used in therapy of Respiratory system – cough, bronchial, asthma, pulmonary tuberculosis, Antimicrobial drugs – sulfonamides, trimethoprim, penicillins, aminoglycosides and bacterial resistance, **Cancer chemotherapy*,** Thyroid and antithyroid drugs, insulin and oral antidiabetic drugs, antifertility and ovulation inducing drugs.

** denotes Self study*

**Teaching Methods**

| |
|---|
| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |

***Textbooks***

1. The pharmacology, Volumes I and II – Goodman, Gilman.
2. Pharmacology 3rd edition – Rang, Tale.
3. Principles of medicinal chemistry – Foye, Waverks Pvt. Ltd. New Delhi.

***References***

1. Basic and clinical pharmacology 7th edition – Katzung, Printice Hall, New Delhi
2. Pharmacology and pharmacotherapeutics – Satoskar *et al.,* Popular Prakashar, Mumbai
3. Burger's medicinal chemistry and drug discovery: principles and practice – Wolf, John Wiley
4. Molecular basis of inherited diseases – Davies, Read, IRL Press
5. Molecular biotechnology 2nd edition – Glick, Pasternak, Panima Publishers, 2002

**PBT45**

**Major Elective**

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | S | H | H | H |
| **CO2** | H | M | S | M | S |
| **CO3** | S | H | H | M | M |
| **CO4** | H | S | S | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT46**

**Major Elective**

| Programme code: 08 | Programme title: M. Sc. Biotechnology | | |
|---|---|---|---|
| Major Elective – Bioethics, Biosafety, IPR and Total Quality Management and Bioentrepreneurship | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To understand the concepts of bioethics, biosafety of genetic engineering, IPR, TQM, product planning and development through entrepreneurship
2. To learn the principles of bioethics and to know the requirements and assessment of biosafety
3. To make the students to understand the scope and significance of TQM

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Define the concepts of IPR, TQM, Product planning and development |
| K2 | CO2 | Understanding the scope and significance of biosafety in biotechnological process |
| K3 | CO3 | Developing knowledge on biosafety assessment in genetically modified organisms and their release into the environment |
| K4 | CO4 | Motivating the entrepreneurial development in life science |

## Syllabus

**UNIT I** (15 Hours)

*Intellectual property rights:* meaning, evolution, Classification and forms, Patents : Concepts and principle of patenting – patentable subject matter, Procedure for obtaining patent – Rights of patent, Infringement of patent right, Remedies for infringement of patent rights-patentability and emerging issues

**UNIT II** (15 Hours)

*Bioethics* : **Principles of bioethics***, ethical conflicts in biotechnology - interference with nature, fear of unknown, unequal distribution of risks and benefits of biotechnology, bioethics vs. business ethics, ethical dimensions of IPR, technology transfer and other global biotech issues.

**UNIT III** (15 Hours)

*Biosafety*: Definition of Biosafety. Requirements, Biosafety for human health and environment Use of genetically modified organisms and their release into the environment, biosafety assessment procedures for biotech foods & related products, Cartagena protocol on biosafety, bioterrorism and convention on biological weapons, WIPO, **GATT*.**

**Major Elective**

**UNIT IV** (15 Hours)

Principles of TQM, Tools, steps, techniques and methods for TQM (six sigma, charts, Ishikawa diagram, tree diagram, RCA, PDCA cycle), Requirements for supplementing TQM - steps for supplementing TQM - questionnaire - assessment through questionnaire, mission statement, benefits of TQM, check list for implementing TQM, Case study.

**UNIT V** (15 Hours)

*Entrepreneurship*: Concept, Definition, Structure and theories of entrepreneurship, Types of entrepreneurship, process of entrepreneurial development, entrepreneurial leadership, Product planning and development, Project management, Concept of projects, Project identification, formulation, project report and project appraisal.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**

1. Sasson A., (1993), Biotechnologies in developing countries present and future, UNESCO Publishers.
2. Gurumani, N., (2006), Research Methodology for Biological Sciences. M JP Publishers,

**Reference Books**

1. Shantharam S., and Jane F. Montgomery., (1999), Biotechnology Biosafety, and Biodiversity**,** Scientific and Ethical Issues for Sustainable Development, CC Now Science Publishers.
2. Drucker, P.F., (1999), Innovation and entrepreneurship: Practice and Principles, - Butterworth-Heinemann, Harper Business, NY.
3. Rao, Carr, Dambolena and Kopp. Across functional perspectives of TQM. John Wileyand sons, Newyork.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | M | M | H | S |
| **CO2** | S | H | H | H | M |
| **CO3** | S | H | S | S | S |
| **CO4** | M | M | M | H | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT48**

**Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Major Elective – Marine Biotechnology | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To understand the concepts, needs of marine Biotechnology
2. To recollect the existing diversity in marine environment
3. To know the importance of marine organisms and its ecological significance

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Introducing the existence of marine ecosystem |
| K2 | CO2 | Updating the knowledge of marine organisms |
| K3 | CO3 | Studying the existing ecosystem in marine diversity and its characteristic features |
| K4 | CO4 | Discussing the importance of marine viruses, molecular approaches of marine products and commercial importance of marine microorganisms. |

## Syllabus

**UNIT I** (15 Hours)

Marine ecosystem – intertidal zone, inhabitants and ecology of estuaries, salt marshes, mangrove swamps, coral reefs and the deep sea. Plankton, nekton and benthos.

