SRI Y.**N** COLLEGE(AUTONOMOUS) NARSAPUR (Affiliated to Adikavi Nannayya University) Thrice Accredited by NAAC at ‘A’ Grade with a CGPA of 3.40 Recognized by UGC as ‘College with Potential for Excellence’ **I B.Sc; BIOTECHNOLOGY** **FRIST SEMESTER – PAPER - I** **BIOMOLECULES & ANALYTICAL TECHNIQUES**

**Aim and objectives of Course:**

To ensure students gain knowledge about the structure, properties and functions of biomolecules and characterization of bimolecular using analytical techniques

**Learning outcomes of Course:**

The course will provide an insight into various aspects of basic aspects of biomolecules and different aspects of biophysical and biochemical techniques applied in the field of biology

**UNIT I**

**Carbohydrates, Protein and Lipids**: Classification, structure, properties of carbohydrates. Classification, structure and properties of amino acids, peptide bond and peptides. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins. Denaturation and renaturation of proteins. Classification structure and properties of saturated and unsaturated fatty acids. Structure and functions of glycolipids, phospholipids, and cholesterol.

**UNIT II**

 **Nucleic acid, Vitamins and Bioenergetics**: Structure and functions of DNA and RNA. Source, structure, biological role and deficiency manifestation of vitamin A, B, C, D, E and K. Glycolysis, TCA cycle,

**UNIT III**

**Centrifugation, Chromatography and Electrophoresis**: Basic principles of sedimentation and types of centrifugations. Principle, instrumentation and application of partition, absorption, paper, TLC, ion exchange, gel permeation, affinity chromatography. Introduction to HPLC, Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (SDS-PAGE). Isoelectric Focusing.

**UNIT IV**

**Spectroscopy, Microscopy and Laser Techniques**: Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric calorimeter and UV-visible spectrophotometer. Introduction to crystallography and application. Types and design of microscopes - compound,, fluorescent electron microscopy (TEM, SEM). Introduction to radioisotopes,

 **UNIT V**

 **Biostatistics**: Mean, median, mode, standard deviation, One-way Anova, Two-way Anova, ttest, F-test and chi-square.

**Additional Input**

* Types of DNA
* Types of RNA
* Chargaff’s rule

**BLUE PRINT**

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

1. **Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M**
2. Denaturation and Renaturation of Proteins.
3. Structure and functions of cholesterol.
4. Types of centrifugations.
5. Factors affecting electrophoretic migration.
6. Beer-Lambert’s law.
7. Extinction coefficient.
8. Vitamin E
9. Gel permeation

 **Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

1. Write about classification, structure and properties of amino acids
2. Explain biological role and deficiency manifestations of vitamin – A, B, C, D, E, K
3. Explain gel filtration chromatographic technique
4. Describe the basic principles and types of electrophoresis
5. Explain ANOVA

**SECTION – C**

1. Write about structure and classification of saturated and unsaturated fatty acids
2. Explain Glycolysis process with a flow chart
3. Explain about UV VIS spectrophotometer
4. Explain the measurements of radioactivity
5. Define mean, median and mode with examples

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**List of Practical's**

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record.
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates.
5. Quantitative estimation of protein - Lowery method.
6. Estimation of DNA by diphenylamine reagent.
7. Estimation of RNA by orcinol reagent.
8. Assay of protease activity.
9. Preparation of starch from potato and its hydrolyze by salivary amylase
10. Preparation of standard buffer and pH determination.
11. Separation of amino acids by paper chromatography
12. Separation of lipids of TLC
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

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**MODEL QUESTION PAPER UG DEGREE EXAMINATIONS**

Lab Time: 3 hours Max Marks: 50M 1. Estimation of DNA by Diphenylamine method 20M 2. Write principle of paper chromatography and separate aminoacids 10M 3. A) Principles of qualitative analysis of carbohydrates 2- ½ B) Find normality of a given compound with equation 2- ½ 4. Spotters 1) Spectrophotometer 2- ½ 2) Centrifuge 2- ½ 5. Record 5 M 6. Viva 5 M

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**Aim and objectives of Course:**

To ensure students gain knowledge about the microbiology, cell and molecular biology aspects

**Learning outcomes of Course:**

The course will provide an insight into basic aspects of microbiology, cell and molecular biology

**Course Objectives:**

To acquaint students with concepts of microbiology, cell and molecular biology. This course is aimed to give an understanding of the basics of microbiology, dealing types of microbes, classification and their characterization, structure and function of prokaryotic and eukaryotic cell organelles, cell division and basics of molecular biology including DNA replication, transcription, translation and regulation of gene expression.

