PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS)

KAKINADA

DEPARTMENT OF BIOTECHNOLOGY

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 5 - PLANT AND ANIMAL BIOTECHNOLOGY

Theory Credits: 3 3 hrs/week

I.LEARNING OUTCOMES

On successful completion of the course, the students will be able to

- Learn about plant tissue culture techniques and secondary metabolites production.
- Learn about transgenesis and molecular markers.
- Learn about animal tissue culture techniques
- Learn about transgenic animals and gene therapy.
- Learn about Bioethics, Biosafety and IPR.

II.Syllabus

Unit – I - Plant tissue culture techniques & secondary metabolites production

1.1 Brief history of Plant-tissue culture, Terms used in tissue culture. Plant tissue culture media. Sterilization techniques. Callus culture

1.2 Applications of tissue culture-micro propagation; Somatic embryogenesis.

1.3 Synthetic seed production; protoplast culture and somatic hybridization. Cryopreservation, Plant secondary metabolites- concept and their importance

Unit – II - Transgenesis and Molecular markers

2.1 Plant transformation technology—Agrobacterium-mediated Gene transfer (Ti plasmid). Transgenic plants as bioreactors.

2.2 Herbicide resistance – glyphosate, Insect resistance- Bt cotton

2.3 Molecular markers - RAPD, RFLP, AFLP

Unit – III - Animal tissue culture techniques

3.1 Cell culture media and reagents; Culture of mammalian cells, tissues and organs; primary culture,secondary culture. Cell lines, stem cell cultures.

3.2 Tests: cell viability and cytotoxicity, Cryopreservation.

3.3 Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) andapplications.

Unit – IV - Transgenic animals & Gene Therapy

4.1 Production of vaccines and Insulin hormones IVF.

4.2 Concept of Gene therapy.

4.3 Concept of transgenic animals – Merits and demerits.

Unit V - Bioethics, Biosafety and IPR

5.1 Bioethics in cloning and stem cell research. Human and animal experimentation, animalrights/welfare.

5.2 Bio safety-introduction to biological safety cabinets; primary containment for biohazards;biosafety levels; GLP,GMP

5.3 Introduction to IP-Types of IP: patents, trademarks & copyright.

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 5 - PLANT AND ANIMAL BIOTECHNOLOGY

BLUE - PRINT

S.NO	UNIT	NO.OF ESSAY QUESTIONS (10M)	NO.OF SHORT ANSWER QUESTIONS (5M)	TOTAL
1	UNIT - I	1	2	20
2	UNIT - II	2	1	25
3	UNIT - III	1	2	20
4	UNIT - IV	1	1	15
5	UNIT - V	1	1	15
	TOTAL	6	7	95

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 5 - PLANT AND ANIMAL BIOTECHNOLOGY

Practical **Credits: 1** **2 hrs/week**

List of Practical: -

1. Plant culture media and composition of MS media
2. Induction of callus from different explants
3. Establishing a plant cell culture (both in solid and liquid media)
4. Suspension cell culture
5. Cell count by hemocytometer.
6. Establishing primary cell culture of chicken embryo fibroblasts.
7. Animal tissue culture – maintenance of established cell lines.
8. Estimation of cell viability by dye exclusion (Trypan blue).
9. ELISA – Demonstration

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II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 6 – MOLECULAR BIOLOGY

Theory | Credits: 3 | 3 hrs/week

I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about genome structure and organization.
2. Learn about mechanism and enzymes of DNA replication.
3. Learn about enzymatic synthesis and features of transcription.
4. Learn about regulation of gene expression.
5. Learn about genetic code and protein synthesis.

II. Syllabus

Unit I - Genome Structure

1.1 Concepts of Genetic Material, Gene, Chromosome and Genome.

1.2 Experiments to prove DNA as genetic material (Griffith experiment, Hershey-Chase experiment)

1.3 Genome organization with specific reference to prokaryoticand eukaryotic genomes; C-Value Paradox.

Unit II - DNA Replication

2.1 Models of DNA Replication. Proof of semiconservative replication.

2.2 Enzymology of replication (DNA polymerase I, polymerase II and III, helicases, topoisomerases,single strand binding proteins, DNA melting proteins, primase).

2.3 Mechanism of DNA replication in prokaryotes.

Unit III - Transcription:

3.1 Enzymatic synthesis of RNA: Basic features of transcription,

3.2 Structure of prokaryotic $R\overset{\sigma}{N}A$ polymerase (core enzyme and holo enzyme) Concept of promoter (Pribnow box, -10 and -35 sequences),

3.3 Four steps of transcription (promoter binding and activation, RNA chain initiation, chainelongation, termination and release). Reverse transcription

Unit IV - Gene Expression and regulation

4.1 Regulation of gene expression; Clustered genes. Poly and mono cistronic m-RNA

4.2 The operon concepts - Negative and positive control of the Lac Operon

4.3 trp operon.