**UNIT II** (15 Hours)

Oceanographic instruments and general sampling procedures. Applications of ocean remote sensing, **Major and minor elements in the sea water***. Properties of light in sea and biological consequences orientation, bioluminescent bacteria.

**UNIT III** (15 Hours)

Unculturable bacteria, occurrence, characteristics, characterization and exploitation. Bioactive compounds – Antimicrobials and antioxidants. **Biofouling and prevention*** Probiotic bacteria and their importance in aquaculture. Vaccines for aquaculture. Transgenic Fish.

**UNIT IV** (15 Hours)

Importance of marine viruses. Red sea tide and its control. Molecular Biology of Green mussel adhesive protein, Marine organism as a source of Polysaccharides.

**Major Elective**

**UNIT V** (15 Hours)

Commercial important enzymes from marine microorganisms: Xylanase, agarase, proteases, chitinases. Giant bacteria and their ecological significance. Marine pollution and its control.

* *denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

***Textbooks***


1. Nair N. B. and Thampy, D. M. 1989. Text book of Marine Ecology.
2. Thurman, H. V. and Webber, H. H., 1984. Marine Biology.
3. Meadiws, P. S. and Campbell, J. J., 1988. An introduction to Marine Sciences.


***References***


1. Drugs from sea (2000). Fusetani, N.
2. Microbiology of deep sea hydrothermal vents (1995). Karl, D.M.
3. The search from bioactive compounds from microorganisms (1992). Omum, S.
4. Biotechnology and Biodegradation (1990). Kamely, D. Chakraborty, A. & Omenn, G.S.
5. Recent Advances in Marine Biotechnology, Vol.2 (1998). Fingerman, M., Nagabushanam, R., Thompson, M.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | M | S | H |
| **CO2** | S | H | H | M | H |
| **CO3** | S | H | H | H | H |
| **CO4** | M | M | M | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT50**

**Major Elective**

| Programme code: 08 | | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|---|
| Major Elective – Medical Biotechnology | | | | |
| Batch<br>2018-2019 | Semester<br>- | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To understand the concepts, developments, applications of medical biotechnology
2. To recollect the biotechnological approaches in healthcare and prevention of diseases
3. To know the novel methods and developments in medical biotechnology

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Introducing the principle and concepts in medical biotechnology |
| K2 | CO2 | Updating the role of biomolecules in healthcare |
| K3 | CO3 | Studying the advanced developments in medical biotechnology |
| K4 | CO4 | Discussing the various therapeutic method for cancer. |

## Syllabus

**UNIT I** (15 Hours)

Introduction of Medical Biotechnology: Worldwide market in medical biotechnology, revolution in diagnosis, approaches of therapy, FDA - Organization chart and regulatory measures for drug discovery: Investigational new drug. Drug discovery: Overview, rational drug design, combinatorial chemistry in drug development, computer assisted drug design, role of bioinformatics in genome - based therapy, antisense DNA technology for drug designing

**UNIT II** (15 Hours)

Role of biotechnology in healthcare. World-wide market and work in medical biotechnology. Vaccine production-New developments. Biosensors in clinical diagnosis, chiral technology, monoclonal antibodies for immunotherapy.

**UNIT III** (15 Hours)

Vaccine technology: Subunit vaccines, **drawbacks of existing vaccines*,** criteria for successful vaccine, peptide vaccine, minicells as vaccines, impact of genetic engineering on vaccine production, viral vector vaccines and AIDS vaccine chiral technology: Principle & Applications.

**Major Elective**

**UNIT IV** (15 Hours)

Recent developments in medical biotechnology–Pharming for human proteins and neutraceuticals. Tissue engineering and therapeutic cloning, Application of nanotechnology in biomedical sciences - Green nanaosubstances, gene delivery, drug delivery. Nanotechnology in replacing defective cells.

**UNIT V** (15 Hours)

Different forms of Cancer therapy: **Chemotherapy***, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection, Stem Cells and Gene therapy – genetically engineered stem cells. Stem cell in cellular assays for screening – stem cell based drug discovery, drug screening and toxicology.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Text Books**

1. Albert Sasson, 2006. Medical Biotechnology: Achievements, Prospects and Perceptions – Published by United Nations University Press.
2. Lee Yaun Kun. 2006. Microbial Biotechnology - Principles and Applications - Published by World Science publications.