**UNIT I**

**Scope and Techniques of Microbiology**: History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming. Ultrastructure of bacteria and growth curve. Pure culture techniques. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram and acid-fast staining.

**UNIT II**

**Microbial Taxonomy and Metabolism**: Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics, transmission and cultivation of viruses. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage).

**UNIT III**

**Cell Structure and Functions:** Structure, properties and functions of cellular organelles (Mitochondria, Ribosomes and Vacuoles) of eukaryotic cells. Cell cycle and cell division (mitosis and meiosis). Chemical composition and dynamic nature of the membrane

**UNIT IV**

 **DNA Replication, Repair and Regulation of Gene Expression:** DNA replication in prokaryotes and eukaryotes (semi conservative, dispersive, conservative). Mechanism of DNA replication, enzymes and protein involved in DNA replication. DNA damage and repair. Regulation of gene expression in prokaryotes Lac operon concept.

**UNIT V**

**Central Dogma of Molecular Biology:** Genome organization of prokaryotic and eukaryotic organisms. Genetic code, prokaryotic and eukaryotic transcription, enzymes involved in transcription. Post-transcriptional modification (Capping Poly adenylation) and splicing.

**Translation:** mechanism of translation in prokaryotic and eukaryotic cells (initiation, elongation, termination). Post-translational modification (glycosylation and phosphorylation).

**Additional Input**

* Antibiotics
* Trp OPeron

**BLUE PRINT**

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**I .Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M**

1. Contributions of Leeuwenhoek
2. Simple staining
3. General characteristics of virus
4. Mitochondria
5. DNA repair
6. Post-transcriptional modifications
7. Capping
8. Adenulation

 **Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Give the ultra-structure of Bacteria and its growth curve with neat labelled diagram. 10. Explain classification of bacteria based on different criteria. 11. Explain the cell cycle and cell division. 12 What is replication and explain the process of replication in eukaryotes 13. Explain the process of transcription in eukaryotes

**SECTION – C**

 14. Explain sterilization techniques. 15. Explain the structure properties of animal cells. 16. Explain the structure and properties of cell organelles. 17. What is Operon concept? Explain positive and negative control methods of lac operon 18. Write a note on post-translational modifications in prokaryotes

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**List of Practicals**

1. Demonstration, use and care of microbial equipment
2. Cleaning and preparation of glassware
3. Preparation of nutrient agar medium for bacteria
4. Preparation of PDA medium for fungi
5. Sterilization techniques (autoclave, hot air oven, filter)
6. Isolation of bacteria from soil
7. Simple staining technique
8. Differential staining technique
9. Microbial counting by Haemocytometer
10. Identification of different bacteria
11. Motility test by hanging drop
12. Biochemical identification of bacteria
13. Preparation of pure culture by slab, slant, streak culture
14. Study of stages of mitotic cell division
15. Study of stages of meiotic cell division
16. Isolation of chloroplast
17. Extraction and isolation of DNA from bacteria.

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MODEL QUESTION PAPER UG DEGREE EXAMINATIONS

Lab Time: 3 hours Max Marks: 50M

1. Write procedure for isolation of bacteria from soil and carryout the experiment 20M
2. Write principle and procedure of simple staining and experiment 10M
3. Identify given spotters 5 x 2=10M a) HOT-air oven b) Stages of meiosis c) Types of bacteria based on shape d) HIV e) Okazaki fragments
4. Record 5M
5. VA-Voce 5M

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**Aim and objectives of Course:**

To acquaint students with concepts of immunology and recombinant DNA technology. This course is aimed to give an understanding of the basics of immunology dealing cells and organs of the immune system, types of immune responses, antigen-antibody interactions, vaccines and tools, techniques and strategies and applications of genetic engineering.

