

M.Sc.: **PREVIOUS**

Semester: I

SUBJECT: BIOTECHNOLOGY

PAPER: I

CELL BIOLOGY

Max. marks : 140

Architecture of Cell

Ultra structure of Bacterial, Plant and Animal cell

Cell membrane – Composition, Physiochemical properties, molecular organization, distribution of lipids, proteins and carbohydrates, Biogenesis and functions, cell wall

Structure and function of organelles – Mitochondria, Chloroplast, Golgi Apparatus, Endoplasmic reticulum, Lysosome, Ribosomes, Nucleus, Microtubules and Microfilaments.

Membrane Transport

Principle of membrane transport, Transport of micro and macro molecules across cell membrane (Properties and Mechanisms), intracellular vesicular traffic- transport from ER through golgi apparatus and transport from golgi apparatus to cell exterior.

Cell Communication

Cell-Cell interactions – Cell adhesion, Cell junctions and Extra cellular Matrix

Signal Transduction - Cell signaling via G Proteins and Enzyme linked surface receptor molecules, Regulation of Signaling pathways.

Cell Cycle

Regulation of cell cycle (Steps and Components), Check points in cell cycle, Intracellular control of cell cycle, CDK complexes, Cyclins, Apoptosis (Phases and Significance), Necrosis.

Cancer

Introduction, types of cancer, Metastasis, Metabolic and Physiological properties of cancerous cells. Oncogenesis, Factors responsible for oncogenesis, Proto-oncogenes.

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M.Sc.: **PREVIOUS**

Semester: **I**

SUBJECT: BIOTECHNOLOGY

PAPER: II

MICROBIOLOGY

Max. marks : 140

Introduction

History, Classification of microorganisms, Isolation and identification techniques.

Microbial Control – Physical Methods (Heat, Filtration and Radiation), Chemical Agents (Phenolics, Alcohols, Halogens, Quaternary Ammonium Compounds, Aldehydes, Gases)

Microbial Growth

Microbial nutrition – Nutritional types of microorganism, Media, **Microbial growth**, growth curve, Measurement of Cell numbers and cell mass, factors affecting microbial growth, Culture – Types and Techniques. **Strain Improvement**.

Microbial Ecology

Soil Microbiology – Microbial population in Soil, Microorganisms in nutrient cycling, Microbial decomposition of Organic matter in soil. Microbial Associations (Mutualism, Parasitism, Ammensalism, Competition, Predation, Commensalism and Synergism). Rhizobium-Legume Association & **PGPR**, Mycorrhizae, Lichens.

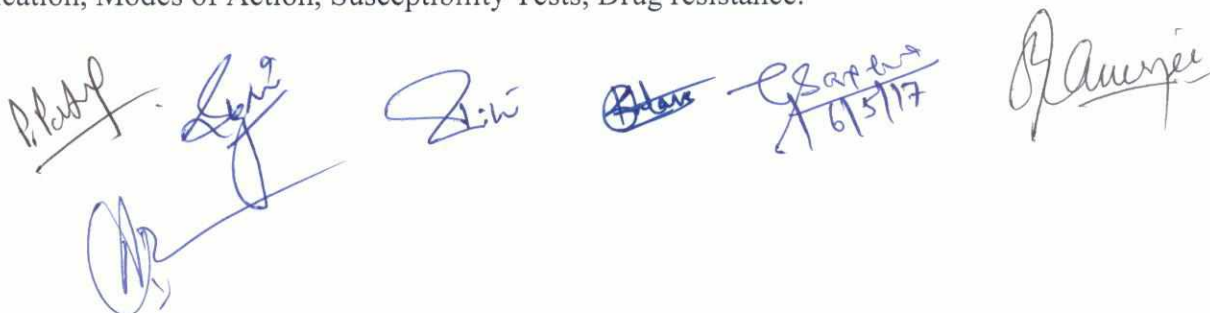
Microbial Genetics:

Gene and gene functions, DNA replication in bacteria. Genetic recombination in bacteria – Conjugation, Transformation and Transduction

Microbial Diseases

Pathogenesis of Bacterial Diseases – Typhoid, Leprosy, Tuberculosis, Plague, Pathogenesis of Viral Diseases – AIDS, Hepatitis, Influenza, Rabies. Pathogenesis of Protozoan Diseases – Malaria, Amoebiasis, African Sleeping Sickness, Leishmaniasis.

