Interdisciplinary Brain Research Centre (IBRC)
Faculty of Medicine
Syllabus for PhD Admission Test: 2022-23 onwards

(Approved by Board of Studies in its meeting held on 09-11-2017)

(Section-B)

1. **Molecular Cell Biology:** Constituents of human Cell, their structure and function; properties of cell membrane and transport across membrane, Cell communication; Cell cycle and programmed cell death; Cell differentiation. Stem cells and their possible role in therapy.

2. **Neurobiology:** Cellular organization of soma and synapses. Synaptic transmission. Membrane potential, action potential generation and propagation. Neuronal membrane excitability, ion channels and transport of ions. Sensory transduction and the visual system, Role of cGMP and Ca signaling pathway.

3. **Advanced Genetics and Molecular Biology:** DNA structure. Genome complexity, Chromosome packaging and nuclesome structure, perpetuation of DNA, Eukaryotes replication. Regulation of gene expression - Transcriptional and translational control in prokaryotic and Eukaryotic systems; Operon concept; Attenuation; Regulation of gene expression in lambda phage; Hormonal control of gene reulation; Oncogenes, protooncogenes and suppressor genes; Control of cell division; Alternative promoters; DNA binding mtifs in gene regulatory proteins; Basic concepts of proteomics. DNA repairmechanisms that safeguard DNA in prokaryotic and Eukaryotic systems.

4. **Behavior and Neurodegenerative diseases:** Type of memory, mechanism for formation, Retention and recall of memory. Neurodegenerative mechanisms behind Parkisnson's and Alzheimer's disease.

5. **Immunogenetics and Genetics of Cancer:** Antibody genes and protein, MHC locus, HLA system and typing, Hypersensitivity, Protooncogenes and role of oncogene in tumor formation.

6. **Neurophysiology:** Introduction, Electrophysiological differentiation of motor units in man. Quantitative EMG in nerve-muscle disorder.

7. **Free radical and anti-oxidants:** Chemistry and pathology of free radicals and antioxidants.

8. **Bioenergetics, Bioinformatics and Biophysical Chemistry:** Principals of bioenergetics, Bioorganic and biophysical chemistry; spectroscopy and bioinformatics.

9. **Techniques:** Basic principles of sedimentation and analysis of sub-cellular fractions; HPLC; Affinity chromatography; immunidiffusion; Principles of electrophoresis; Ultraviolet and visible light spectroscopy, circular dichroism spectroscopy; DNA fingerprinting; ELISA; Radioimmunaoassay; Western blotting; Polymerase Chain Reaction; Restriction mapping of DNA fragments; Cell cultures; Polyacrylamide gel electrophoresis (PAGE)

10. **Quality control and Biostatistics:** Quality Control and automation in clinical biochemistry; biostatistics and its application in research and clinical biochemistry; selection of statistical methods and their evaluation; sample size for designing experiments; standard error; standard deviation; Student's and paired 't' test; Chi-square test; fisher exact test; Non-parametic test of significance; Multivariate analysis methods; One-way and two-way analysis of variance; Multiple range test.

Recommended books:

1. Principal of Biochemistry (7th edition)
2. **Biochemistry (7th edition)**
   Jeremy M. Berg, John L. Tymoczko and Lubert Stryer
3. Neurology and Clinical Neurosciences (1st edition)
   Anothony H.V. Schapira
4. Harper's Biochemistry (27th edition)
   Anothony H.V. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell.
5. Neuroscience Exploring the Brain (4th edition)
   Mark F. Bear, Barry W. Connors, Michael A. Par adiso