 **Learning outcomes of Course**:

The course will provide an insight into basic aspects of immunology and rDNA technology

**UNIT I**

**Concepts, Cells and Organs of the Immune System**

Terminology, antigen, hapten, antibody (types), antigenicity, immunogenicity and types of immunity. Innate and adaptive immunity. Hematopoiesis, organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines). Introduction to complement components, MHC. Basic concepts of humoral and cell-mediated immune response.

**UNIT II**

 **Vaccinology and Clinical Immunology**

 Live, killed, attenuated, subunit and recombinant vaccines. Role and properties of adjuvants. Hybridoma technology, monoclonal antibodies and their application in immunodiagnosis. Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA. Introduction to hypersensitivity and autoimmunity.

**UNIT III**

**Introduction, Tools and Techniques of rDNA Technology**

 Introduction to rDNA technology, steps involved in cloning, tools of genetic engineering (Genes, Cloning vectors - plasmids and cosmids, Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast). Principles and application of PCR. Southern, Northern and Western Blotting. Introduction to DNA sequencing (Sanger Sequencing)

**UNIT IV**

**Cloning Strategies and Application of rDNA Technology**

 rDNA library, construction, methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (DNA fingerprinting).

**UNIT V**

**Bioinformatics**

Databases (PubMed, NCBI, EMBL), nucleotide and protein BLAST analysis, and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics).

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M** 1. MHC 2. Hematopoiesis 3. Properties of Adjuvants 4. Monoclonal Antibodies Applications 5. Sanger Sequencing 6. Principle of PCR 7. DNA Fingerprinting 8. Proteomics

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Explain the different organs of immune system 10.What is vaccine? Explain the different types of vaccines? 11. Write about tools and steps involved in genetic engineering 12. Write about applications of r-DNA technology in agricultural field 13.Describe in details about Omics

**SECTION – C**

 14. Write about immunity and explain the types of immunity 15. Explain the different types of Ag-Ab reactions 16. Explain blotting techniques 17. What is transformation? Write about methods of transformation 18. Explain about protein BLAST method

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**List of Practical's**

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ocuteroloney immunodiffusion
5. Radial immune diffusion
6. ELISA
7. Production of antibodies (theory exercise)
8. Bleeding, separation of serum and storage
9. Lymphoid organs (theory exercise)
10. Isolation of plasmid DNA (alkaline lysis method)
11. Analysis of plasmid DNA by Agarose gel electrophoresis
12. Southern blotting (theory exercise)
13. PCR Amplification (theory exercise)

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MODEL QUESTION PAPER UG DEGREE EXAMINATIONS

Lab Time: 3 hours Max Marks: 50M

1. Write principle and procedure for isolation of plasmid DNA and carry out experiment 20M
2. Determination of blood groups 10M
3. Identify the spotters 5 x2 =10M 1) Lymhoid organs 2) Cosmids

 3) ELISA

 4) BLA ST

 5)RIA

1. Record 5M
2. Viva-voce 5M

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**Aim and objectives of Course:**

The objectives of this course are to introduce students to the principles, practices and application of animal biotechnology, plant tissue culture, plant and animal genomics, genetic transformation.

 **Learning outcomes of Course**:

 Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications

**UNIT I**

**Plant tissue culture techniques & secondary metabolites production**

 Plant tissue culture: totipotency, media preparation – nutrients and plant hormones; sterilization techniques; establishment of cultures – callus culture, cell suspension culture, applications of tissue culture-micro propagation; Somatic embryogenesis; synthetic seed production; protoplast culture and somatic hybridization - applications. Cryopreservation,

 **UNIT II**

**Transgenesis and Molecular markers**

Plant transformation technology-- Agrobacterium mediated Gene transfer (Ti plasmid), Transgenic plants as bioreactors. Herbicide resistance –glyphosphate, Insect resistance- Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting-principles and applications.

 **UNIT III**

**Animal tissue culture techniques**

Animal cell culture: cell culture media and reagents; culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines; Tests: cell viability and cytotoxicity, Cryopreservation. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

**UNIT IV**

**Transgenic animals & Gene Therapy**

Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin,somatostatin, vaccines),IVF, Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -Ethical issues in animal biotechnology.

**UNIT V**

 **Bioethics, Biosafety and IPR**

Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare. Bio safety-introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; Introduction to IP-Types of IP: patents, trademarks & copyright.