Chemotherapeutic agents – General characteristics, Introduction to sulfonamides, **Antibiotics** – Classification, Modes of Action, Susceptibility Tests, Drug resistance.



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M.Sc.: PREVIOUS

Semester: I

SUBJECT: BIOTECHNOLOGY

PAPER: III

BIOCHEMISTRY

Max. Marks: 140

Bioenergetics And Biological Buffers

[A] Water- structure of water, Ionization of water and electrolyte balance.

[B] Buffers and pH- pH scale, acid and base, Henderson equation, Biological buffers and its buffering mechanism.

[C] Bioenergetics – Law of thermodynamics and its application in biological system. coupled reactions.

Carbohydrates

Classification and structure of carbohydrates. Glycolysis, Kreb's cycle, ETC, HMP shunt, Gluconeogenesis and its regulation, Glycogenesis, Glycogenolysis. Blood sugar level regulation with respect to glycogenesis and glycogenolysis

Photophosphorylation, Calvin cycle, C₄ cycle, CAM cycle

Amino Acid And Proteins

Classification and structure of amino acids, titration curve of amino acids, pKa, isoelectric point and zwitter ions

Biosynthesis of proline, alanine, serine, cysteine

Degradation of Arginine, methionine, phenylalanine, tryptophan

Classification and structure of Proteins - Primary, Secondary, Tertiary and Quaternary.

Lipids And Nucleic Acid

Classification and structure of lipid, Metabolism of glycerol, biosynthesis of fatty acid, Beta oxidation of fatty acid. ketone bodies, Metabolism of ketone bodies and its clinical aspect with respect to diabetes.

Classification and structure of Nucleic acid. Metabolism of purines and pyrimidines

Enzyme

Classification, nomenclature and properties, Activation energy, transition state theory, theories for enzyme substrate complex formation, enzyme specificity.

Enzyme inhibition-Competitive, uncompetitive, mixed inhibition and irreversible inhibition. Isozymes, Coenzymes.

Mechanism of enzyme action - Acid-base catalysis and covalent catalysis.

Mechanism of carboxypeptidase, lysozyme and ribonuclease, chymotrypsin.

Enzyme kinetics – Michaelis - Menton Equation, Lineweaver - Burk Equation, Bisubstrate reactions. Enzyme immobilization.

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INSTITUTE FOR EXCELLENCE IN HIGHER EDUCATION, BHOPAL

Session 2017 – 2018

M.Sc.: **PREVIOUS**

Semester: **I**

SUBJECT: **BIOTECHNOLOGY**

PAPER: **IV**

INSTRUMENTAL METHODS OF ANALYSIS

Max. Marks: 140

Microscopy

Light Microscopy- light and compound microscopy, Bright Field Microscopy, Dark Field Microscopy, Phase Contrast Microscopy, Fluorescent Microscopy, and Polarizing Microscopy.
Electron Microscopy- Scanning Electron Microscopy, Transmission Electron Microscopy
Three Dimensional Microscopy - Confocal Microscopy

Chromatography

Basic techniques of Chromatography- Paper Chromatography, Thin Layer Chromatography (TLC), Column Chromatography
Advanced Chromatography- Ion exchange chromatography, Affinity chromatography, Gel Filtration Chromatography, Gas Liquid Chromatography (GLC) and High Performance Liquid Chromatography (HPLC)

Centrifugation And Spectroscopy

Principle of centrifugation, Preparative and Analytical Centrifugation with their types
Sedimentation analysis, Ultra Centrifugation
Principle of Colorimetry and Spectroscopy, UV-Vis Spectroscopy, IR spectroscopy, NMR

Electrophoresis

Principle and types of electrophoresis - Moving boundary and paper electrophoresis, Thin layer electrophoresis (TLE), Gel electrophoresis: Agarose gel electrophoresis, PAGE, SDS-PAGE and 2D PAGE, Capillary electrophoresis, Gradient gel electrophoresis, Pulse Field electrophoresis, Isoelectric focusing.

Radioisotopic And Biomedical Techniques

Geiger Muller Counter, Scintillation Counter, X-Ray diffraction, Labeling Techniques, CAT scan, PET Scan, MRI Scan.

