

Choice based Credit System (CBCS)
For
B.Sc., (Biotechnology)
(Undergraduate Programme)
(Effective from the Academic Year 2020-21)



Department of Biotechnology
Sri Y N College (Autonomous)
Narsapur, Andhra Pradesh

DETAILS OF PAPER TITLES & CREDITS

| Sem | Course no. | Course Name | Course type (T/L/ P) | Hrs./ Week: Science:4+2 | Credits : Science:4+1 | Max. Marks Cont/Internal/Mid Assessment | Max.Marks Sem-end Exam |
|-----|------------|--|----------------------|-------------------------|-----------------------|---|------------------------|
| I | 1 | Bio-molecules & Analytical Techniques | T | 4 | 4 | 25 | 75 |
| | | Bio-molecules & Analytical Techniques Lab | L | 2 | 1 | - | 50 |
| II | 2 | Microbiology, Cell and Molecular Biology | T | 4 | 4 | 25 | 75 |
| | | Microbiology, Cell and Molecular Biology Lab | L | 2 | 1 | - | 50 |
| III | 3 | Immunology and rDNA technology | T | 4 | 4 | 25 | 75 |
| | | Immunology and rDNA technology Lab | L | 2 | 1 | - | 50 |
| IV | 4 | Plant and Animal Biotechnology | T | 4 | 4 | 25 | 75 |
| | | Plant and Animal Biotechnology Lab | L | 2 | 1 | - | 50 |
| | 5 | Environmental & Industrial Biotechnology | T | 4 | 4 | 25 | 75 |
| | | Environmental & Industrial Biotechnology Lab | L | 2 | 1 | - | 50 |

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

Instruments/Software/ Computers

| Sem. No. | Lab/Practical Name | Names of Instruments/Software/ computers required with specifications | Brand Name | Qty Required |
|----------|--|---|-------------------------------|--------------|
| 1 | Bio-molecules& Analytical TechniquesLab | Photo Colorimeter, UV VIS Spectrophotometer, PH meter, Double Distillation unit | Elico/ Equiptronics | 2 |
| 2 | Microbiology, Cell and Molecular Biology Lab | Autoclave, Compound microscope, Gel Electrophoresis, PCR Machine, Gel Doc | Olympus microscope, BioradPCR | 1 |
| 3 | Immunologyand rDNA technologyLab | ELISA Kit, Water bath, Ice making machine, | Thermo | 1 |
| 4 | Plant and Animal Biotechnology | Lab Centrifuge, PCR Machine | Systronics | 1 |
| 5 | Environmental& Industrial BiotechnologyLab | Lab fermenter | Steri Fermenter | 1 |

Govt/Pvt organizations Suitable levels of positions for these graduates either in industry/govt organization like. Technical assistants/ scientists.

| S.No | Position | Company/ Govt organization | Remarks | Additional skills required, if any |
|------|---|--|---------|--|
| 1 | Project Assistant | CSIR Institutes/ other central and State Research laboratories | none | Job training/ certificate program/ apprentice |
| 2 | Trainee/Apprentice/Skilled Assistant/ Field Assistants | State/ Central Agricultural Research laboratories; Pharma/ Biotech | none | Certificate course |

Govt. organizations / Pvt Companies for employment opportunities or internships or projects

| S.No | Company/ Govt organization | Position type | Level of Position | | | |
|------|----------------------------|---|-------------------|--|--|--|
| 1 | Pharma/Biotech companies | Research Assistant | - | | | |
| 2 | ICAR/CSIR institutes | Scientific Assistant/ Junior Scientist | - | | | |



SRI Y.N COLLEGE(AUTONOMOUS) NARSAPUR

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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 biomolecular 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

| | 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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I B.Sc BIOTECHNOLOGY
FRISRT SEMESTER – PAPER- I
BIOMOLECULES & ANALYTICAL TECHNIQUES

Time: 3 Hrs

Max Marks: 75M

SECTION – A

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

1. Denaturation and Renaturation of Proteins.
2. Structure and functions of cholesterol.
3. Types of centrifugations.
4. Factors affecting electrophoretic migration.
5. Beer-Lambert's law.
6. Extinction coefficient.
7. Vitamin E
8. Gel permeation

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

5 X 10M = 50M

SECTION – B

9. Write about classification, structure and properties of amino acids
10. Explain biological role and deficiency manifestations of vitamin – A, B, C, D, E, K
11. Explain gel filtration chromatographic technique
12. Describe the basic principles and types of electrophoresis
13. Explain ANOVA