**Additional Inputs**

* Phytohormones

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|  | **ESSAY QUESTIONS**  | **SHORT ANSWER QUESTIONS** |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **2** |
| **UNIT -V** | **2** | **1** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M**

1. Micro propagation 2. Cryopreservation 3. RAPD 4. Ti-Plasmid 5. Somatic embryogenesis 6. Cell lines 7. IVF 8. Animal rights

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary each question carries 10 marks.**

 **5 X 10M = 50M**

**SECTION – B**

9. What are metabolites and explain different plant secondary metabolites 10. Explain the herbicide and insecticide resistance in transgenesis process 11. What are cell cultures and explain different types of cell cultures 12. Write a note on transgenic animals with merits and demerits 13. Explain about human and animal experimentation

**SECTION – C**

14. Explain different types of cultures. 15. What are transgenic plants? Write a note on transgenic plants as bioreactors 16. What is transfection and explain different methods of transfection 17. Write about recombinant DNA products in medicine 18. Explain about biosafety and different levels in biosafety.

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List of Practical's:

1. plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants, cytology of callus
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. suspension cell culture
7. Cell count by hemocytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Animal tissue culture – maintenance of established cell lines.
10. Animal tissue culture – virus cultivation.
11. Estimation of cell viability by dye exclusion (Trypan blue).
12. ELISA – Demonstration

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MODEL QUESTION PAPER UG DEGREE EXAMINATIONS

Lab Time: 3 hours Max Marks: 50M

1. Write procedure for process of callus induction from different explants 20M
2. Suspension cultures 10M
3. Spotters 2 x 5 = 10M 1) RFLP 2) Bt-Cotton 3) Bioreactor 4) Plasmid 5) Chick embryo fibroblast
4. Record 5M
5. Viva 5M

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**Aim and objectives of Course:**

This course aims to introduce fundamentals of Environmental Biotechnology. The course will also give an insight in introducing major groups of microorganisms and their industrial applications.

 **Learning outcomes of Course:**

 Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications.

**UNIT I**

**Pollution Types and Control**

Environmental Biotechnology-Environmental Pollution: Types of pollution, Biofilters, Bioscrubbers, Biotrickling filter. Water pollution and its management: Measurement of water, pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

**UNIT II**

 **Bioremediation**

Biodegradation and Bioremediation – Concepts & principles of Bioremediation, Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism. Role of genetically Engineered microbes, Concept of Phytoremediation, environmental safety guidelines.

**UNIT III**

 **Biofuels**

Biofuels-biogas, microbial groups involved in biogas production & interactions, factors affecting biogas production, Biofertilizers, Vermiculture.

**UNIT IV**

**Basic principles of Microbial technology**

 Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Strain Improvement, Basic concepts of fermentation; Design of Fermenter and applications.

**UNIT V**

Commercial Production of Microbial products: Microbial technology products and applications; Microbial production of Organic acids (Lactic acid), Amino acids (Glutamicacid). Fermentation by microbes for food additives: dairy products (Cheese), beverages (Beer) and antibiotics (Streptomycin, Pencillin)

**Additional inputs**

* Down steam processing
* Food additives

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **2** |
| **UNIT -III** | **2** | **1** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M**

1. Air pollution 2. Oxidation ponds 3. Hydro carbons applications 4. Phytoremediation 5. Biofertilizers 6. Vermiculture 7. Fermenter applications 8. Streptomycin

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Explain the microbiology of waste water treatment 10. Explain biodegradation and bioremediation processes 11. Write about biogas production 12. Explain about preservation of industrial microbial cultures 13. Explain about microbial production of organic acids

**SECTION – C**

14. Explain about Biofertilizers and their application 15 Write about role of genetically engineered microbes 16. Write about factors affecting biogas production 17. Explain design and process of fermentation with an example 18.What are food additives and explain the process of fermentation for food additives.

