

Examination Scheme for the Pre-Ph.D. Course 2013-14 (Medical Biotechnology)

Serial Number	Paper code	Subject	Internal assessment	Written theoretical evaluation	Seminars (if any)	Maximum Marks
1	MBTPP-101	Computational and systems biology	20*	80	0	100
2	MBTPP-102	Trends in medical biotechnology	20*	80	0	100
3	MBTPP-103	Research Methodology	20*	80	0	100
4	MBTPP-104	Review writing and presentation	0	50	50**	100
Grand total						400

***Internal assessment will be based on following criterion:**

- | | |
|--------------------------------------------|----------|
| 1. Written test: | 10 marks |
| 2. Assignment presentation and submission: | 5 marks |
| 3. Attendance: | 5 marks |

**** Division of marks of seminars:**

Participation:	10
Seminar report:	10
Presentation:	20
Discussion:	10
Total:	50

Review should be submitted within month after the final examination is over

Passing marks will be 50% in each paper.

Note: The candidate should present seminar related to the topic of research problem under the guidance of the Faculty in the Department.

Computational and systems biology

Theory Marks: 80

Internal assessment: 20

Paper code: MBTPP-101

Note for Examiner: Examiner should set 2 questions from each unit. Each question shall carry 16 marks. Students will have to attempt atleast one question from each unit.

Unit-1

Biological data (BD)

Types of biological data (various omics)

Biological Databases Nucleic acid and protein sequence and protein structure databases

Overview of available Bioinformatics resources on the web

Unit-2

Bioinfo tools 1 DNA sequence analysis (DSA)

Sequence annotations and sequence analysis - Phylogeny of gene (blast, fasta, HMMer) and residue conservation. Primer design and T_m Calculation, DNA Restriction pattern analysis.

Codon bias and its effect on the protein expression with reference to various expression systems

Unit-3

Bioinfo tools 2 Protein sequence and structure insights (PSSI)

X-ray, NMR, Comparative modeling, *ab initio*, threading methods. Energy minimisation approaches (Steepest descent, Conjugate gradient etc), Basis of Molecular dynamics simulations and its application. Protein functional site identification for site directed mutagenesis / protein activity modulation, Protein-protein interaction prediction.

Unit-4

Molecular recognition (MR)

Basis of molecular recognition, Prediction of intrinsically disordered proteins and their interaction functions, Pharmacophore identification and receptor mapping, 3D- QSAR, Design and mechanism of peptidomimetics, Folding for binding or binding for folding.

Unit-5

Introduction to Systems Biology (SB)

Principles of Networks – Graph Theory and information theory of molecular systems

Types of biological networks

Biological Network Databases Genomic networks (Gene regulation)

Protein-protein interaction networks; Biochemical flux networks

Students are advised to consult relevant journal articles and reviews to gather the recent information on the above mentioned topics

Trends in Medical Biotechnology

Theory Marks: 80

Internal assessment: 20

Paper code: MBTPP-102

Note for Examiner: Examiner should set 2 questions from each unit. Each question shall carry 16 marks. Students will have to attempt atleast one question from each unit.

Unit 1

Advances in Vaccinology

Conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems, subunit vaccines, synthetic vaccines, DNA vaccines, virus like particles, recombinant vaccines, edible vaccines, nanoparticles in vaccine delivery systems

Unit 2

Stem cell biology

Epigenetic mechanism of cellular memory, Germ line Stem Cells, Stem Cells and Cloning, Nuclear cloning and Epigenetic reprogramming; Growth Factors and Signal Cascades BMP, Nodal, Wnt, Notch and Retenoid signaling during gastrulation, Molecular basis Pluripotency and its application, Stem cell niches, Stem cell renewal, Cell cycles regulators in stem cells

Unit 3

Parasitology

Molecular tools in parasitology, Molecular biology, immunology and structural studies of malaria parasite proteins, Therapeutics and diagnostics approaches for malarial parasite, Chromatin remodeling process, proteins involved and their biochemical characterization, Targeted transformation of insect genome, GFP as marker for transgenic insect, Application of transgenic insect technology in the sterile insect technique.

Unit 4

Microbiology

Viral Cell Interaction, Virus Replication, Respiratory viruses, Virus encephalitis, Viral hepatitis, Enteric viruses, Arboviruses, HIV, HTLV, Swine Flu, Molecular and Immunological techniques for viral detection,

Virulence factors at the molecular levels associated with pathogens such as *Mycobacterium tuberculosis*, *Salmonella typhi*, *Clostridium tetani*, *Bascillus anthracis*, *Vibrio cholerae*.

Advances in antibiotic development Penecillin, Streptomycin, Tetracyclines, Rifampicin.

Advances of Vaccinology:Recombinant vaccines, naked DNA vaccines, subunit peptide and edible Vaccines

Unit 5

Chemotherapy

General characteristics of antimicrobial drugs and routes of drug administration, PKS & types of PKS in antibiotic production, Quorum sensing, determination of the level of antimicrobial activity – disc assay, microbroth dilution and spore germination inhibition, Toxicological study – Hemolytic, MTT assay

Students are advised to consult relevant journal articles and reviews to gather the recent information on the above mentioned topics

Research Methodology

Theory Marks: 80

Internal assessment: 20

Paper code: MBTPP-103

Note for Examiner: Examiner should set 2 questions from each unit. Each question shall carry 16 marks. Students will have to attempt atleast one question from each unit.

Unit 1

Colloidal solutions of biopolymers and their electrochemical properties, Hydrodynamic properties; Viscosity, diffusion etc of biopolymers; Molecular weight determination, osmotic pressure, reverse osmosis and Donnan effect, Structure of biomembranes and heir electrochemical properties, membrane potential, action potential and propagation of impulses; PPI

Unit 2

Electrophoresis; different methods of electrophoresis for protein, nucleic acids, small molecular weight compounds and immuno precipitates (Immuno electrophoresis). Peptide mapping and combination of electrofocussing and SDS-PAGE. Blotting techniques (Northern, Southern and western blotting); RT-PCR

Unit 3

Theory of centrifugation and application to biological systems. Rotors angle/vertical/zonal/continuous flow centrifuge, differential centrifugation density gradient centrifugation. Ultra centrifugation principle and application. Chromatography – adsorption, affinity, partition, Ion-exchange, gel permeation, GLC, TLC, RPC, HPLC etc.

Unit 4

Introduction to principles and applications of (a)Spectroscopic methods (UV, Vis, IR, Fluorescence, ORD, CD, & PAS) (b)NMR, ESR & Mass spectrometry, Use of radioactive and stable isotopes and their detection in biological systems.

Unit 5

Automatic analyzer for amino acids, protein sequencer, peptide synthesizer & nucleic acid synthesizer. Cell sorters and their applications. Theory of lyophilization and its applications to biological systems. Introduction to principles and working of light and electron microscope.

Students are advised to consult relevant journal articles and reviews to gather the recent information on the above mentioned topics