**Reference Books**

1. Aparna, R. Fundamentals of medical biotechnology.,Ukaaz Publications.
2. Jogdand, S. N. Medical biotechnology, Himalaya Publications.
3. Collee, J. G., T. J. Mackie, J. E. McCartney, 1996. Mackie & McCartney practical medical microbiology. Churchill Livingstone, New York.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | M | S | H |
| **CO2** | S | H | H | M | H |
| **CO3** | S | H | H | H | H |
| **CO4** | M | M | M | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT52**

**Non-Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Non-Major Elective – Competitive Science-I | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To understand the concepts, developments, applications of plant biotechnology
2. To recall the plant taxonomy and secondary metabolite production
3. To know the novel methods of microbial fermentation and environment

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Introducing the principle and concepts in plant taxonomy and biotechnology |
| K2 | CO2 | Updating the role of secondary metabolites |
| K3 | CO3 | Studying the advanced developments in microbial fermentation |
| K4 | CO4 | Discussing the various environmental issues |

## Syllabus

**UNIT I** (15 Hours)

Principles and methods of taxonomy, nomenclature of plants. Photosynthesis-Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; $CO_2$ fixation – C3, C4 and CAM pathways. Photorespiratory pathway. Nitrogen metabolism: Nitrate and Ammonium assimilation; amino acid biosynthesis.

**UNIT II** (15 Hours)

Tissue culture methods for plants, Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. Sensory photobiology: Structure, function and mechanisms of phytochromes, cryptocromes and phototropins; photoperiodism and biological clocks. Translocation; transpiration.

**UNIT III** (15 Hours)

Secondary metabolites – Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. Plant viral vectors, transgenic plants. Stress physiology: Responses of plants to biotic (pathogen and insects) and biotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress.

**UNIT IV** (15 Hours)

**Microbial fermentation and production of small and macro molecules*.** Application of immunological principles (vaccines, diagnostics). Molecular approaches to diagnosis and strain

**Non-Major Elective**

identification, molecular clocks; molecular tools in phylogeny. Genomics and its application to health and agriculture, including gene therapy.

**UNIT V** (15 Hours)

The Environment: Physical environment; biotic environment, Habitat and niche: Concept, Fundamentals and characters of habitat and niche. Population ecology, Species interactions, Community ecology, Ecological succession, Ecosystem and function, **Major terrestrial biomes***, Conservation biology. Biodiversity management approaches.

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**Textbook**

Jain, V. K., 2003. Fundamentals of Plant Physiology. S. Chand and Co., New Delhi.

**References**


1. Dubey, R. C., 2004. An Introduction to Biotechnology. S. Chand and Co., New Delhi.
2. Slater et al., 2003. Plant Biotechnology: The genetic manipulation of plants. Oxford University Press, Oxford.
3. Razdan, M. K., 2002. An Introduction to Plant Tissue Culture. Oxford and IBH Publishing Co., New Delhi.
4. Stanbury P. F. and Kargi, F. 2003. Bioprocess engineering: Basic concepts. Prentice Hall, Engelwood Cliffs.
5. Joshi et al. 2004, Biodiversity & Conservation. APH Publishing Corporation, New Delhi.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | M | S | H |
| **CO2** | S | H | S | M | S |
| **CO3** | S | S | M | H | H |
| **CO4** | M | M | M | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT54**

**Non-Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Non-Major Elective – Competitive Science-II | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To realize the concepts, developments, applications of general science and cell biology
2. To recall the concepts of biochemistry, genetics
3. To recognize the novel methods of biofertilizers

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Introducing the principle and concepts in general science |
| K2 | CO2 | Apprising the role of biofertilizers |
| K3 | CO3 | Studying the advanced developments in biochemistry, genetics |
| K4 | CO4 | Discussing the various process of cell biology |

## Syllabus

**UNIT I** (15 Hours)

General Sciences: Common Elementary Computer Science; General awareness of computer hardware: CPU and other peripheral devices-Input and Output, Auxiliary and Storage device; Basic Mathematical Methods: Linear algebra, Matrices. Linear differential equations; Laws of thermodynamics and their consequences, Thermodynamic potentials and Maxwell's relations; Electromagnetic waves – reflection and refraction.

**UNIT II** (15 Hours)

Biofertilizers:- Definitions and types (nitrogen fixers, P-solubilizers and P-mobilizers. Isolation, purification and characterization of microorganisms, which are potential biofertilizers. Screening for their efficiency and strain improvement. Biopesticides: Definition and significance, mass production and formulation of microbial control agents: Bt and NPV

**UNIT III** (15 Hours)

Cell Biology: Structure and function of cells and intracellular organelles (of both prokaryotes and eukaryotes): mechanism of cell division including (mitosis and meiosis) Microscopic techniques for the study of cells; Diversity of Cell size and Shape; **Cell differentiation and Cell signaling***.

