M.Sc. (BIOTECHNOLOGY)

C.S.J.M UNIVERSITY, KANPUR

SEMESTER-I

PAPER-I   MAX. MARKS-100

Molecular Cell Biology

Cell Classification, cell variability (size,shape,complexity,function etc.); Prokaryotes & Eukaryotes : cell structure and sub-cellular organelles and components; Plant and animal cells: variations in structure and function; Microtubules, microfilaments and cytoskeleton Viruses: Structure and classification, life cycle; Cell division and cell cycle (including cell synchrony and its application); Cell-cell interactions and Signal transduction; Cell senescence and death; Fine structure of special cells such as-Muscle cell nerve cell and blood cell, Cancer as a cellular disease.

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General Biochemistry

Structure of water and its interaction with ions, nature, significance of weak acids and bases. Handerson-Hasselbalch equation, pH and buffers. Laws of thermodynamics. Gibbs-energy equation, redox electrochemical and membrane potentials,

Carbohydrates: Classification, characteristics and function of simple carbohydrates, there structure and properties, complex carbohydrates types, structure and general function, chemistry of amino sugars, blood sugar compounds, sugar nucleotides, mucopoly-saccharides. Lipids: Fatty acids-general formula, nomenclature and chemical properties, lipid classification - simple, complex, general structure and function of major lipid sub-class acylglycerol, phosphoglycerides sphingolipids, waxes terpenes , steroids and prostaglandins.

Vitamins: structure, properties, deficiency symptoms and function including biochemical reactions. Hormones: Structure, properties and function of animal and plant hormones Basic structure and function of amino acids, proteins and nucleic acids.

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Biophysical chemistry and techniques

Electrochemistry: Potentiometric and conductometric titrations

Centrifugation Techniques and there application: differential, zonal, density gradient and ultracentrifugation, Chromatography: Theory and general techniques of absorption, partition, ion exchange, gel filtrations, reverse phase, covalent, gas chromatography and HPLC.

Electrophoretic techniques and there applications : moving boundary and zone electrophoresis, isoelectric focusing isotachophoresis, immunoelectrophoresis.

Photometry: theory, Instrumentation and techniques of absorption, emission and flourimetry, spectroscopy: NMR, ESR and mass, different types of microscopy and X-ray crystallography

Tracer techniques: Detection and measurement of isotopes and application of isotopes, RIA, IRMA and ELISA.

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Fundamentals in Biostatistics and Biomathematics

Handling of data: tabulation and graphic representation; Sampling techniques; Measures of central tendency: mean, median and mode; Measures of dispersion, range, variance, standard deviation, standard error, Tests of significance: Z, T and F tests, Chi-square test, correlation and regression.

Differentiation, Integration, ordinary differential equations: First and Second order.

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Molecular Biology and Genetics

Modern concept of gene; Transcription and translation of genetic information interaction of alleles and genes in phenotype production; mutagenesis and deference against mutation; transmission, genetic analysis of viral and prokaryotic gene arrangement; transmission, genetic analysis of eukaryotic gene arrangement; DNA recombination; analysis of gene arrangement by molecular technique; regulation of genes and there products; genetic equilibrium and disequilibrium; transposable elements; evolutionary trends in gene structure, function and arrangements; extrachromosomal inheritance; developmental genetics; cytological genetics; ecological and evolutionary genetics.

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Microbiology

Classification. structure and properties of virus, bacteria, algae, fungi, protozoa and parasites; biosynthesis of bacterial cell wall and biochemistry of bacterial sporulation; biochemistry of microbial pathogenesis with special reference to cholera, amaebiasis, malaria, hepatitis, T.B. ; nutrition, physiology and growth of microbial cells; special features of bacterial metabolism.

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Metabolism

Metabolism of carbohydrates, lipids in plants, animals and bacteria; metabolism of aminoacids and proteins, protein biosynthesis and its regulation; effects of hormones and antibiotics on protein biosynthesis; metabolism and regulation of purines, pyrimidines and nucleotide biosynthesis; nitrogen fixation. regulation and metabolism in plants and bacteria; photosynthesis, heme and chlorophyll biosynthesis, mineral metabolism in human beings.

PAPER- IV   MAX.MARKS-100

Basic Bioinformatics and Computer Application

Introduction to Computer: Types of computers, hardware, software storage and memory devices (RAM, ROM Disk, Tapes etc.), I/O devices (Monitores, keyboards, printers, polotters etc.) files and directories. Networking: LAN and WAN

Operating Systems: Overview, Booting, DOS files, Internal and external DOS commands, file management (creating, editing, deleting, copying etc.) The windows environment.