SECTION – C

14. Write about structure and classification of saturated and unsaturated fatty acids
15. Explain Glycolysis process with a flow chart
16. Explain about UV VIS spectrophotometer
17. Explain the measurements of radioactivity
18. Define mean, median and mode with examples

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I B.Sc; BIOTECHNOLOGY
FRIST SEMESTER – PRACTICAL PAPER - I
BIOMOLECULES & ANALYTICAL TECHNIQUES

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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I B.Sc; BIOTECHNOLOGY
FRIST SEMESTER – PRACTICAL PAPER - I
BIOMOLECULES & ANALYTICAL TECHNIQUES LAB
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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I B.Sc; BIOTECHNOLOGY
SECOND SEMESTER – PAPER - II
MICROBIOLOGY , CELL AND MOLECULAR BIOLOGY

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

| | 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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II B.Sc BIOTECHNOLOGY
SECOND SEMESTER –PAPER- II
MICROBIOLOGY , CELL AND MOLECULAR BIOLOGY

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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SECOND SEMESTER – PRACTICAL PAPER - II
MICROBIOLOGY , CELL AND MOLECULAR BIOLOGY

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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SECOND SEMESTER – PRACTICAL PAPER - II
MICROBIOLOGY , CELL AND MOLECULAR BIOLOGY LAB
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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II B.Sc; BIOTECHNOLOGY
THIRD SEMESTER – PAPER - III
IMMUNOLOGY AND r DNA TECHNOLOGY

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).

BLUE PRINT

| | 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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II B.Sc BIOTECHNOLOGY
THIRD SEMESTER – PAPER- III
IMMUNOLOGY AND r DNA TECHNOLOGY

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 from 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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II B.Sc; BIOTECHNOLOGY
THIRD SEMESTER – PAPER - III
IMMUNOLOGY AND r DNA TECHNOLOGY

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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II B.Sc; BIOTECHNOLOGY
THIRD SEMESTER – PRACTICAL PAPER - III
IMMUNOLOGY AND r DNA TECHNOLOGY LAB

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) Lymphoid organs
 - 2) Cosmids
 - 3) ELISA
 - 4) BLA ST
 - 5)RIA
4. Record 5M
5. Viva-voce 5M

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II B.Sc BIOTECHNOLOGY
FOURTH SEMESTER – PAPER - IV
PLANT AND ANIMAL BIOTECHNOLOGY

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

BLUE PRINT

| | 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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II B.Sc BIOTECHNOLOGY
FOURTH SEMESTER – PAPER - IV
PLANT AND ANIMAL BIOTECHNOLOGY

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 from 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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FOURTH SEMESTER – PAPER - IV
PLANT AND ANIMAL BIOTECHNOLOGY LAB

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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II B.Sc; BIOTECHNOLOGY
FOURTH SEMESTER – PRACTICAL PAPER - IV
PLANT AND ANIMAL BIOTECHNOLOGY LAB

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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II B.Sc; BIOTECHNOLOGY
FOURTH SEMESTER – PAPER - V
ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY

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 (Glutamic acid). Fermentation by microbes for food additives: dairy products (Cheese), beverages (Beer) and antibiotics (Streptomycin, Penicillin)

Additional inputs

- Down stream processing
- Food additives

BLUE PRINT

| | 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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Thrice Accredited by NAAC at 'A' Grade with a CGPA of 3.40
Recognized by UGC as 'College with Potential for Excellence'

II B.Sc BIOTECHNOLOGY
FOURTH SEMESTER – PAPER - V
ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY

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 from 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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II B.Sc; BIOTECHNOLOGY
FOURTH SEMESTER – PAPER - V
ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY

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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II B.Sc; BIOTECHNOLOGY
FOURTH SEMESTER – PRACTICAL PAPER - V
ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY LAB

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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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – – PAPER III (A)
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

| | 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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II B.Sc BIOTECHNOLOGY
FIFTH SEMESTER – PAPER - III (A)
Genetics and Molecular Biology

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. Topoisomerase
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

9. Describe Mendel's laws of inheritance
10. What are linkages? Explain the types of linkages
11. Describe the Hershey – Chase Experiment
12. Explain the Enzymology of replication
13. Describe Enzymes involved in transcription and process of transcription

Section – C

14. Describe Recessive and Dominant epistatic gene interaction.
15. Explain sex determination with examples
16. Write an essay on Watson and crick model of DNA
17. Describe process of replication. Proof of semi conservative method of replication
18. Describe the concept of Promoter

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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – – PAPER IV (A)
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 YAC Cutting 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, designing of primers for PCR. Application of recombinant DNA technology.