**Non-Major Elective**

**UNIT IV** (15 Hours)

Bio-chemistry and Physiology: Structure of atoms, molecules and chemical bonds; Structure, function and metabolism of carbohydrates, lipids and proteins; Enzymes and coenzyme; Respiration and photosynthesis; Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps; Electrical properties of membranes.

**UNIT V** (15 Hours)

Genetics and Evolutionary Biology: Chromosome structure and function; Gene Structure and regulation of gene expression. Linkage and genetic mapping; Mutation: DNA damage and repair, chromosome aberration: Transposons; Concepts of evolution; Theories of organic evolution; Mechanisms of speciation; Hardyweinberg genetic equilibrium, genetic polymorphism and selection.

**References**


1. A.R.Vasistha. Matrices. Emerald Publications.
2. P.C.Joshi et al. 2004, Biodiversity and Conservation. A.P.H.Publishing Corporation, New Delhi.
3. G.M.Cooper. The Cell-A Molecular Approach. ASM Press, Washington.
4. Lodish et al, 2001. Molecular Cell Biology, W.H.Freeman & Company, New York.
5. D.L. Nelson and M.M.Cox, 2003. Lehninger's Principles of Bio-Chemistry, 3rd Edition Macmillan/Worth Publishers, New York.
6. K.Wilson and J. Walker. 2000, Practical Biochemisrty, 5th Edition, Cambridge University Press, Cambridge.
7. P. S. Verma and V. K. Agarwal. 2003. Genetics. S. Chand & Co, New Delhi.
8. Fundamentals of Computer Hardware- Mandeep Singh Bhatia.
9. Motion Studies and Thermodynamics - V K Shrivastava.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | H | M | S | H |
| **CO2** | S | M | S | M | H |
| **CO3** | S | S | S | S | S |
| **CO4** | H | M | H | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT56**

**Non-Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Non-Major Elective – Food Technology | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To study the primary source of microbes in various foods,
2. To know the definition, general features and different products.
3. To understand the existence of microbes on foods and foodborne diseases.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Introducing the students to the fundamentals of food science and technology |
| K2 | CO2 | Interpreting the role of carbohydrates and enzymes in food sciences. |
| K3 | CO3 | Identifying the foodborne diseases and causative agents with their social impacts. |
| K4 | CO4 | Understanding of the advanced principles of food processing and how to choose a method of preservation in relation to food composition |

## Syllabus

**UNIT I** (15 Hours)

Carbohydrates: Structure and functional properties of mono-oligo-polysaccharides including starch, cellulose, pectic substances and dietary fibre; Proteins: Classification and structure of proteins in food; Lipids: Classification and structure of lipids, Rancidity of fats, Polymerization and polymorphism; Pigments: Carotenoids, chlorophylls, anthocyanins, tannins and myoglobin; Food flavours: Terpenes, esters, ketones and quinones.

**UNIT II** (15 Hours)

Enzymes: Specificity, Kinetics and inhibition, Coenzymes, Enzymatic and non-enzymatic browning; Nutrition: Balanced diet, Essential amino acids and fatty acids, PER, Water soluble and fat soluble vitamins, Role of minerals in nutrition, Antinutrients, Nutrition deficiency diseases.

**UNIT III** (15 Hours)

Characteristics of microorganisms: Morphology, structure and detection of bacteria, yeast and mold in food, Spores and vegetative cells; Microbial growth in food: Intrinsic and extrinsic factors,

**Non-Major Elective**

Growth and death kinetics, serial dilution method for quantification; Food spoilage: Contributing factors, Spoilage bacteria, Microbial spoilage of milk and milk products, meat and meat products.

**UNIT IV** (15 Hours)

Foodborne disease: Toxins produced by Staphylococcus, Clostridium and Aspergillus; Bacterial pathogens: Salmonella, Bacillus, Listeria, Escherichia coli, Shigella, Campylobacter; Fermented food: Buttermilk, yoghurt, cheese, sausage, alcoholic beverage, vinegar, **sauerkraut*** and soya sauce. Prebiotics and Probiotics.