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Practical I - Cell biology and Instrumentation

Max. Marks: 100

1. To prepare cytological stains and fixatives
2. To study (a) Mitosis in Onion root tip (b) Meiosis in Grasshopper testis, onion buds, alloe buds
3. To study the effect of colchicines and para di chloro benzene on mitosis
4. To determine mitotic index
5. To prepare cytological permanent slides
6. To study chromosomes from Chironomus larvae.
7. To prepare slide for Barr body identification.
8. Identification of tissue typing – Histological preparation of tissues (microtomy).
9. To study the effect of hypertonic, hypotonic and isotonic environment of human RBC.
10. To study plasmolysis and deplasmolysis
11. To identify mitochondria in cheek epithelium by Janus green staining.
12. To observe chloroplast in plant cells.
13. To prepare Heme crystal from RBC.
14. To study karyotyping of human chromosome, *Allium cepa*, *Allium sativum*, *Drosophila*.
15. To study the principle and working of different laboratory instruments
 - a. Microscope
 - b. Autoclave
 - c. Hot air oven
 - d. Incubator
 - e. pH meter
 - f. Centrifuge
 - g. Spectrophotometer
 - h. Preparation of buffers
16. To separate cells from blood using centrifuge.
17. To isolate DNA from prokaryotes and eukaryotes
18. To study qualitative and quantitative of DNA by electrophoretic technique.
19. To separate protein by Paper chromatography - plant pigment and amino acids
20. To separate amino acids by Thin Layer Chromatography
21. To determine λ max for given solution by spectrophotometer.

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S. Singh
Z. K. Singh
P. Singh
R. Singh
6/5/17
R. Singh

Practical II – Microbiology

Max. Marks: 100

1. To prepare microbiological media and study sterilization techniques.
2. To isolate microorganisms from (a) Water, (b) Soil, (c) Air, and preparation of pure culture by -
 - a) Pour plate
 - b) Spread plate
 - c) Streak plate
3. To study preservation methods
 - a) Stab culture and slant preparation
 - b) Demonstration of Lyophilization technique
 - c) Mineral oil preservation and wax dipping (only description)
4. To identify microorganisms by:
 - (A) Morphological characterization
 - (B) Measurement of size of microorganisms by micrometry
 - (C) Staining techniques: a) Simple staining, b) differential staining, c) endospore staining, d) negative staining, e) Lacto Phenol Cotton Blue staining, f) Flagellar staining, g) Motility testing – hanging drop
 - (D) Biochemical testing
5. To study methods of microbial growth measurement: a) Serial dilution, b) Direct microscopic count, c) Cell mass measurement, d) Optical density measurement
6. To study Growth curve of bacteria.
7. To perform Antibiotic sensitivity test by a) Disc diffusion and b) MIC method.

P. Purohit *S. Singh* *Z. K.* *Prakash* *G. S. Singh* *P. Anand*
6/5/17

Practical III - Biochemistry

Max. Marks: 100

1. To estimate biomolecules qualitatively (a) carbohydrate (b) proteins amino acids. And (c) lipids (d) vitamins
2. To study osazone formation.
3. To estimate reducing sugar by DNS method.
4. To estimate reducing sugar by Nelson Somogyi method.
5. To estimate total sugar by Anthrone method.
6. To determine concentration of given protein by Biuret method.
7. To determine concentration of given protein by Folin Lowry method.
8. To determine concentration of given protein by Bradford method
9. To estimate Cholesterol by LB method.
10. To determine concentration of given DNA by DPA method.
11. To determine the concentration of ascorbic acid in given sample.
12. To determine Acid value of oil.
13. To determine iodine value of oil.
14. To find out the isoelectric point of casein.
15. To perform the experiment on enzyme kinetics.
16. To study liver functioning by SGOT/SGPT.

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6/5/17

M.Sc.: **FINAL**

Semester: **III**

SUBJECT: BIOTECHNOLOGY

PAPER: I

GENETIC ENGINEERING

Max. Marks: 140

Enzymes in Genetic Engineering:

Historical background, Restriction and modifying enzymes - exonucleases, endonucleases, Restriction Modification system, ligases, polymerases and topoisomerases.