Blue Print

| 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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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PRACTICAL PAPER IV (A)
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. Karyotyping 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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II B.Sc BIOTECHNOLOGY
FIFTH SEMESTER – PAPER - IV (A)
GENE EXPRESSION AND rDNA TECHNOLOGY

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

9. What is genetic code? Explain it.
10. Describe the Post translational modifications.
11. Describe the Lac Operon concept.
12. What is Blotting? Explain the Southern Blotting.
13. Explain the polymerase chain reaction.

Section – C

14. Describe the Codon and Anticodon interaction and selection of Initiation codon
15. Describe the regulation of translation.
16. Describe the Eukaryotic gene regulation
17. Describe the different types of Cloning Vectors
18. What are the application of recombinant DNA technology

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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PRACTICAL PAPER IV (A)
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

Structure and Syllabus under CBCS

| | | | | | |
|---------------------|---|-----------------------|---|-----|----|
| III YEAR | * Any one Paper from VII A, B and C | VII (A)* | Developmental Biology | 100 | 03 |
| | | | Practical - VII A | 50 | 02 |
| | | VII (B)* | Ecology | 100 | 03 |
| | | | Practical - VII B | 50 | 02 |
| | | VII (C)* | Biostatistics, bioinformatics and IPRS | 100 | 03 |
| | | | Practical - VII C | 50 | 02 |
| | ** Any one cluster from VIII, A, B and C | VIII (A)** | Cluster Electives - I : | | |
| | | | VIII-A-1: Plant Physiology | 100 | 03 |
| | | | VIII-A-2: Animal Physiology | 100 | 03 |
| | | | VIII-A-3: Inheritance Biology | 100 | 03 |
| | | | Practical VIII A-I | 50 | 02 |
| | | | Practical VIII A-2 | 50 | 02 |
| | | | Practical VIII A-3 | 50 | 02 |
| | | VIII (B)** | Cluster Electives - II :: | | |
| | | | VIII-B-1: Diversity in Life | 100 | 03 |
| | | | VIII- B-2 :Evolution | 100 | 03 |
| | | | VIII-B-3 :Project | 100 | 03 |
| | | | Practical VIII B-I | 50 | 02 |
| | | | Practical VIII B-2 | 50 | 02 |
| | | | Viva-Voce VIII B-3 | 50 | 02 |
| | | VIII (C)** | Cluster Electives - III :: | | |
| | | | VIII-C-1: Plant Biotechnology and Animal Biotechnology | 100 | 03 |
| | | | VIII-C-2 :Environmental Biotechnology | 100 | 03 |
| | | | VIII-C-3 :Industrial Biotechnology | 100 | 03 |
| | | | Practical VIII C-I | 50 | 02 |
| | | | Practical VIII C-2 | 50 | 02 |
| | | | Practical VIII C-3 | 50 | 02 |

***Candidate has to choose only one paper**

**** Candidates are advised to choose Cluster (A) if they have chosen VII (A) and Choose Cluster (B) if they have chosen VII (B) etc. However, it is suggestive.**

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III B.Sc; BIOTECHNOLOGY
SIXTH SEMESTER – PAPER - VII
ECOLOGY

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).

BLUE PRINT

| | 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PAPER- VII
ECOLOGY

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 Components of Environment and their interaction with plants
10. Describe Population and Characteristics 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PRACTICAL PAPER- VII
ECOLOGY

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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III B.Sc; BIOTECHNOLOGY
SIXTH SEMESTER – PAPER – VIII CE-I
DIVERSITY IN LIFE

UNIT I

Principles & methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical & quantitative 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.

BLUE PRINT

| | 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PAPER- VIII CE.-I
DIVERSITY IN LIFE

Time: 3 Hrs

Max Marks: 75M

SECTION – A

Answer any 5 questions. Each question carries 5 marks.

5 X 5M = 25M

1. Hierarchical taxa
2. Adaptive radiation
3. Circadian rhythms
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 from 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 rhythms 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PRACTICAL PAPER- VIII C.E.-I
DIVERSITY IN LIFE

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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III B.Sc; BIOTECHNOLOGY
SIXTH SEMESTER – PAPER – VIII CE-II
EVOLUTION

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; Experiment 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.

BLUE PRINT

| | 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PAPER- VIII CE-II
EVOLUTION

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 from 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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III B.Sc BIOTECHNOLOGY
SIXTH SEMESTER – PRACTICAL PAPER- VIII CE.-II
EVOLUTION

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. $\alpha\beta\gamma$ 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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II B.Sc; BIOTECHNOLOGY
SIXTH SEMESTER – PAPER - VIII CE-III
PROJECT

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.