**UNIT V** (15 Hours)

Food processing principles**: Canning***, chilling, freezing, dehydration, control of water activity, CA and MA storage, fermentation, hurdle technology, addition of preservatives and food additives, Food packaging, cleaning in place and food laws. Production concept in dairy industries, Solvent extraction, refining and hydrogenation of oil, processing principles in fruits vegetables and plantation products: Extraction, clarification concentration and packaging

** denotes Self study*

**Teaching Methods**

| Powerpoint presentation/Seminar/Quiz/Discussion/Assignment |
|---|

**References**


1. Foods: Facts and Principles – N. Shakuntalamanay M ShadaksharaSwamy
2. Food Science - B Srilakshmi
3. Food science, Chemistry and Experimental Foods - M Swaminathan
4. Text Book on Foods Storage and Preservation - Vijayakhader


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | H | M | S | H |
| **CO2** | S | M | M | M | H |
| **CO3** | M | S | S | S | S |
| **CO4** | H | S | H | H | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT58**

**Non-Major Elective**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Non- Major Elective – Cancer biology | | | |
| Batch<br>2018-2019 | Hours / Week<br>5 | Total Hours<br>75 | Credits<br>5 |

## Course Objectives

1. To make students learn the basics of cancer biology
2. To make the students understand the molecular genetics of cancer
3. To provide knowledge on diagnosis and treatment of cancer.

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students are practiced to remember the specific terminologies by repeated discussions |
| K2 | CO2 | Students are explained wit neat diagrams to understand the molecular mechanism of cancer |
| K3 | CO3 | Students are trained to apply their new ideas in the field of cancer therapy |
| K4 | CO4 | Students are triggered to assume and analyze the results and interpret |

## Syllabus

**UNIT I** (15 Hours)

Introduction to Cancer: Cancer: Definition; Cancer incidence and mortality; Origin of neoplastic cells; Cancer as cellular disease; Types of Cancer: Benign Tumors Vs. Malignant Tumors, Common Symptoms, Causes of Cancer: Chemical Carcinogenesis; Irradiation Carcinogenesis; Oxygen Free Radicals, Aging and Cancer; Genetic Susceptibility and Cancer; Multiple Mutations in Cancer; DNA repair defects and their relationship to cancer; Viral Carcinogenesis.

**UNIT II** (15 Hours)

Cell Cycle Regulation and Cell Signaling in Cancer: Growth Characteristics of Malignant Cells; Cell Cycle Regulation; Evasion of Apoptosis (Programmed Cell Death); Growth Factors; Signal Transduction Mechanisms-G protein linked receptors, The phosphoinositide 3-kinase pathway, mTOR, Tyrosine kinase pathways, JAK-STAT pathway, Estrogen receptor pathway, Hypoxia-inducible factor, Tumor necrosis factor receptor signaling, Tumor growth factor-β signal transduction, Heat shock protein mediated events; Angiogenesis; Invasion and Metastasis; Biology of Tumor Metastasis.

**Non-Major Elective**

**UNIT III** (15 Hours)

Molecular Genetics of Cancer: Molecular Basis of Cancer-DNA Methylation and Cancer; Loss of Heterozygosity; Telomeres and Telomerase; Molecular Genetic Alterations in Cancer Cells - Translocations and Inversions, Chromosomal Deletions, Gene Amplification, Point Mutations, Aneuploidy, Disomy, Trinucleotide Expansion, Microsatellite Instability, Mismatch DNA Repair Defects, Gene Derepression in Cancer Cells, Oncogenes, Tumor Suppressor Genes: pRb and p53, DNA Tumor Viruses - V40 and Polyoma, Papilloma Viruses E6 and E7, Adenoviruses E1A and E1B, Hepatitis B Virus and Herpes Viruses.

**UNIT IV** (15 Hours)

Tumor Immunology: Mechanisms of the Immune Response to Cancer: Antigen Presenting Cells; Antigen Processing; T Lymphocytes and T Cell Activation; The Immunological Synapse; B Lymphocytes and B Cell Activation; Natural Killer Cells; Cell-Mediated Cytotoxicity; Role of Gene Rearrangement in the Tumor Response; Heat Shock Proteins as Regulators of the Immune Response; Inflammation and Cancer; Immunotherapy

**UNIT V** (15 Hours)

Cancer Diagnosis and Treatment: Tumor Markers; Gene Expression Microarrays; Proteomic Methods; Circulating Epithelial Cells; Circulating Endothelial Cells and Endothelial Progenitor Cells; Molecular Imaging; Haplotype Mapping. Molecular Mechanisms of Aging and cancer: Somatic Mutation; Telomere Loss; Mitochondrial Damage; Formation of Oxygen-Free Radicals; Cell Senescence; DNA Repair and Genome Stability; Caloric Restriction. Diet and Cancer Prevention; Chemoprevention; Antiproliferative Agents; Antioxidants; Protease Inhibitors; Histone Deacetylase Inhibitors; Statins; Multiagent chemoprevention

** denotes Self study*

**Text books**

1. Cancer Biology, Raymond W. Ruddon, 2007, 4th edition, Oxford University Press
2. Molecular Biology of Cancer by F. Macdonald, C.H.J. Ford, and A.G. Casson; Garland Science / Bios Scientific Publishers
3. The Biology of Cancer, Weinberg. Robert A, 2007, New York: Garland Science.
4. Molecular Biology of Human Cancers by Wolfgang Arthur Schulz Springer.
5. Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics 2nd Ed. by Lauren Pecorino. Oxford University Press