Bergs terminal transferase Boyer Cohen Chang Experiment - blunt end ligation method (dA:dT joints), , linkers , adapters.

Cloning and Expression vectors:

Properties of vectors, bacterial plasmid vectors, cosmid, phagemids, F-factor based vectors, plant viruses (TMV, CaMV, Geminivirus) and animal viruses (Adenovirus, Adeno-associated Virus, Herpes virus and Retrovirus) vectors. Artificial chromosome as vectors – YAC's, BAC's. Baculoviruses as expression vector, virus expression vectors, binary and shuttle vectors. Transposons as vectors.

Techniques of genetic engineering:

Methods of gene isolation, preparation of genomic library and cDNA library gene cloning- preparation of recombinant, insertion of recombinant in host, selection and screening of recombinants. **Blotting** – Southern, Western, Northern, Immunoprecipitation. Dot Blot.

Sequencing and synthesis of genes:

DNA sequencing: Sanger Coulson dideoxymethod, Maxam Gilbert chemical cleavage method, pyrosequencing, multiplex DNA sequencing and automated sequencing. **PCR-** Principle and types: inverse PCR, asymmetric PCR, RT-PCR, realtime PCR, and application of PCR. Gene therapy.

MOLECULAR MARKERS AND APPLICATIONS:

Construction of molecular maps-genetic and physical maps, Molecular markers- RFLP, RAPD, AFLP .DNA chip and microarray, reverse genetics, GMO and GEM.

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BIOPROCESS ENGINEERING

Max. Marks: 140

Introduction to bioprocess engineering:

Fermentation - historical background, isolation, preservation and maintenance of industrially important microorganisms. **Strain improvement** of industrially important microorganism. Media for industrial fermentation.

Dynamics of Fermentors:

Aeration and agitation system of bioreactors, mass transfer, heat transfer, rheology of fermentation fluids, mean residence time, substrate utilization rate, oxygenation, yield coefficient, mass balance and energy balance system.

Bioreactors:

Principle, Fermentor design. **Types of Fermentors** - CSTR, air lift, plug flow, fed batch, fluidized bed, rotator disc/drum reactor, immobilized cell fermentation. Standardization kinetics.

Types of Fermentation Process - Batch process, Fed Batch process, Continuous process, recycled and non-recycled process, liquid state and solid state fermentation.

Downstream processing:

Introduction, removal of microbial cells and solid matter, foam separation, precipitation, centrifugation, cell disruption and chromatography, Solvent extraction. Product recovery process and unit operations. Safety considerations in downstream processing. Economics of downstream process.

Bioprocess applications: Basic principles of scale up and cost reduction. Unit process for production of (a) amylase, (b) penicillin (c) beer (d) Glycerol.

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M.Sc.: FINAL

Semester: III

SUBJECT: BIOTECHNOLOGY

PAPER: III

Biostatistics and Bioinformatics

Max. Marks: 140

Data and Data Representation: Introduction to statistics. Data - definition, collection of data, sampling. Types of classification. Tabulation - Types of Tables, format, sorting. Frequency distribution, cumulative frequency distribution. Representation of Data - Graphical representation. I D Diagrammatic representation. Representation of frequency distribution - Histogram, Frequency polygon, frequency curve, Ogive.

Data Interpretation: Arithmetic Mean, Median, Mode. Geometric Mean. Harmonic Mean. Partition Values - Quartiles, Deciles, Percentiles. Measures of Dispersion - Range. Mean Deviation, Standard Deviation, Variance, Coefficient of Variation. Basic concepts of Skewness and Kurtosis, Correlation and Regression. Test of Significance - T-Test. F-Test. Chi square test, ANOVA. Probability - Terms and Concepts, Theorems (Addition, Multiplication and compound) Distribution - Binomial. Poisson. Normal.

Introduction to bioinformatics: Definition, role, scope, limitations and applications of bioinformatics. Introduction to biological databases - nucleotide databases- GenBank, EMBL, DDBJ, Protein sequence databases- PIR, PROSITE, Pfam, Structural databases- PDB, CATH, SCOP, Specialized databases- REBASE, ENZYME and KEGG. Sequence file format-FASTA, GENBANK, CLUSTALW, PHYLIP, PDB.

