

**Scheme of Examination for the Ph.D Course Work (Medical Biotechnology)**  
**Jan,17 to Dec, 17**

| <b>Serial Number</b> | <b>Paper code</b> | <b>Subject</b>                           | <b>Internal assessment</b> | <b>Written theoretical evaluation</b> | <b>Seminars (if any)</b> | <b>Maximum Marks</b> |
|----------------------|-------------------|--|----------------------------|---------------------------------------|--------------------------|----------------------|
| <b>1</b>             | <b>17MBTPC1</b>   | <b>Computational and systems biology</b> | <b>20</b>                  | <b>80</b>                             | <b>0</b>                 | <b>100</b>           |
| <b>2</b>             | <b>17MBTPC2</b>   | <b>Trends in Medical Biotechnology</b>   | <b>20</b>                  | <b>80</b>                             | <b>0</b>                 | <b>100</b>           |
| <b>3</b>             | <b>17MBTPC3</b>   | <b>Research Methodology</b>              | <b>20</b>                  | <b>80</b>                             | <b>0</b>                 | <b>100</b>           |
| <b>4</b>             | <b>17MBTPC4</b>   | <b>Review writing and presentation</b>   | <b>0</b>                   | <b>50</b>                             | <b>50</b>                | <b>100</b>           |
| <b>Grand total</b>   |                   |  |                            |                                       |                          | <b>400</b>           |

Internal assessment will be based on assignment, test and attendance in the class  
Review should be submitted within month after the final examination is over  
Qualification marks will be 50% in aggregate

# Computational and systems biology

17MBTPC1

*Theory Marks: 80*

*Internal assessment: 20*

**Note for Examiner:** 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.

## **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<sub>m</sub> 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.

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

# **Trends in Medical Biotechnology**

## **17MBTPC2**

*Theory Marks: 80*

*Internal assessment: 20*

**Note for Examiner:** 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.

### **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*, *Bacillus anthracis*, *Vibrio cholerae*.

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

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

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

## **Research Methodology**

### **17MBTPC3**

*Theory Marks: 80*

*Internal assessment: 20*

***Note for Examiner:*** 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.

#### **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 their 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.

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