**PBT60**

## MAPPING

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | M | H | S | M |
| **CO2** | H | M | M | M | S |
| **CO3** | S | S | S | S | M |
| **CO4** | S | H | S | H | H |

1. **S** – Strong **H** – High **M** – Medium **L** – Low

**18PBTJ1**

| Programme code: 08 | Programme title: M.Sc. Biotechnology | | |
|---|---|---|---|
| Course code : 18PBTJ1 | JOC 1 - Plant tissue culture and Organic farming | | |
| Batch<br>2018-2019 | Hours / Week<br>2 | Total Hours<br>30 | Credits<br>2 |

## Course Objectives

1. To make students understand the applications of plant tissue culture
2. To give a detailed idea about the instruments used in plant tissue culture
3. To provide ideas on easy and low cost preparations of biomanures and biocontrol agents

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students are remembered with names the scientific names by spell repeatedly |
| K2 | CO2 | Outline the concepts by summarize to easy understanding |
| K3 | CO3 | Students trained to choose the correct method and solve the problem by applying the specific techniques |
| K4 | CO4 | Students made in to distinguish even small variations by simple analysis |

## Syllabus

### UNIT I

Introduction to plant tissue culture: Brief history, Principle and Significance of tissue culture, Design and Layout for wash area, Media preparation, Sterilization, Storage room, Transfer area for aseptic manipulations, Culture rooms and Observation/data collection areas.

### UNIT II

Instrumentation in plant tissue culture: Laminar air flow chamber, Autoclave, Distillation unit, pH meter, Orbital shaker, Microscope, Deep freezer and Growth chamber - working principle and maintenance.

### UNIT III

Types of media and cultures: Introduction, Types of media and its importance, Nodal culture, Callus culture, Cell culture, Embryo culture, Haploid culture, Protoplast isolation and culture, Somatic embryogenesis and synthetic seed preparation, Rooting and Hardening.

**18PBTJ1**

**UNIT IV**

Organic farming and manures: Organic farming; definition, relevance, biological nutrient management, Organic manures; Vermicompost, **Green manure***, Organic residue, Biofertilizer Soil amendments.

**UNIT V**

Integrated pest and weed management: Integrated pest and Weed management; use of biocontrol agents, bio pesticides etc. Organic certification in brief. Integrated farming system: Definition, Goal, Components, Factors affecting ecological balance, **Land degradation***, Soil health management.

** denotes Self study*

**Text Books**


1. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
2. Dubey, R.C., 2013. A text book of Biotechnology (Revised Edition), S. Chand & Company Ltd. New Delhi.
3. Palaniappan SP &Anandurai K. 1999. Organic Farming–Theory and Practice. Scientific Publishers, Jodhpur
4. Joshi, M. 2014. New Vistas of Organic Farming 2nd Ed. Scientific Publishers, Jodhpur.


**Reference Books**


1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Razdan, M. K., 2003. Introduction to Plant Tissue Culture. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | S | H | H |
| **CO2** | H | H | H | H | S |
| **CO3** | S | H | H | H | H |
| **CO4** | H | H | H | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBTJ2**

| Programme code: 08 | Programme title: M. Sc. Biotechnology | | |
|---|---|---|---|
| Course code : 18PBTJ2 | JOC 2 - Herbal Biotechnology | | |
| Batch<br>2018-2019 | Hours / Week<br>2 | Total Hours<br>30 | Credits<br>2 |

## Course Objectives

1. To enable the students to learn about the biochemical parameters used in the in the identification and utilization of medical plants
2. To enable the students to learn about the extraction of phytochemicals and to procedures
3. To exploit and explore the medicinal values of plants

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | The students recall the biosynthesis of primary and secondary metabolites involved in plants |
| K2 | CO2 | The students understand the concept of phyto-chemical extraction and principles involved in DNA and chemical fingerprinting techniques |
| K3 | CO3 | The students also know about applications of phyto-constituents in development of drug |
| K4 | CO4 | The students can able to validate the results obtained using the techniques involved in photochemical analysis |

## Syllabus

### UNIT I

*Phytochemistry:* Biosynthesis of primary and secondary metabolites, Classification and metabolisms of alkaloids, terpenoids, carotenoids, flavonoids, tannins and phenolic acids.

### UNIT II

General extraction isolation and purification techniques for alkaloids, terpenoids, carotenoids, flavonoids, tannins and other phenolic compounds from plants.

### UNIT III

*Biotechnology of medicinal plants:* Suspension cultures, Production of secondary metabolites from cultured plant cells, elicitation, immobilization and biotransformation. Bioreactors.