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**List of Practical's**

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of industrially important microorganisms from soil.
8. Isolation of amylase producing organisms from soil.
9. Production of α – amylase from Bacillus Spp. by shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Production of citric acid by submerged fermentation
12. Estimation of citric acid by titrimetry

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MODEL QUESTION PAPER UG DEGREE EXAMINATIONS

Lab Time: 3 hours Max Marks: 50M

1. Write procedure for BOD determination and carryout experiment 20M
2. Write procedure for determination of hardness of water 10M
3. Spotters 2 x 5 = 10M Fermenter
4. Record 5M
5. Viva 5M

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 **GENETICS AND MOLECULAR BIOLOGY**

**UNIT I**

**Mendel’s Laws and Inheritance:** Mendel experiments, Mendel Laws and deviations: incomplete dominance and Co dominance Penetration and pleiotropism, Recessive and Dominant epistatic gene interactions. Concept of multiple alleles

**UNIT II**

**Genes and their variations:** Structure of gene, gene and environment, gene copies and heterogeneity. Non disjunction of chromosomes, linkages, recombination, test cross and back cross, interference and coincidence, sex determination, Hardy Weinberg equations.

**Unit III**

**Genome Structure:** Watson and Crick model of DNA; Genome size. Concepts of Genetic Material, Gene, Chromosome and Genome. Experiments to prove DNA as genetic material (Griffith experiment, Hershey- Chase experiment)

**Unit** **IV**

**DNA** **Replication**:Enzymology of replication (DNA polymerase I, pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase. Proof of semi conservative replication, Replication origins, initiation, elongation, and termination. Rolling circle replication of DNA.

**Unit V**

**Transcription:** Enzymatic synthesis of RNA: Basic features of transcription, structure of prokaryotic RNA polymerase (core enzyme and holo enzyme, sigma factor), concept of promoter (Pribnow box, -10 and -35 sequences), four steps of transcription (promoter binding and activation, RNA chain initiation, chain elongation, termination and release). Reverse transcription.

**BLUE PRINT**

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **2** |
| **UNIT -III** | **2** | **1** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**Section – A**

**I. Answer any FIVE of the following questions. 5 X 5 = 25 M**

1. Test cross and back cross
2. Co-dominance
3. Law of purity of gametes
4. Hardy Weinberg equations
5. Chromosomes
6. Topoismoerases
7. Replication origin
8. Reverse transcription

 **II. answer any FIVE questions choosing atleast TWO from each section B and C**

  **5 X 10 = 50M**

**Section – B**

1. Describe Mendel’s laws of inheritance
2. What are linkages? Explain the types of linkages
3. Describe the Hershey – Chase Experiment
4. Explain the Enzymology of replication
5. Describe Enzymes involved in transcription and process of transcription

 **Section – C**

1. Describe Recessive and Dominant epistatic gene interaction.
2. Explain sex determination with examples
3. Write an essay on Watson and crick model of DNA
4. Describe process of replication. Proof of semi conservative method of replication
5. Describe the concept of Promoter

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**GENE EXPRESSION AND rDNA TECHNOLOGY**

**UNIT I**

**Genetic Code**

Genetic code: codon and its characteristics, identification of start and stop codons, universality, degeneracy and commaless nature of codons. The decoding system: aminoacyl synthetases.the adaptor hypothesis, attachment of amino acids to Trna Codon – anticodon interaction – the wobble hypothesis. Selection of initiation codon – Shine and Dalgarno sequence

**UNIT II**

**Protein Synthesis**

Initiation, elongation, termination and post translational modification. Regulation of translation: phage T4 protein p32 translational regulation

**UNIT III**

**Gene Expression and regulation**

Regulation of gene expression: clustered genes and the operon concepts – negative and positive control of the lac operon, trp operon, and control of gene expression.

**UNIT IV**

**rDNA Technology**

DNA Cloning: Basics of genetic engineering, restriction endonulceases Vectors: plasmid vectors (pBR322 and pUC18)Phage vector: lambda replacement and insertion Vectors cosmids.phagemids and YACCutting and joining DNA (Cohesive end ligation, methods of blunt end ligation)Blotting techniques: Southern and Northern blotting

**UNIT V**

**Genomic DNA library and cDNA library**

Construction of genomic and cDNA libraries. Advantages and disadvantages of genomic and cDNA libraries. General consideration of Polymerase chain reaction, desgining of primers for PCR. Application of recombinant DNA technology.

