

Choice based Credit System (CBCS)
For
B.Sc., (Biotechnology)
(Undergraduate Programme)
(Effective from the Academic Year 2022-23)



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
V	6	Apiculture	T	4	4	25	75
		Apiculture Lab	L	2	1	-	50
		Pearl culture	T	4	2	25	75
		Pearl culture 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 Techniques Lab	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, Biorad PCR	1
3	Immunology and rDNA technology Lab	ELISA Kit, Water bath, Ice making machine,	Thermo	1
4	Plant and Animal Biotechnology	Lab Centrifuge, PCR Machine	Systronics	1
5	Environmental & Industrial Biotechnology Lab	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	-			



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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 biomolecules 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 form 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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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 gelelectrophoresis
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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II B.Sc BIOTECHNOLOGY
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, Pencillin)

Additional inputs

- Down stream 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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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 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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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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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



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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PAPER – VI
APICULTURE

Learning outcomes

Students after successful completion of the course will be able to

1. Understand the basic concepts of Apiculture.
2. Obtain the elementary knowledge of different species and races of honey bees
3. Appreciate the importance of health and hygiene in Bee keeping
4. Maintain the Bee hives in a scientific way

UNIT-I

Biology of Bees

History, Classification and Life Cycle of Honey Bees. Social Organization of Bee Colony.

UNIT -II

Rearing of Bees

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Methods of Extraction of Honey (Indigenous and Modern).

UNIT-III

Diseases and Enemies

Bee Diseases and Enemies. Control and Preventive measures.

UNIT- IV

Economy and Entrepreneurship

Products of Apiculture Industry and its Uses (Honey, Bee Wax, Propolis) and Pollen.



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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER - PAPER - VI
APICULTURE

Time: 3 Hrs

Max.Marks:75 M

SECTION-A

I. Answer any five questions. Each answer carries 5 marks 5 x 5=25 M

1. Apiculture
2. Drones
3. Langstroth
4. Modern bee keeping
5. Propolis
6. Bee wax
7. Role of bees in agriculture
8. Bee pollination

II. Answer any five of the following questions atleast Two from each section B & C. Draw a labeled diagrams wherever necessary. Each answer carries 10 marks. 5 X 10 = 50 M

SECTION-B

9. Write about history, classification and Life Cycle of Honey Bees?
10. What is apiary? Write about different types of beehives?
11. Write in detail about bee diseases, control and preventive measures?
12. Write about harvesting and processing of bee products?
13. Write about role of bees in cross pollination in horticulture and agriculture?

SECTION-C

14. Discuss in detail about Social Organization of Bee Colony?
15. Discuss about indigenous and modern methods of Extraction of Honey?
16. Write about Products of Apiculture Industry and their Uses?
17. Discuss about bee keeping industry: present and future.
18. Discuss about prospects of apiculture as self-employment venture?

APPROVED

Ch. Yaswanth.

3-9-2022

K. L. (ul) 3/9/22

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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PAPER – VI
APICULTURE

Skills Outcomes

On successful completion of this practical course, student shall be able to:
Maintain the Bee hives in a scientific way.

- ❖ Clean & Maintain Bee Boxes
- ❖ Use of other tools required in Bee Keeping
- ❖ Building and division of colony
- ❖ Understand the methodologies of extracting, preservation and marketing of honey and other products of honey bee

Practical Syllabus

1. Handling of tools and techniques for Apiculture
2. To study the morphological and anatomical characteristics of queen and worker bees
3. Identification of different species of honey bees
4. Preparation of honey bee trays for beekeeping, maintenance and colony inspection.
5. Extraction of honey and bee wax
6. Processing of honey, packing and storing.
7. Identification of honey adulteration.

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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PAPER – VII
PEARL CULTURE

Learning outcomes

Students after successful completion of the course will be able to

- ❖ Understand the basic concept of pearl culture.
- ❖ Obtain the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.
- ❖ Acquaint with the various types of implantation methods and pearl culture surgery techniques.
- ❖ Acquire skill on production of pearl and its marketing for economic gain.

UNIT- I

Overview of Pearl oyster

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

UNIT-II

Process of Pearl formation

Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

UNIT-III.

Pearl oyster culture

Pearl oyster culture Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters.

UNIT- IV

Pearl Oyster surgery

Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Postoperative culture, harvesting of pearl, clearing of pearl.

UNIT-V

Pearl culture Economy

Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.



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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER - PAPER - VII
PEARL CULTURE

Time: 3 Hrs

Max.Marks:75 M

SECTION-A

I. Answer any five questions. Each answer carries 5 marks 5 x 5=25 M

1. Pearl oyster
2. Mantle histology
3. Chemical composition of pearl
4. Artificial production of pearl
5. Rafts
6. Selection of oyster
7. Post operative culture
8. Diseases of pearl oysters

II. Answer any five of the following questions atleast Two from each section B & C. Draw a labeled diagrams wherever necessary. Each answer carries 10 marks. 5 X 10 = 50 M

SECTION-B

9. Write in detail about biology of pearl producing molluscs?
10. Discuss about natural process of pearl formation?
11. Discuss in detail about pearl oyster culture techniques?
12. Discuss in detail about various aspects of pearl oyster surgery?
13. Write in detail about diseases and predators of pearl oysters'?

SECTION-C

14. Write about life cycle of pearl oyster?
15. Write about economic importance of pearls?
16. Write about collection and rearing of oysters and also discuss about environmental parameters involved in pearl oyster culture?
17. Write in detail about harvesting and cleaning of pearls?
18. Discuss about present status, prospects and problems of pearl industry in India?

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K. f. *[Signature]*
CH. Yaswanth. 3/9/22
3-9-2022
Kishy 03/09/22

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III B.Sc; BIOTECHNOLOGY
FIFTH SEMESTER – PAPER – VII
PEARL CULTURE

Time: 3 Hrs

Max.Marks:75 M

Skills Outcomes

On successful completion of this practical course, student shall be able to

- ❖ Execute pre- pearl culture activities
- ❖ Learn the technique of surgical operation
- ❖ Develop skill of Post operation activities
- ❖ Implement culture activities
- ❖ Perform pearl harvesting.

Practical Syllabus

1. Technique for measurement of soil and water
2. Culture technique of microorganism for pond maintenance. Surgical techniques
3. Graft tissue preparation, implantation techniques, post operation care
4. Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls
5. Sorting of pearls, marketing of pearls.

APPROVED

C.A. Yaswanthi.

3-9-2022

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UNIT-V

Entrepreneurship in Apiculture

Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agriculture. Prospects of apiculture as self-employment venture.

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

APPROVED

C.H. Yaswanthi.
3-9-2022

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