**18PBTJ2**

## UNIT IV

*Bioactive studies:* DNA fingerprinting of medicinal plants–DNA isolation and fingerprinting techniques. Chemical fingerprinting – GC, HPTLC and HPLC**.**

## UNIT V

Anticancer, antidiabetic, anti-inflammatory, hepatoprotectives, antimicrobials from medicinal plants. Antioxidants of plant origin – phenolics, terpenoids and alkaloids. Toxicity studies on medicinal plants and herbal formulations.

## Teaching Methods

Powerpoint presentation/Seminar/Quiz/Discussion/Assignment

## References


1. Harborne, J.B., 1998. Phytochemical methods to modern techniques of plant analysis. Chapman & Hall, London.
2. Trease G. E, M. C. Evans, 1979. Textbook of Pharmacognosy12th ed. Balliere-Tindal, London.
3. Irfan A. Khan and AtityaKhanum (Eds.). 2004. Role of Biotechnology in medicinal and Aromatic plants, Vols. I-X. Ukaaz Publications, Hyderabad.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | M | S | H | S | M |
| **CO2** | H | S | M | M | M |
| **CO3** | M | H | M | S | S |
| **CO4** | M | H | M | S | S |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBTD1**

| | |
|---|---|
| Programme code: 08 | Programme title: M. Sc. Biotechnology |
| Course code : 18PBTD1 | ALC. 1 – Frontier Technologies in Biosciences |
| Batch<br>2018-2019 | Credits<br>2 |

**UNIT I**

Stem cell technology: Stem cell, definitions, types and properties. Scientific terms, factors governing manipulations and culturing of stem cells. Micro-environmental factors governing stem cell propagation. Applications: Tissue engineering, reprogramming of genome function through epigenic inheritance. Ethical and social considerations of stem cell technology.

**UNIT II**

Neurobiology: Chemistry, synthesis, storage and release of neurotransmitters. Classes and mode of action of neuropeptides. Neuropeptide receptors, coexistence of neuropeptides with other neurotransmitters in "Dorsomedial Hypothalamic Nucleus". Neurodegenerative Disorders: Parkinson's, Alzheimer's disease, amyotrophic lateral sclerosis, senile dementia.

**UNIT III**

Nanobiotechnology: Definitions and terms, molecular motors, DNA hybridization control using metal ion crystal antennae. DNA-Based Nanofabrication. Self-Assembling DNA Tilings as Structural Templates, Molecular Electronics Microarray chips:- Microarray probes / chips, array fabrication, targets, assays, read out, image analysis, uses and examples.

**UNIT IV**

Diagnostic Techniques: Immunoassay Classification and Commercial Technologies, assay development. Cell Based and DNA based diagnostics. Functional Proteomics: Proteome, Mass spectroscopy of various protein complexes, Organization of proteome in an organism and its systematic study, Protein chips and Computation.

**UNIT V**

Biosensors: Concepts and applications, Noninvasive Biosensors in Clinical Analysis, Surface Plasmon Resonance, Biosensors based on Evanescent Waves, Applications of Biosensor-based instruments to the bioprocess industry, Application of Biosensors to environmental samples, Biochips and their application in modern Sciences.

**18PBTD1**

**Textbook**

Biotechnology. U. Satyanarayana. Books and Allied (P) Ltd. August 2007.

**References**


1. The Science of Laboratory Diagnosis, J. Crocker and D. Burnett 2nd Edition. John Wiley Publishers. 2005.
2. Nanotechnology: A Gentle Introduction to the Next Big Idea, M. Ratner and D. Ratner. Prentice Hall. 2002
3. Text book of Medical Physiology, A.C. Guyton & J.E. Hall. 10th Edition. Harcourt, Asia. 2001.
4. Principles of Cell Biology. G. Ramsay.1998. Commercial Biosensors. John Wiley and Son, Inc. K. Smith and M. Kish. Harper-Cellins Pub. Inc. New Delhi.


**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | M | S | H | H |
| **CO2** | H | H | H | H | S |
| **CO3** | S | S | S | M | H |
| **CO4** | H | H | H | H | M |

**S** – Strong **H** – High **M** – Medium **L** – Low

**18PBTD2**

| | |
|---|---|
| Programme code: 08 | Programme title: M. Sc. Biotechnology |
| Course code : 18PBTD2 | ALC. 2 – Stem Cell Technology |
| Batch<br>2018-2019 | Credits<br>2 |

## Course Objectives

1. To make students understand the basics of stem cells
2. To give a detailed idea about the application of stem cells
3. To provide ideas on the technologies implied in stem cell culturing and application

## Course Outcomes (CO)

| | | |
|---|---|---|
| K1 | CO1 | Students remember the scientific terms by repeated learning |
| K2 | CO2 | Students understand the concepts with help of videos displayed during class hours |
| K3 | CO3 | Students are trained to choose the correct method and solve the problem by applying the specific techniques |
| K4 | CO4 | Students are trained to distinguish even small variations by simple analysis |

## Syllabus

**UNIT I**

Cell Diversification and responses in the early animal embryo: *Xenopus* - Blastomeres and Spatial Segregation, inductive interactions, progressive pattern of new cell types generation. Morphogen gradient organization of complex pattern of cell responses, cell signal response, intracellular signals, early mammalian embryo and developmental potential, responses of mammalian embryonic stem cells to environmental stress and their pathway of development.

