CENTRE FOR MEDICAL BIOTECHNOLOGY

M. D. UNIVERSITY, ROHTAK

COURSE- Ph.D. Course Work – MEDICAL BIOTEHNOLOGY

Program Specific Outcomes:

PSO1. Students after completing this course work can successfully start their research in the most demanding sector of medical biotechnology such as Immunology, virology, parasitology, drug designing, bioinformatics, stem cell biology etc.

PSO2. To create doctoral students that can acquire successful career as a researcher in the field of biotechnology with temperament of lifelong learning.

PSO3. Hands-on training of various techniques and mandatory review article will help our students in providing knowledge and technical experience of problem-solving in a research environment.

PSO4. To train student who can conduct high quality research.

PSO5. To prepare students this can disseminate their ideas scholarly to the audiences

PSO6. Become a part of mission-Skill India- to develop researcher and scientists to uncover advance biology problems.

PSO7. Students will be able to generate knowledge regarding particular scientific problem and review writing will help them in putting their ideas together

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COURSE- Ph.D. Course Work – MEDICAL BIOTEHNOLOGY SCHEME OF EXAMINATION (2017-2018)

Serial No.	Paper code	Subject	Internal assessment	Written theoretical evaluation	Seminars (if any)	Maximum Marks
1	17MBTPC1	Computational and systems biology	20	80	0	100

2	**17MBTPC2**	**Trends in Medical Biotechnology**	**20**	**80**	**0**	**100**
3	**17MBTPC3**	**Research Methodology**	**20**	**80**	**0**	**100**
4	**17MBTPC4**	**Review writing and presentation**	**0**	**50**	**50**	**100**
Grand total						**400**

Internal assessment will be based on two assignments of 10 marks each

Computational and System Biology: 17MBTPC1

MM. Th 80 + 20, Time: 3h

Course Outcomes:

CO1. Students will be able to describe various types of biological data.

CO2. Students will be able to explain the various types of bio info tools for DNA sequence analysis.

CO3. Students will be able to explain the different types of bioinfo tools for protein sequence and structure insights.

CO4. Students will have expertise in molecular recognition technique.

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 Tm 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 peptidomemetics, Folding for binding or binding for folding.

NOTE: In all Nine questions will be set, Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. Out of remaining eight questions, two questions will be set from each unit and students are required to attempt four questions i.e. one from each unit.

Trends in Medical Biotechnology: 17MBTPC2

MM. Th 80 + 20, Time: 3h
Course Outcomes:

CO1. Students will be able to understand basic differences between different forms of vaccines

CO2. Students will understand different types of stem cell signalling pathways.

CO3. Students will be able to explain about the different types parasitology tools and how insect transgenesis use.

CO4. Student will be able to know the etiological agents and its virulence factor in disease.

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 Pluripotentency 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 typhii, Clostridium tetani, Bascillus anthracis, Vibrio cholera,* Advances in antibiotic development Penecillin, Streptomycin, Tetracyclines, Rifampicin. Advances of Vaccinology:Recombinant vaccines, naked DNA vaccines, subunit peptide and edible
Vaccines

NOTE: In all Nine questions will be set, Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. Out of remaining eight questions, two questions will be set from each unit and students are required to attempt four questions i.e. one from each unit.

Research Methodology: 17MBTPC3

MM. Th 80 + 20, Time: 3h
Course Outcomes:

CO1. Students will be able to describe how nerve impulse propagates and how biopolymer membrane used in biological system.

CO2. Students will be able to explain the general principle and the uses of electrophoresis, PCR and blotting in protein and nucleic acid analysis.

CO3. Students will be able to explain the different types of chromatography and centrifugation techniques and their uses.

CO4. Students will be well acquainted with about how spectroscopic and radioisotopes

are used and underlying principle for detections and analysis of biological system.

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/continous 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 spectrometery, Use of radioactive and stable isotopes and their detection in biological systems.

NOTE: In all Nine questions will be set, Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. Out of remaining eight questions, two questions will be set from each unit and students are required to attempt four questions i.e. one from each unit.

Review writing and presentation: 17MBTPC4:

Marks : Written theoretical evaluation: 80 + Seminars: 20

Course Outcomes:

CO1. Students will be able to read and write thoroughly on biological facts.

CO2. Students will be able to present and explain an issue pertaining to various biotechnology facts.

CO3. Students will be able to understand the importance of writing and documenting their results and discussions.

CO4. Review writing will help in students orientation of future research work .