**Blue Print**

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| Unit no | Essay Questions | Short Answer Questions |
| I | **2**  | **2** |
| II | **2**  | **2** |
| III | **2** | **1** |
| IV | **2**  | **1** |
| V | **2** | **2** |

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**GENE EXPRESSION AND rDNA TECHNOLOGY**

**List of Practical's**

1. Effect of UV radiation on the growth of micro organisms.
2. Isolation of plasmid DNA from bacteria
3. Purify analysis of the nucleic acids
4. Study of different phases of mitosis in onion root tips and meiosis in Alliumcepa and flower buds.
5. Karyptyping in Allium or Drosophila
6. Problems and assignments in Mendilian genetics
7. Isolation of auxotropic nutrants (plant or inscets)
8. Mutation of bacteria by U.V
9. Chemical induced mutation in bacteria.

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**Time: 3 Hrs Max Marks: 75M**

**Section – A**

**I. Answer any FIVE of the following questions. 5 X 5 = 25 M**

1. Characteristics of Codon
2. Wobble hypothesis
3. Initiation
4. YAC
5. Blunt ends
6. Vector
7. Genome
8. Primers

**Section – B**

**II. answer any FIVE questions choosing atleast TWO from each section B and C**

  **5 X 10 = 50M**

1. What is genetic code? Explain it.
2. Describe the Post translational modifications.
3. Describe the Lac Operon concept.
4. What is Blotting? Explain the Southern Blotting.
5. Explain the polymerase chain reaction.

 **Section – C**

1. Describe the Codon and Anticodon interaction and selection of Initiation codon
2. Describe the regulation of translation.
3. Describe the Eukaryotic gene regulation
4. Describe the different types of Cloning Vectors
5. What are the application of recombinant DNA technology

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**GENE EXPRESSION AND rDNA TECHNOLOGY**

**List of Practical's**

1. To measure concentration of DNA and RNA by UV Spectrophotometry.
2. Estimation of proteins by Bradford method.
3. Isolation of genomic DNA
4. Isolation of genomic RNA
5. Restriction digestion of DNA
6. Demonstration of replica plating technique
7. Identification of Lac +bacteria by blue white screening using IPTG

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**UNIT I**

**The Environment**: Physical environment;biotic environment; biotic and abiotic interactions. Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

**UNIT II**

**Population Ecology:** Characteristics of a population; population growth curves; population regulation;

**UNIT III**

**Community Ecology**: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

**UNIT IV**

**Species Interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

**UNIT V**

 **Ecosystem Ecology:** Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M** 1. Ecological Succession and Niche 2. Population growth curves 3. Edges and Ecotones 4. Symbiosis 5. Components of Ecosystem 6. Abiotic interaction 7. Definitions and examples of individual , population, community and habitat 8. Upright energy flow and inverted energy flow in eco system with examples

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Describe Abiotic and biotic Compenents of Environment and their interaction with plants 10. Describe Population and Characterstics of population 11. Describe Structure and attributes of community 12. Describe different types of species interactions and their effects 13. Describe different types of energy flow and Carbon cycling

**SECTION – C**

 14. Describe Niche and different types of Niche 15. Describe Population curve and its regulation 16. Describe succession mechanism and types 17. Describe Symbiosis and types of symbiotic relations with examples 18. . Describe different types of ecosystems with energy flow and examples

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**List of Practical's**

1. To determine basal cover of trees in a forest ecosystem/forest plantation.
2. Quantitative analysis of soil organic carbon.
3. Quantitative analysis of soil pH.
4. To study pore space, water holding capacity and bulk density of soil.
5. Identification of rocks and minerals on the basis of physical characters.

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**UNIT I**

**Principles & methods of taxonomy**: Concepts of species and hierarchical taxa, biological nomenclature, classical &quantititative methods of taxonomy of plants, animals and microorganisms.

**UNIT II**

**Levels of structural organization**:Unicellular, colonial and multicellular forms. Levels of organization of tissues,organs & systems. Comparative anatomy, adaptive radiation, adaptive modifications.

**UNIT III**

**Natural history of Indian subcontinent**: Major habitat types of the subcontinent, geographic origins and migrations of species.