Sequence analysis: Introduction, methods (HMM & ANN) and significance. Sequence Comparison- Pair wise alignment and significance. Methods of alignment- Dot matrix, Dynamic Programming (Needleman-Wunsch and Smith-Waterman algorithm), Homology sequence searching- FASTA and BLAST. Concept of Scoring matrix (PAM and BLOSUM) and Gap penalty Multiple Sequence Alignment- methods, tools (ClustalW) and application. Phylogenetic Analysis- Introduction and importance, Phylogenetic tree, methods of Phylogenetic analysis and tools (PHYLIP and MEGA).

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Max. Marks: 100

1. To isolate Lactic Acid Bacteria from dairy products.
2. To formulate medium and development of inoculum for alcohol production.
3. To produce alcohol from different substrates.
4. To produce gas by microbial fermentation of various substrates.
5. To immobilize enzymes and cell.
6. To isolate fungus from spoiled foods and their characterization by LPCB staining.
7. To observe antimicrobial effect of plant extracts on microorganisms.
8. To isolate cellulose/lipid degrading microorganism.
9. To isolate nitrogen fixing microorganism and production of biofertilizer.
10. To perform quality testing of milk.
11. To perform Mushroom cultivation.
12. To perform Vermicomposting.
13. To demonstrate Fermentor.

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Practical III - BIOINFORMATICS AND BIOSTATISTICS

Max. Marks: 100

1. To study biological databases and data retrieval-
 - a) Nucleotide Databases: GenBank, EMBL, DDBJ
 - b) Protein Databases: SWISSPROT, PIR
 - c) Others: KEGG
2. To perform Homology Sequence alignment –
 - a) FASTA
 - b) BLAST
3. To perform Multiple sequence alignment- CLUSTAL W
4. To study Molecular Visualization by RasMol, spdvb
5. To study Phylogenetic analysis- MEGA, PHYLIP
6. Protein secondary structure prediction.
7. To draw and visualize drug molecule through chemsketch.
8. Collection of biological data and tabulation.
9. Data collection and preparation of a frequency distribution table.
10. Graphical representation of collected data.
11. Measurement of central tendencies
 - a. Mean
 - b. Median
 - c. Mode
12. Measures of dispersion-
 - a) Range
 - b) Mean deviation
 - c) Standard deviation
 - d) Variance
13. Cluster analysis and dendogram making
14. T-test
15. Chi – Square test
16. Correlation and regression analysis
17. ANOVA

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DEPARTMENT OF BIOTECHNOLOGY

M. Sc. Biotechnology

Semester II and IV

Session 2017 – 2018

S.No.	CLASS	SEMESTER	PAPER	TITLE OF PAPER
1	M.Sc. Previous	II	I	Genetics
2		II	II	Molecular Biology
3		II	III	Immunology & Animal Tissue Culture
4		II	IV	Plant & Environmental Biotechnology
5	M.Sc. Final	IV		Dissertation

Member of Board of Studies

Name

Signature

Dr. B. Dubey

Dr. Saurabh Jain

Dr. Ritu Thakur

Dr. Kirti Shrivastav

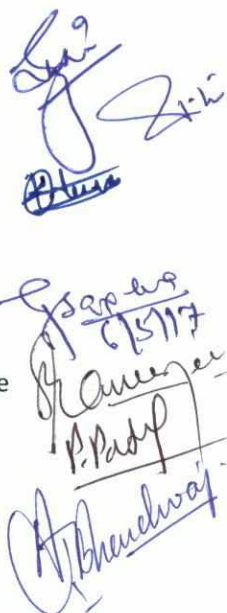
Priyanka Chauhan

Dr. Geeta Saxena

Dr. Suchitra Banerjee

Dr. Pramod Patil

Dr. A. K. Bhardwaj

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M.Sc.: **PREVIOUS**

Semester: **II**

SUBJECT: BIOTECHNOLOGY

PAPER: I

GENETICS

Max. Marks: 140

Mendelian Genetics

Mendel's Experiments- monohybrid dihybrid , trihybrid . Probability in Mendelian Genetics – codominance, Incomplete dominance, Lethals, Multiple alleles, epistasis extrachromosomal inheritance. Hardy Weinberg Equilibrium Law

Quantitative genetics- nature of continuous traits, inheritance of continuous trait, heritability, response of selection

Linkage, crossing over and Mapping

Linkage, Crossing Over, Cytological basis of crossing over, Chromosome mapping and gene mapping

Sex determination and differentiation

Sex chromosomes, sex linkage, sex determination - theories of sex determination [Dosage compensation (Lyon Hypothesis)] and sex differentiation. Pedigree analysis

Gene concept and transposable elements

Classical concept - structure of gene, molecular concept of gene, pseudogenes, overlapping genes, prokaryotic (IS and Tn) and eukaryotic (maize) transposable elements.

