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|  | Pithapur Rajah's Government College (Autonomous) Kakinada | Program & Semester II B.Sc Semester -III | | | |
| CourseCode | Plant and Animal Biotechnology | | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites: | | 3 | 1 | - | 3 |

Course Objectives:

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.

Outcomes:

On Completion of the course, the students will be able to-

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| CO1 | Student can learn about plant tissue culture techniques and secondary metabolites production |
| CO2 | Course will provide knowledge on transgenesis and molecular markers. |
| CO3 | Understand about transgenic animals and gene therapy. |
| CO4 | Student can learn about Bioethics, Biosafety and IPR |

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| Skill Development | | Employability | | Entrepreneurship | |
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Syllabus:

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

- 1.1 Totipotency, media preparation – nutrients and plant hormones, Sterilization techniques. Establishment of cultures – callus culture, cell suspension culture.
- 1.2 Applications of tissue culture-micro propagation; Somatic embryogenesis.
- 1.3 Synthetic seed production; protoplast culture and somatic hybridization - applications.
- 1.4 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), Hairyroot features of Ri plasmid, Transgenic plants as bioreactors.
- 2.2 Herbicide resistance – glyphosate, Insect resistance- Bt cotton
- 2.3 Molecular markers - RAPD, RFLP
- 2.4 DNA fingerprinting-principles and applications.

Unit – III - Animal tissue culture techniques


- 3.1 Cell culture media and reagents;
- 3.2 Culture of mammalian cells, tissues and organs; primary culture,secondary culture. Cell lines, stem cell cultures.
- 3.3 Tests: cell viability and cytotoxicity, Cryopreservation.
- 3.4 Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

Unit – IV - Transgenic animals & Gene Therapy

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

Unit V - Bioethics, Biosafety and IPR

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

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|  | Pithapur Rajah's Government College (Autonomous) Kakinada | Program & Semester II B.Sc Semester -III | | | |
| CourseCode | PLANT AND ANIMAL BIOTECHNOLOGY | | | | |
| Teaching | Hours Allocated: 30 (Lab) | L | T | P | C |
| Pre-requisites: | | - | - | 2 | 1 |


Course 3: Plant and Animal Biotechnology Lab

Total Hours: 30

Credits: 1

List of Practical: -

1. Plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants
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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|  | Pithapur Rajah's Government College(Autonomous)Kakinada | Program &Semester II B.Sc Semester -III | | | |
| CourseCode | MOLECULAR BIOLOGY | | | | |
| Teaching | Hours Allocated: 60 (Theory) | L | T | P | C |
| Pre-requisites: | | 3 | - | - | 3 |

Outcomes:

On Completion of the course, the students will be able to-

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| CO1 | Learn about genome structure and organization. |
| CO2 | Learn about mechanism and enzymes of DNA replication. |
| CO3 | Learn about enzymatic synthesis and features of transcription. |
| CO4 | Learn about genetic code and protein synthesis |

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| SkillDevelopment | | | Employability | | | Entrepreneurship | |
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Unit I - Genome Structure

- 1.1 Watson and Crick model of DNA;
- 1.2 Genome organization with specific reference to prokaryotic and eukaryotic genomes; Genome size.
- 1.3 Concepts of Genetic Material, Gene, Chromosome and Genome.
- 1.4 Experiments to prove DNA as genetic material (Griffith experiment, Hershey-Chase experiment)

Unit II - DNA Replication

- 2.1 Enzymology of replication (DNA polymerase I, pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase).
- 2.2 Proof of semiconservative replication.
- 2.3 Replication origins.
- 2.4 Rolling circle replication of DNA.

Unit III - Transcription:


- 3.1 Enzymatic synthesis of RNA: Basic features of transcription,
- 3.2 Structure of prokaryotic RNA polymerase (core enzyme and holo enzyme)
- 3.3 Concept of promoter (Pribnow box, -10 and -35 sequences),
- 3.4 Four steps of transcription (promoter binding and activation, RNA chain initiation, chain elongation, termination and release). Reverse transcription.

Unit IV - Gene Expression and regulation

- 4.1 Regulation of gene expression; Clustered genes
- 4.2 The operon concepts - Negative and positive control of the Lac Operon
- 4.3 trp operon.
- 4.4 Control of gene expression. Poly and Mono cistronic m-RNA.

Unit V - Genetic Code and Protein Synthesis

- 5.1 Genetic code: Features of genetic code, Structure of m RNA,
- 5.2 Brief structure of tRNA,
- 5.3 The adaptor hypothesis, attachment of amino acids to tRNA.
- 5.4 Codon-anticodon interaction - the wobble hypothesis. Initiation, elongation, termination protein.