Unit V - Genetic Code and Protein Synthesis

5.1 Genetic code: Features of genetic code

5.2 Structure of t RNA, Adaptor Hypothesis, Amino acid activation, Wobble hypothesis

5.3 Mechanism of protein synthesis.

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 6 – MOLECULAR BIOLOGY

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	TOTAL	6	7	95

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 6 – MOLECULAR BIOLOGY

Practical **Credits: 1** **2 hrs/week**

List of Practical's:

1. Effect of UV radiations on the growth of microorganisms.
2. Quantitative estimation of RNA
3. Quantitative estimation of DNA
4. Isolation of plasmid DNA from bacteria
5. Isolation of genomic DNA from *E.coli*
6. Isolation of DNA from plant leaves (Rice or Tobacco or any other plant)
7. Separation of DNA by Agarose gel Electrophoresis
8. Purity analysis of the Nucleic acids

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DEPARTMENT OF BIOTECHNOLOGY

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 7 – GENETIC ENGINEERING

Theory | Credits: 3 | 3 hrs/week

I. LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about the history and tools of genetic engineering
2. Learn about vectors used in genetic engineering
3. Learn about Hybridization techniques
4. Learn about vectors and their screening techniques
5. Learn about gene editing tools

II. Syllabus

UNIT - I

1.1 History, scope, and recent developments in Genetic Engineering.

1.2 Molecular tools in genetic engineering- Restriction enzymes: Endo & Exonucleases. Modifying enzymes

1.3 Ligation (cohesive & blunt end ligation) – linkers & adaptor.

UNIT-II

2.1 Cloning vectors - Plasmid (pUC19 & pBR322), λ - Phage vectors and cosmids.

2.2 Shuttle and expression vectors; YAC (S.cerevisiae as a model) & BAC (E.coli)

2.3 Screening and selection of recombinants.

UNIT-III

3.1 Hybridization techniques – Southern and Western blotting

3.2 Polymerase Chain Reaction (PCR) – Principle, Applications and types of PCR

3.3 Labeling of DNA- Nick translation. Random priming method & labeling by primer extension.

UNIT-IV

4.1 Construction of genomic & c DNA libraries.

4.2 Strategies of gene delivery – Non-Viral (Physical and Chemical methods)

4.3 Expression in insects, plant & mammalian cells

UNIT-V

5.1 Targeted gene replacement, Site directed mutagenesis.

5.2 DNA sequencing – Maxam Gilbert (chemical) & Sanger's, Nicolson sequencing.

5.3 Pyrosequencing. Human Genome Project.

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II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 7 – GENETIC ENGINEERING

Practical **Credits: 1** **2 hrs/week**

List of Practicals:

1. Problem in Genetic engineering.
2. Isolation of Plasmid DNA
3. Restriction digestion of DNA and its electrophoretic separation.
4. Ligation of DNA molecules and their testing using electrophoresis.
5. Transformation in Bacteria using plasmid
6. Activity of DNAase and RNAse on DNA and RNA.
7. Demonstration of PCR

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II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 8 – METABOLISM

Theory | Credits: 3 | 3 hrs/week

LEARNING OUTCOMES

On successful completion of the course, the students will be able to

1. Learn about Carbohydrate metabolism
2. Learn about Lipid metabolism
3. Learn about Amino Acid metabolism
4. Learn about nomenclature and specificity of enzymes
5. Learn about enzyme kinetics of enzyme

Syllabus

Unit I - Carbohydrate metabolism

1.1 Anabolism & catabolism , Photosynthesis – light and dark reactions. C3 cycle, C4 pathway.

1.2 Catabolism of Glucose – Glycolysis, TCA cycle and electron trasport

1.3 Gluconeogenesis, HMP stunt pathway ,

Unit II : lipids metabolism

2.1 Fatty acid biosynthesis.

2.2 β Oxidation of fatty acids

2.3 Cholesterol metabolism.

Unit III :Amino acid Metabolism

3.1 General reactions of amino acids, deamination, decarboxylation & transamination.

3.2 Urea cycle.

3.3 Inborn errors of aromatic and branched-chain amino acid metabolism.

UNIT IV - Enzymes:

4.1 Difference between chemical and biological catalyst, definitions of Holoenzyme apoenzyme and coenzyme

4.2 Classification and nomenclature of enzymes.

4.3 Enzyme specificity. Interaction between enzyme and substrate -lock and key and induced fit models.

UNIT – V Enzyme kinetics:

5.1 Factors affecting enzyme activity- substrate concentration, enzyme concentration, pH and temperature.

5.2 Enzyme inhibition kinetics -competitive, uncompetitive, and non-competitive

5.3 Immobilized enzymes and their applications

II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 8 – METABOLISM

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II B.Sc BIOTECHNOLOGY – III SEMESTER

PAPER – 8 – METABOLISM

Practical **Credits: 1** **2 hrs/week**

List of Practical's

1. Immobilization of enzymes / cells by entrapment in alginate gel
2. Assay of protease activity.
3. Preparation of starch from Potato and its hydrolysis by salivary amylase
4. Estimation of amino acids by ninhydrin method
5. Estimation of protein by Biuret method
6. Estimation of glucose by DNS method
7. Estimation of glucose by Benedicts method
8. Estimation of total carbohydrates by anthrone method