Mutations and aberrations

Mutation- Types, molecular mechanism, damage and repair.

Structural and Numerical aberrations - Deletion, Duplication. Inversion, Translocation, Euploidy, Aneuploidy, Polyploidy. (Klinefelter Syndrome, Turner's Syndrome, Down Syndrome, Cri-du-chat-Syndrome, Patau Syndrome), tests for detecting mutation.

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Institute for Excellence in Higher Education (IEHE), Bhopal
Session 2017 – 2018

M.Sc.: **PREVIOUS**

Semester: **II**

SUBJECT: BIOTECHNOLOGY

PAPER: II

MOLECULAR BIOLOGY

Max. Marks: 140

Physicochemical properties of nucleic acids

Structure and Topology of DNA- A, B, Z forms. 3 D structure of DNA
Denaturation and Renaturation of DNA, Tm, GC content, DNA renaturation kinetics, Cot curves
Structure of RNA, Types of RNA molecules

Functional properties of Nucleic acids

Homologous recombination at molecular level- models for recombination, protein machinery
DNA replication in Prokaryotic and Eukaryotic organisms
Enzymology of DNA replication (Prokaryotic and Eukaryotic)
Transcription in Prokaryotic organisms. Transcription in Eukaryotic organisms- Transcription factors (RNA Pol II, promoters, enhancers)

Protein Synthesis I

Post transcriptional modifications- mRNA stability, characteristic features of Eukaryotic mRNA (5' capping, 3'- polyadenylation). Nuclear pre mRNA splicing
Central Dogma, Concept of Genetic Code, structure and function of tRNA

Protein synthesis II

Translation machinery in Prokaryotic organisms (Initiation, Elongation and Termination),
Translation machinery in Eukaryotic organisms
Post translational modification- protein folding, protein stability, protein translocation

Regulation of Gene Expression

Gene'-expression regulation in prokaryotes (lac, trp, ara)

Bacterial genome organization, Operon concept, catabolite repression, CAP protein, Positive and negative regulation mechanisms. Gene expression regulation in eukaryotes: Britten Davidson model. Regulation of Gene Expression in Yeast, Regulation of expression at Transcriptional and Translational level

Lytic and lysogenic switches, Transcriptional regulation in viruses (Bacteriophage λ)

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Institute for Excellence in Higher Education (IEHE), Bhopal
Session 2017 – 2018

M.Sc.: **PREVIOUS**

Semester: **II**

SUBJECT: BIOTECHNOLOGY

PAPER: III

IMMUNOLOGY AND ANIMAL TISSUE CULTURE

Max. Marks: 140

Introduction to immune system

Historical perspective of immunity. innate immunity, acquired immunity, Antigenicity vs immunogenicity, Types of antigens, Antibodies (structure and types) Theories of antibody generation. Molecular mechanism of antibody diversity, Class switching, Monoclonal antibodies, Polyclonal antibodies. Ag-Ab interaction applications – Precipitation reaction: RID ODD, Immuno-electrophoresis, and Agglutination reaction: ELISA, CFT, RIA, FIA, flow Cytometry.

Cells and organs of immune system: Eosinophils, Mast cells, Neutrophils, Macrophages, Natural Killer Cells B & T Lymphocytes- $T_H/T_c/T_s$ cells, Plasma cell, Memory cell and cell surface receptors.

Lymphoid organs- Thymus, Bone marrow, Spleen, MALT, BALT, GALT

Humoral and cell mediated immune response

Complement System- Classical and Alternate pathways, MHC Class I and II molecules- Organization of genes, antigen processing and presentation. Cytokines, T and B cell activation, TCR, BCR. Hypersensitivity. Immune tolerance, Autoimmunity- types and mechanisms.

