Ph.D. Selection for Sem II, 2020-21, Modality for first round of interview

The examination will be conducted in 2 stages. In the first stage, 8 questions will be asked to the students from the syllabus mentioned below. The first 4 questions will be common questions while next 4 questions will be from a section chosen by the candidate: either Biochemical Engineering section or Biological sciences.

Only those candidates who clear the first round will be invited for the second round of interview. In the second round, the interview will be divided into four broad categories: one of the subjects as per their specialisation, Bachelors / Master’s thesis (understanding and interpretation), research aptitude and their understanding of the proposed project.

Syllabus for first round of the interview

GENERAL SECTION
Basic physical chemistry: Properties of gases, chemical equilibrium, pH, ionization of weak acids and bases; solubility and precipitation.
Basic Microbiology: Microbial Growth – Measurement techniques; growth kinetics.
Basic Biochemical Engineering: Batch growth kinetics, extraction, filtration and centrifugation.

BIOLOGICAL SCIENCES
Carbohydrates: structure and function (monosaccharides, disaccharides and common polysaccharides – starch and cellulose).
Proteins – primary, secondary, tertiary & quaternary structures; Ramachandran plots
Enzyme: chemical and functional nature of enzymes, Enzyme kinetics
Structure and function of nucleotides, DNA and RNA
Basic metabolic pathways (Glycolysis, TCA cycle, Glyoxalate cycle, Pentose Phosphate pathway).
Biological Membrane: structure and function
Prokaryotic and eukaryotic genome organization
Basic mechanisms in replication, transcription and translation
Gene regulation in prokaryotes: lact, ara and trp operons
Mutations: Types of mutations, Isolation of mutants
Enzymes used in molecular cloning and their applications
DNA sequencing: chemical and enzymatic methods
Southern, Northern and western blotting and hybridization
Vectors: types and characteristic features
Directed evolution

Structure and function of prokaryotic and eukaryotic cell
Energy transduction (fermentation, aerobic respiration and anaerobic respiration).
Genetic recombination; basic features of transformation, transduction and conjugation.
Bacteriophages

**BIOCHEMICAL ENGINEERING**
Fundamentals of growth: Monod growth kinetics; growth cycle phases for batch cultivation.
Enzyme kinetics: Kinetics of enzyme catalyzed reactions: Michaelis-Menten equation; Lineweaver-Burkplots; Eadie-Hofstee plots; substrate inhibition kinetics; competitive, non-competitive and uncompetitive inhibition; effect of pH and temperature.
Bioreactor kinetics: Batch, fed-batch and continuous (CSTR and PFR) reactors; conditions for “wash-out” and maximum cell production in chemostat cultures. Analysis of rate data for batch/continuous flow reactors and development of rate equation; Introduction to the concept of yield, titer and productivity; Principles of recovery operations: filtrations, centrifugation, solvent extraction, chromatography.

**Suggested Reading**