**UNIT II**

Renewal by stem cells: Stem cells division, epidermis and differentiated progeny, various keratins synthesis during stem cell development, basal cells, basal cell proliferation and thickness. Epidermal stem cells, secretory cells in the epidermis and population kinetics.

UNIT III

Specialized cells and their functions. Genesis, modulation, and regeneration of skeletal muscle: myoblasts fusion, muscle cells properties and protein isoforms, quiescent stem cells in the adult.

**18PBTD2**

**UNIT IV**

Fibroblasts and their transformations: the connective-tissue cell family fibroblasts response to signals in the extracellular matrix, connective-tissue cell differentiation, fact cells signaling and production, bone remodeling, osteoblasts and bone matrix, osteoclasts and their ole to connective-tissue framework and body structure.

**UNIT V**

Hematopoietic stem cell: Types and functions. Hematopoietic stem cell disorders-classification and manifestations of aplastic, myelodysplastic, myeloproliplastic disorders. Clinical applications of colony stems. Complications of germline therapy, replacement therapy and marrow transplantation. Immunological principles, preservation and clinical use of blood and blood components, hemapheresis procedures and oxiplantation.

**Textbook**

Gilbert. S.F. 2000Developmental Biology. 6th Edition. Sinauer Associates, Inc. NY.

**References**

1. Kiessling A.A. and C.S. Anderson, 2003. Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential. Amazon Publishers.
2. Alberts, B., 2002. Molecular Biology of the Cell. 4th Edition. Garland Publishing, Inc., NY.

**MAPPING**

| PSO / CO | PSO1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 |
|---|---|---|---|---|---|
| **CO1** | H | H | S | H | H |
| **CO2** | H | H | H | H | S |
| **CO3** | S | H | H | H | H |
| **CO4** | H | H | H | H | H |

**S** – Strong **H** – High **M** – Medium **L** – Low

**PBT69**

**QUESTION PAPER PATTERN FOR CIA & END OF SEMSTER EXAMINATION**

**M. Sc., BIOTECHNOLOGY**

**1. THEORY** Max Marks = 75

Time = 3.00 hrs

**SECTION - A** (10 x 1=10 marks)

Choose the correct answer type.

*Q.No. 1 to 10: Multiple choice type* ***alone.***

Questions with four alternative (distracter) answers each (Two questions from each unit).

**SECTION - B** (5 x 5=25 marks)

Short answer questions

*Q.No. 11-15: Either (a) or (b) short note type (One question 'a' or 'b' from each unit)*

**SECTION - C** (5 x 8=40 marks)

Essay type of questions:

*Q.No. 16-20: Either (a) or (b) essay type (One question 'a' or 'b' from each unit)*

**2. BREAK UP OF INTERNAL MARKS (25 marks)**

**Internal marks (25) = CIA (**out of 15**) + Attendance (**out of 5**) + Assignment (**out of 5**)**

***CIA marks (out of 15 marks) = I CIA marks + II CIA marks / 150 X 15**

**3. PRACTICALS – Question Pattern & Break-up of marks**

**PBT70**

***END OF SEMESTER PRACTICAL EXAMINATION***

*Max. Marks: 60*
*Duration: 3hrs*

**I. Major** (One question) (1 x 20 = 20)

**II. Minor** (One question) (1 x 10 = 10)

**III. Spotters** (3 x 5 = 15)

Examine, identify and critically comment on the spotters A, B, C, D and E.

**IV. Viva** (05)

**V. Record / Observation*** (10)

**Record for ESE; Observation for CIA exam.*

***INTERNAL - PRACTICAL MARKS***

| | | |
|---|---|---|
| From Model Practical Examination | - | 25 |
| Observation | - | 10 |
| Attendance | - | 5 |
| Total | - | 40 |

**PBT71**

**QUESTION PAPER PATTERN FOR JOC AND ALC SUBJECTS EXAMINATION**

**THEORY** Max Marks = 100

Time = 3.00 hrs

**SECTION - A** (10 x 10=100 marks)

Essay type of questions:

*Q.No. 1-10: Either (a) or (b) essay type (Two questions 'a' and 'b' from each unit)*