Diseases and immunotechnology

Immune response to viral infection- AIDS, Influenza

Immune response to Bacterial infection- Tuberculosis

Transplantation immunology- Graft rejection, immunosuppressive drug therapy

Animal Tissue Culture

Introduction to animal tissue culture techniques. aseptic techniques, culture media. Biology of cultured cells. Cell propagation, contamination detection

Culture techniques – Dispersion and disaggregation of tissue, Primary culture, subculturing and cell lines, measurement of growth. Bioreactors for mass culture of cells, cryopreservation and storage of cell.

Specialized Techniques

Cell viability and cytotoxicity, cell propagation, characterization and cell differentiation, immortalization, 3D culture- organ, histotypic, organotypic culture, Amniocentesis, Application of animal tissue culture, Stem cells and Stem cell therapy.

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Institute for Excellence in Higher Education (IEHE), Bhopal
Session 2017 – 2018

M.Sc.: **PREVIOUS**

Semester: **II**

SUBJECT: BIOTECHNOLOGY

PAPER: IV

PLANT AND ENVIRONMENTAL BIOTECHNOLOGY

Max. Marks: 140

Introduction

History of PTC, Plant tissue culture as a technique to produce novel plants – sterilization techniques, Tissue culture media (composition and preparation), initiation of callus culture and maintenance, cell synchronization.

Organogenesis – Meristem culture - Shoot tip culture, Root tip culture. Rapid clonal propagation.. Anther, pollen and ovary culture for production of haploid plants. Embryo culture and embryo rescue technique . Protoplast culture, Somatic hybridization- isolation, protoplast fusion, testing of viability and regeneration and its application. Micro propagation and somaclonal variation, somatic embryogenesis and artificial seeds. Cryopreservation technique , (Vitrification) – DNA banking for germplasm conservation.

Techniques for Plant Transformation

Genetic manipulation of plants- Direct DNA transfer in plant cells. Gene transfer in plants through vectors – Selectable markers, reporter genes and promoters. *Agrobacterium tumefaciens* mediated transformation. Practical applications of single cell suspension culture for screening.

Applications of Plant Transformation

Transgenic plants – Resistance to herbicide, insect resistance, nematode resistance, virus resistance, Bt genes, non Bt like Protease inhibitors, Amylase inhibitor. Advantages of genetically modified crops for resistance against biotic/abiotic stress and nutritional quality RNA silencing in Tomato and Soybean, Plant as a bioreactor

Introduction to Environmental Biotechnology

Basic concepts – Environment, Ecosystem, Biome & Biosphere. Current Issues – Pollution, Climate change, Global warming, Loss of Biodiversity. Waste management (Biomedical, Industrial and Hazardous waste), Biomagnification

Applications of Environmental Biotechnology

Biofuel (Jatropha), Bioplastics. Biogum, Biopesticides and Integrated Pest Management, Biomining, Bioleaching, Bioremediation, Biodegradation of Xenobiotic compounds (PCP, 2,4-D, 4CB). Waste water treatment,

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Practical I – Genetics and Molecular Biology

Max. Marks: 100

1. To isolate DNA from bacteria.
2. To isolate DNA from animal source.
3. To isolate DNA from plant source.
4. To isolate plasmid DNA from bacteria.
5. To perform Agarose Gel Electrophoresis of DNA
6. To study the screening of competent cells employing X-Gal / IPTG
7. To perform Gradient Plate method for selection of antibiotic resistant microorganisms.
8. To perform Replica plating technique for isolation of auxotrophic mutants.
9. To study the effect of UV light on DNA.
10. To study translocation in *Rheo diacolor*
11. To study DNA repair by light and dark repair mechanism.
12. To study methods of pedigree construction.
13. To detect mutants in fungal isolates from different substrate by using enzyme activity.
14. To study genetic ratio by color beads of flowers.