Word Processing: Introduction to text files, types of word processors, file operation and utilities under Wordstar or MS Word package.

Data Processing:

Spreadsheets: Introduction to worksheet. The Lotus 123 Package: Operation and utilities dBASE I I I plus: Introduction to database, structure of dBase files, fields and records, creation, editing, browsing and processing of dBase files. Data processing, retrieval and preparation of reports.

Databases for the Life Science, Agriculture and Biotechnology :

Database structure and description : Bibiliographic and non-brbiliographic. Useful databases: MEDLINE, AGRIC, EMBL, GENBANK and protein databank.

Information retrieval and internet operations:

Overview, Access: online, CD-ROM, NICNET, Email etc., Search operations: keyward, string etc. Internet connectivity, Webside and pages. Searching for specific information, Journal content, reference, Abstracts etc.

Software:

Presentation of results in text/graphic mode: Sigma plot or Harward graphic package. Demo of some PC based educational software packages in genetic engineering.

Computer Basic & peripherals, office application Pubmed, Medline, Citation, of attract from given webside & ISE database pairwise & multiple sequence alignment, tree tool. Interface, Webpage, Basic, sequence alignment.

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Cellular and Molecular Immunology

Introduction to the cells and organs of immunity, structure of primary and secondary lymphoid organs. cell mediated vs. humoral immunity, T & B lymphocytes, structure and types of antibody, antigen-antibody interactions and its measurement; activation and differentiation of T & B lymphocytes; role of major histocompatibility complex (MHC), genes and products in immune response; complement components of classical and alternative pathways; hypersensitivity: Types I, I I, I I I & IV responses ; autoimmunity and immunodeficiency: clinical disease eg. Insulin dependent diabetes mellitus and AIDS.

PAPER-I 1   MAX.MARKS-100

Principles and methods of Genetic Engineering

Basic gene manipulation techniques; modification and restriction; Vectors: plasmid, cosmid, phagemids and yeast vectors; isolation of gene; Recombinant DNA technology: gene cloning, sequence; gene library; nucleic acid probes; fundamentals of gene transfer and advanced techniques of genetic engineering.

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Cell and Tissue Culture

Sterilization and preparation of culture media; cell and tissue culture techniques; concept of totipotency; introduction of different types of culture, subculturing, protoplast culture; Cell induction and maintenance; clonal multiplication, protoplast; fusion; organogenesis and embryogenesis, Lymphocyte culturing and maintenance of cell lines; production of natural products in culture and their industrial application.

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Enzymology and Enzyme Technology

Classification and nomenclature of enzymes; general properties of enzymes and techniques of enzyme assay; enzyme kinetics, effect of enzyme concentration, pH and temperature on kinetics of enzyme reactions, enzyme inhibition; applications of enzymes in industry; immobilized enzymes and their application in bioreactors, production of L-amino acids from racemic mixture, large scale production of enzymes.

SEMESTER-IV

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Plant Biotechnology

Cloning in plant cells; genetic engineering of seed proteins; application of biotechnology to agriculture transgenic plant: expression of foreign genes in transgenic plants and effects of gene copies and position; chloroplast and mitochondrial genome structure and function; nuclear genes controlling chloroplast development.

Culture technique for microorganism's plant tissue culture, animal cell line, agro bacterium mediated genetic transformation in plants, transgenic development.

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Medical and Microbial Biotechnology

Human growth hormones; Insulin: structure of insulin, production of growth and tissue differentiation factors: yaccines: prep aration of vaccine role of genetic engineering in the production of vaccines, salient features of interferons, production of interferons application and drawbacks; production of antibiotics human genome project.

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✓ Industrial Biotechnology

General stages of fermentation process, production of alcohol, acids, polysaccharides, alcoholic beverages, (single cell protein, production and nutritive value of single cell protein, mushroom culture, microorganisms in mushroom culture, industrial application of microbial energy, methods of enzyme immobilization and application of immobilized enzyme, production of plant growth hormones, antibodies, vitamin B2 and B12, Bio-fertilizers, bio-pesticides, algai production) fermentation process, control, production, separation, extraction, centrifugation, distillation, cell rupture and lyophilization.

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Environmental Biotechnology, Patenting & Product Regulation

Pollution: air, water, lignin detergent, dyes, heavy metals, drugs, industrial waste effluents; Impact analysis of some common pollutants; degradation: biodegradable and

nondegradable pollutants, metabolism and toxicity of agro and industrial chemical to plants and animal, Treatment of waste water and industrial effluent bioremediation, vermin culture, biochemical aspects, environmental monitoring and ecosystem analysis; detection of toxic exposures: acute toxicity, chronic toxicity, the basic of antidotal procedures.