**UNIT IV**

**Organisms of health & agricultural importance**: Common parasites and pathogens of humans, domestic animals and crops.

**UNIT V**

**Organisms of conservation concern**: Rare, endangered species. Conservation strategies.

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M** 1. Hierarchial taxa 2. Adaptive radiation 3. Circadian rythms 4. Continental drift and gene pool 5. Two types symbiotic relation between plants and microbes with mechanism 6. Endangered, Rare and Extinct Species with example 7. Principles of taxonomy 8. Totipotency aneuploidy and polyploidy with examples

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Describe principles and methods of taxonomy 10. Describe multicellular forms of life 11. Describe circadian ryhtms behind migration of species with two elaborate examples 12. Describe importance of organisms in health and agriculture 13. Describe strategies for conservation of endangered species

**SECTION – C**

 14. Describe classical and quantitative methods of taxonomy in microbes 15 Describe comparative taxonomy with examples 16. Describe habitat and distribution of population in habitat 17. Describe common pathogens parasites of human and domestic animals with two elaborate examples 18. Describe different levels representing status of life forms with example

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**List of Practical's**

1. Identification of museum specimens of some economically important fishes.
2. Study of flora and fauna through charts and maps.
3. Preparation of field report based on the visit to a Wild Life Sanctuary/National Park/Zoo/Biosphere Reserve.
4. Preparation of field report based on the survey of local flora.
5. Study of centre of diversity of plants from maps.

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**UNIT I**

**Emergence of evolutionary thoughtsLamarck**; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; The evolutionary synthesis.

**UNIT II**

**Origin of cells and unicellular evolution**:Origin of basic biological molecules; Concept of Oparin and Haldane; Experiement of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

**UNIT III**

**Molecular Evolution**:Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification

**UNIT IV**

**The Mechanism:Population genetics**- Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift

**UNIT V**

**Adaptive radiation**; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

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|  | **ESSAY QUESTIONS** | **SHORTS ANSWER QUESTIONS**  |
| **UNIT -I** | **2** | **2** |
| **UNIT -II** | **2** | **1** |
| **UNIT -III** | **2** | **2** |
| **UNIT -IV** | **2** | **1** |
| **UNIT -V** | **2** | **2** |

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**Time: 3 Hrs Max Marks: 75M**

**SECTION – A**

**Answer any 5 questions. Each question carries 5 marks. 5 X 5M = 25M** 1. Darwins concept of evolution 2.Putrefaction 3. Neutral evolution 4. Hardy – Weinberg law 5. Allopatricity and sympatricity 6. UPGMA 7. Gene frequency and allelic frequency with example 8. Graphical representation of r-selection and k-selection

**Answer any FIVE of the following questions atleast TWO form each section B & C Draw a labeled diagrams wherever necessary. Each question carries 10 marks.**

**5 X 10M = 50M**

**SECTION – B**

9. Describe Mendelian principles of Evolution 10. Describe Anaerobic metabolism in prokaryotes 11. Describe molecular divergence and molecular clocks with mechanism 12 Describe concepts and rate of change in gene frequency through natural selection 13. Describe Speciation and types of speciation

**SECTION – C**

 14. Describe Spontaneity of mutation and natural mutation with examples 15. Describe concept of Operin and Haldane concept of Evolution with Muller’s experiment 16. Describe molecular phylogeny and different types of phylogeny concepts 17. Describe Hardy – Weinberg law with elaboration of equation 18. Describe r –selection and k- selection

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 **Practical**

1. Give detailed description of different symbolic representation of Pedigree analysis
2. Give diagrammatic representation of X-linked recessive trait
3. In a plant species the ability to grow in soil contaminated with nickel is determined by a dominant allele. i. If 60% of the seeds in a randomly mating population are able to germinate in contaminated soil, what is the frequency of the resistance allele? ii. Among the plants that germinate, that proportion is homozygous?
4. αβγ is an autosomal recessive disorder of man. The frequency of effected newborn infants is about 1 in 14000. Assuming random mating, what is the frequency of heterozygotes?
5. DNA isolation and Polymerize chain reaction of the DNA
6. Agarose gel electrophoresis of the amplified solution and check the amplified bands in UV transilluminator/UV Gel documentation.

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Lab Time: 3 hours Max Marks: 100M

 Thesis Submission (Quality of work) – 25M

 Result – 25 M

 Power point presentation – 25 M

 Viva – 25 M

Should submit Thesis copy and power point presentation handouts hard copy to the Examiner.