P. K. Singh *S. Singh* *Z. Singh* *Sharma* *Prasanna* *6/5/17* *Ramgopal*

Practical II – Immunology and Animal tissue culture

Max. Marks: 100

1. To perform Blood grouping.
2. To prepare blood film and identify cells.
3. To isolate serum from blood.
4. To calculate total WBC count of given blood sample
5. To calculate differential WBC count of given blood sample.
6. To perform Widal test by kit.
7. To perform Rocket electrophoresis by kit.
8. To perform Radial Immunodiffusion by kit.
9. To perform Ouchterlony Double diffusion by kit.
10. To perform Immunoelectrophoresis by kit.
11. To perform DOT ELISA by kit.
12. To study bleeding time test and clotting time.
13. To perform precipitin ring test.
14. To prepare Animal Cell culture medium
15. To perform Primary cell culture of lymphocytes.
16. To demonstrate animal cell culture techniques by charts and PowerPoint presentations.

The bottom of the page features several handwritten signatures and dates in blue ink. From left to right, there is a signature that appears to be 'P. Singh', followed by a large, stylized signature, then a signature that looks like 'Z. Singh', a signature that is partially obscured and possibly 'A. Singh', a date '6/5/17' with 'G. Sharma' written above it, and finally a signature that appears to be 'A. Sharma'.

INSTITUTE FOR EXCELLENCE IN HIGHER EDUCATION, BHOPAL

Session 2017 – 2018

SUBJECT: BIOTECHNOLOGY

M.Sc. SEMESTER: II

Practical III - Plant and Environmental Biotechnology

Max. Marks: 100

1. To study soil texture, temperature, moisture, pH and inorganic components.
2. To determine the DO and BOD of water.
3. To determine total dissolved solids, total suspended solids and total solid content in sewage water sample.
4. To enumerate Most Probable Number (MPN) in water sample.
5. To prepare and study Winogradsky column.
6. To isolate nitrogen fixing bacteria from rhizosphere and their characterization.
7. To clean and sterilize glasswares for plant tissue culture.
8. To prepare MS medium.
9. To sterilize explants by different agents for PTC.
10. To perform Meristem culture.
11. To perform Callus culture and organogenesis.
12. To perform Embryo culture.
13. To perform Seed culture.

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CONCEPTS IN APPLIED BIOTECHNOLOGY

Max. Marks: 140

Industrial and Pharmaceutical Biotechnology

Industrially important microorganisms, microbial production of – enzymes (protease, lipase, and pectinase), organic acids (vinegar, citric acid), ethanol, SCP from algae, antibiotics (Tetracycline & streptomycin), vitamins (B12), amino acid (glutamic acid), Interferons, interleukins.

Food Biotechnology

Fermented foods – wine, beer, sauerkraut, fermented dairy products – cheese, curd, and yogurt. Bioaromas, Bioflavours, Biocolours. Food spoilage, Methods of food preservation Concept of Probiotics, Prebiotics and symbiotic

Agricultural Biotechnology

Biofertilizers, Biopesticides, aquaculture, sericulture, Plant cell culture for production of useful secondary metabolites, perfumes, pigments, flavours, pharmacologically important compounds

Nanobiotechnology and Biosensors

Nanobiotechnology – introduction to nano science, size matter, tools for measuring nano structure, nano fabrication, and nanobiotechnology impact on types of DNA chip production. Biosensor – development and application. Functional proteomics. Bioterrorism

Biosafety and IPR

Biosafety, risk assessment, risk regulation. Biosafety containment, biosafety guidelines and regulation, biohazards.

Ethical issues concerning (a) cloning, (b) genetically modified organisms, (c) GEMs, (d) clinical trials (e) IVF & sex determination.

Intellectual property rights – Forms of protection: patents, patenting of biological material, significance of patenting in India, Copyrights, Trademarks, Trade Secrets, PVP, PBR. WTO, GATT, GATS, TRIPS, IPP

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Practical I - Genetic Engineering**Max. Marks: 100**

1. To isolate genomic DNA from Bacteria/plant/animal source.
2. To isolate plasmid DNA from Bacteria.
3. To perform agarose gel electrophoresis of given DNA sample.
4. To perform Restriction Digestion.(by using commercial kit)
5. To prepare competent cells (by using commercial kit).
6. To perform Cell transformation.(by using commercial kit)
7. To perform SDS – PAGE of given protein sample.
8. To demonstrate Western Blotting by kit.
9. To demonstrate PCR.
- 10.To perform CaCl_2 mediated transformation.
- 11.To perform Blue and white colony selection employing X-Gal / IPTG

Prady *Sir* *Zin* *Alan* *Sarvesh* *6/5/17* *Ramya*