

Syllabus For The Ph.D. Entrance Examination

Name Of The Institute	:	INSTITUTE OF SCIENCE
Academic Year	:	2024-2025

1. RESEARCH METHODOLOGY

Design of research experiments; definitions of various types of clinical trials; randomization; hypothesis testing; types of variables; type-1 and type-2 error in null hypothesis, probability and confidence interval, standard deviation and standard error; t-test, P-Value, ANOVA, manual and computer based methods of calculation of statistical significance; method and sources of literature survey; basics of bioinformatics, ethics of scientific experiments and publications; Plagiarism; Intellectual property rights; Good laboratory practice; Data archiving and management; Human and animal ethical committee: mandate, structure, & guidelines; Biosafety aspects for human and ecosystem in scientific experiments;

2. LIFE SCIENCES

Microscopic Techniques (could be removed from here- added to bioanalytical techniques added towards the end), Metabolic pathways and their regulation, basics of enzymology (Enzyme kinetics, Enzyme inhibitors, mechanisms and regulation of enzyme activity, isoenzymes). Plasma Membrane Structure, Membrane Transporters; Cytoskeleton: Structure and Dynamics; Microtubules and Mitosis; Intracellular protein transport; Cell organelles, Cell Signaling pathways; Cell – Cell Adhesion and Communication; Cell Cycle; Mitosis, Meiosis, Role of Cyclins and Cyclin Dependent Kinases; Apoptosis and senescence; hallmarks of cancer cells. Genome organization in prokaryotes and eukaryotes, -Nuclear and Mitochondrial DNA, DNA Replication and repair, Transcription, RNA Processing, Translation, Gene Expression Regulation, gene silencing, coding and non-coding DNA, Mitochondrial inheritance, molecular cytogenetics, gene mapping, Mendelian genetics and determinants of inheritance, Animal models for human diseases, human genome project. Physiology and biochemistry of prokaryotes, soil microbiology, agriculturally important microorganisms, basics of rDNA technology. General and applied aspects of microbiology; Medical microbiology (principles of virulence and pathogenicity, basics of molecular pathogenesis mechanisms), antimicrobial resistance; Virology (structure and classification, effect on cells, viral pathogenesis, acute and persistent viral infections, tumor viruses). Microbial evolution, taxonomy, and diversity; Microbial ecology; Bioremediation, bacterial metabolism, ultrastructure of bacteria, tools and techniques of a microbiology lab. Basics of innate and adaptive immunity, MHC structure, function and regulation, Concept of memory B and T cell generation, immunosuppression and immunomodulation, history of vaccination, types of vaccines and vaccination strategies, efficacy and efficiency of vaccines. Components of the Nervous System, Brain parts and endocrine regulation, Neuron and Glial Cells - Different Types, Structure, Function. Synapse: Nerve Impulse, Neurotransmitters, Organization of Nervous System- CNS. Structure, function, regulation and pathophysiological changes during diseases condition of organs and organ system in human body. Structure, function and regulation of human reproductive systems, role of endocrines in reproduction and pregnancy, role of immunological cells in human reproductive system and during pregnancy. Basics of endocrinology (endocrine glands, types of release, receptors, signal transduction and gene regulation, HPA axis, biosynthesis and function

of endocrine hormones), Basics of cell culture techniques, hybridoma technology, applications of animal biotechnology. Basics of toxicology, dose-response relationship, determination of ED50 and LD50. Basics of cancer cell biology and molecular mechanisms, cancer genetics, carcinogenesis, cancer metastasis and cancer therapy. Principles and applications of bioanalytical techniques (ultracentrifugation, ultrafiltration, precipitation, dialysis, electrophoresis, chromatography, spectroscopy, radioisotope techniques, NMR, X-ray crystallography, mass spectrometry, microscopy, immunoassays and flow cytometry).

Bala
30/01/2024

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