IIT JAM SYLLABUS

Biotechnology

BIOLOGY (10 + 2 + 3 level) :-

Cell Biology : -

Structure of prokaryotic and eukaryotic cells; Membrane structure and function; Organelles and internal organization of the eukaryotic cell Protein trafficking in a eukaryotic cell; Cell communication – signalling pathways: endocrine and paracrine signalling; Extracellular matrix and apoptosis; Cell cycle – stages of mitosis and meiosis, and control of cell division cycle.

Biochemistry :-

Structure and function of biological macromolecules; Allostery; Enzymes – basic mechanisms of enzyme catalysis, Michaelis-Menten kinetics, enzyme inhibition, vitamins as coenzymes, and regulation; Bioenergetics – free-energy change, high-energy compounds, biological oxidation-reduction reactions and reduction potential; Metabolism – glycolysis, TCA cycle, oxidative phosphorylation, photosynthesis, nitrogen fixation, urea cycle, and regulation of glycolysis and TCA cycle.

Genetics :-

Mendel's laws; Inheritance patterns of polygenic traits; Mendelian inheritance patterns of human disorders; Pedigree analysis; Chromosomal basis of inheritance;

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Genetic recombination; Mapping genes on chromosomes based on linkage analysis; Plant breeding.

Molecular Biology :-

Landmark experiments that established DNA is the genetic material; DNA replication; Proofreading and repair of DNA; DNA recombination; Transcription; RNA processing; Translation; Regulation of gene expression including operons bacteria and differential gene expression in multicellular eukaryotes.

Evolution :-

Darwinian view – natural selection, fossil record and descent with modification; Population genetics – sources of genetic variation, gene pools and allele frequencies, Hardy-Weinberg equation, genetic drift, gene flow and adaptive evolution; Different types of speciation; Phylogenetic classification; Origin of life – abiotic synthesis of biological macromolecules, protocell, dating fossils and origin of multicellularity.

Microbiology :-

Isolation; Cultivation; Structural features of viruses, bacteria, fungi and protozoa; Pathogenic microorganisms; Nutrition-based classification of microbes; Microbial metabolism; Growth kinetics; Submerged fermentation techniques; Microbial genetics.

Plant Biology :-

Types of tissues and organs; Primary and secondary growth; Morphogenesis; Transport in vascular plants; Plant nutrition; Development of flowering plants – gametophytic and sporophytic generations, different developmental phases,

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genetic control of flowering, gametogenesis, incompatibility, embryogenesis, dormancy, germination and environmental influence; Plant hormones; Photobiology; Plant response to biotic and abiotic stresses

Animal Biology : -

Digestive, circulatory, respiratory, excretory, nervous, reproductive and endocrine systems; Basics of immunology – Innate and adaptive immunity, Immune cells and Immunoglobulins; Animal development – Fertilization, embryonic pattern formation, cleavage, gastrulation, cellular differentiation and morphogenesis.

Ecology :-

Climate patterns ; Terrestrial and aquatic biomes; Environmental constraints on species distribution; Factors affecting population density; Interactions among communities; Ecosystems; Ecological remediation.

Biotechnology :-

Plant tissue culture; Cloning of animals through somatic cell nuclear transfer; Applications of recombinant DNA technology in medicine, agriculture and forensic science.

Methods in Biology :-

Cell Biology :-

Microscopy (light microscopy and electron microscopy); Staining proteins with antibodies; Visualizations using the GFP reporter.

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Biochemical Techniques :-

UV spectrophotometry ; Biomolecular chromatography; cell fractionation by centrifugation; Electrophoresis; and Western blotting.

Molecular Biology Techniques : -

DNA cloning – plasmid vectors, and restriction enzymes; Polymerase Chain Reaction; Expression of cloned eukaryotic genes in bacteria; Hybridization techniques; DNA sequencing.

CHEMISTRY (10+2+3 level) :-

Structure and properties of Atoms: Bohr's theory; Periodicity in properties.

Bonding in Molecules : -

Chemical bonding; Complex formation; Physical and chemical basis of molecular interactions.

Chemical Kinetics, Thermodynamics, and Equilibrium

:-Chemical equilibrium; Chemical thermodynamics (first and second law); and Chemical kinetics (zero and first order reactions).

Physical and Chemical properties of Compounds :-

Chemical catalysis; Acid-base concepts; Concepts of pH and buffer; Conjugative effects and resonance; Inductive effects; Electrometric effects; Photochemistry; and Electrochemistry.

Chemistry of Organic Compounds :-

Hydrocarbons; Alkyl halides; Alcohols; Aldehydes; Ketones; Carboxylic acids; Amines and their derivatives; Aromatic hydrocarbons, halides, nitro and amino compounds, phenols,

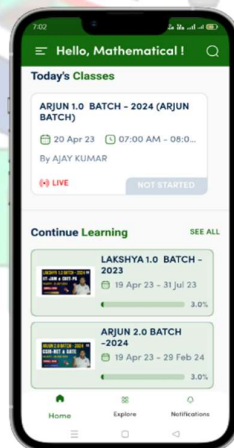An Ideal Platform to Crack the Exam for Leading Institutions in India!

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diazonium salts, carboxylic and sulphonic acids; Soaps and detergents; Stereochemistry of carbon compounds.

Instrumental Techniques :-

Spectroscopy: fundamentals of molecular spectroscopy, emission and absorption spectroscopy, UV-Vis, IR and 1-D proton NMR spectroscopy, basics of mass spectrometry; Basics of calorimetry; Basic concepts of crystallography.

MATHEMATICS (10+2 level) :-

Sets; Relations and Functions; Mathematical Induction; Logarithms; Complex numbers; Linear and Quadratic equations; Sequences and Series; Trigonometry; Cartesian System of Rectangular Coordinates; Straight lines and Family; Three Dimensional Geometry; Permutations and Combinations; Binomial Theorem; Vectors; Matrices and Determinants; Boolean Algebra; Functions; Limits and Continuity; Differentiation; Ordinary Differential Equations; Application of Derivatives; Integration as inverse process of differentiation; Definite and indefinite integrals; Methods of Integration; Integration by parts.

Statistics :-

Measures of dispersion; Mean Deviation for grouped and ungrouped data; Variance and Standard Deviation; and Analysis of Frequency Distribution.

Probability :-

Random Experiments; Event; Axiomatic Approach to Probability; Conditional Probability and its properties; Multiplication Theorem on Probability; Independent Events; Bayes' Theorem; Random Variables and its Probability Distributions; Bernoulli Trails and Binomial Distributions.

PHYSICS (10+2 level) :-

Units and measurements; Motion in one and two dimensions; Laws of motion; Work and kinetic energy; Conservation of energy; System of particles and rotational motion; Mechanical properties of solids and fluids; Thermal properties of matter; Heat and laws of thermodynamics; Kinetic theory of gases; Electric charge and field; Electric potential and capacitance; Current, resistance and simple circuits; Moving charges and magnetic field; Magnetism and matter; Electromagnetic induction; Electromagnetic waves; Alternating currents; Optics: Geometrical Optics – Reflection by spherical mirrors, Refraction at spherical surfaces and lenses, Total internal reflection and Optical instruments; Wave optics – Reflection and refraction of plane waves, Interference, Diffraction, Polarization, and Young's experiment: Dual nature of radiation and matter; Atoms, nuclei and nuclear physics; Semiconductor materials, devices and simple circuits.