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| CourseCode | MOLECULAR BIOLOGY | | | | | |
| Teaching | Hours Allocated: 30 (Lab) | | L | T | P | C |
| Pre-requisites: | | | - | - | 2 | 1 |


Course 4:Molecular Biology Lab

Total Hours: 30

Credits: 1

List of Practical's:

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

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|  | Pithapur Rajah's Government College (Autonomous) Kakinada | | Program & Semester II B.Sc Semester -III | | | |
| CourseCode | GENETIC ENGINEERING | | | | | |
| Teaching | Hours Allocated: 60 (Theory) | | L | T | P | C |
| Pre-requisites: | | | 3 | - | - | 3 |

Outcomes:

On Completion of the course, the students will be able to-

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|-----|----------------------------------------------------------|
| CO1 | Learn about the history and tools of genetic engineering |
| CO2 | Learn about gene editing tools |
| CO3 | Learn about Hybridization techniques |
| CO4 | Learn about vectors and their screening techniques |

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|------------------|--|--|---------------|--|--|------------------|--|
| SkillDevelopment | | | Employability | | | Entrepreneurship | |
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Syllabus:

UNIT - I

- 1.1 Basics, history, scope, and recent developments in Genetic Engineering; guidelines;
- 1.2 Strategies in plant and animal genetic engineering.
- 1.3 Molecular tools in genetic engineering- Restriction enzymes: Endo & Exonucleases. Modifying enzymes
- 1.4 Ligation (cohesive & blunt end ligation) – linkers & adaptor.

UNIT-II

- 2.1 Cloning vectors: plasmid - definition, properties and types. pUC19 & pBR322
- 2.2 Phage vectors (λ & M13).
- 2.3 Cosmid vectors, Shuttle and expression vectors; YAC (*S.cerevisiae* as a model) & BAC (*E.coli*);
- 2.4 Screening and selection of recombinants; Gene transfer methods

UNIT-III

- 3.1 Hybridization techniques: Probes (radioactive & non-radioactive), detection.
- 3.2 Polymerase Chain Reaction (PCR) – Principle , Applications and types of PCR
- 3.3 Labeling of DNA- Nick translation.
- 3.4 Random priming method & labeling by primer extension.

UNIT-IV

- 4.1 Construction of genomic & c DNA libraries.
- 4.2 Vector engineering & codon optimization, strategies of gene delivery, invitro translation
- 4.3 Expression in bacteria, yeast, insects.
- 4.4 Expression in plant & mammalian cells

UNIT-V

- 5.1 Chromosome engineering, targeted gene replacement,
- 5.2 Gene editing, gene regulation & silencing. Site-directed mutagenesis.
- 5.3 DNA sequencing – Maxam Gilbert (chemical) & Sanger's, Nicolson sequencing,
- 5.4 Pyrosequencing. Gene therapy, Human Genome Project.



**Pithapur Rajah's Government
College(Autonomous)Kakinada**

**Program
&Semester
II B.Sc
Semester -III**

| | | | | | |
|-----------------|--------------------------------------|----------|----------|----------|----------|
| CourseCode | GENETIC ENGINEERING | | | | |
| Teaching | Hours Allocated: 30 (Lab) | L | T | P | C |
| Pre-requisites: | | - | - | 2 | 1 |

GENETIC ENGINEERING

Total Hours: 30

Credits: 1

List of Practicals:

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



Pithapur Rajah's Government College (Autonomous) Kakinada

Program
& Semester
III B.Sc
Semester -III

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|-----------------|---------------------------------|---|---|---|
| CourseCode | METABOLISM | | | |
| Teaching | Hours Allocated: 60 (Theory) | | | |
| Pre-requisites: | L | T | P | C |
| | 3 | - | - | 3 |

I. 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

II. Syllabus

Unit I - Carbohydrate metabolism

- 1.1 Anabolism & catabolism, Photosynthesis – light and dark reactions. C3 cycle, C4 pathway,
- 1.2 Glycolysis – formation of lactate and pyruvate, TCA cycle and its regulation
- 1.3 Gluconeogenesis, HMP shunt pathway,
- 1.4 Disorders of Carbohydrate metabolism- Diabetes mellitus

Unit II : lipids metabolism

- 1.1 Denovo synthesis of Fatty Acids.
- 1.2 Biosynthesis & degradation of TAG (Triacyl Glycerol).
- 1.3 Disorders of Lipid metabolism.
- 1.4 Biosynthesis of cholesterol, Ketogenesis

Unit III : Amino acid Metabolism

- 1.1 General reactions of amino acids, deamination, decarboxylation & transamination.
- 1.2 Urea cycle.
- 1.3 Biosynthesis of creatine
- 1.4 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 coenzyme
- 4.2 Classification and nomenclature of enzymes.
- 4.3 Enzyme specificity.
- 4.4 interaction between enzyme and substrate -lock and key and induced fit models.

UNIT – V Enzyme kinetics:

- 5.1 Michaelis-Menten equation.
- 5.2 Factors affecting enzyme activity- substrate concentration, enzyme concentration, pH and temperature.
- 5.3 Enzyme inhibition kinetics -competitive, uncompetitive, and non-competitive
- 5.4 Immobilized enzymes and their applications



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Semester -III**

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|-----------------|--------------------------------------|----------|----------|----------|----------|
| CourseCode | METABOLISM | | | | |
| Teaching | Hours Allocated: 60 (Lab) | L | T | P | C |
| Pre-requisites: | | - | - | 2 | 1 |

1. Immobilization of enzymes / cells by entrapment in alginate gel 19. Effect of temperature / pH on enzyme activity
2. Assay of protease activity.
3. Assay of alkaline phosphatase
4. Preparation of starch from Potato and its hydrolysis by salivary amylase
5. Isolation of urease and demonstration of its activity
6. Estimation of amino acids by ninhydrin method
7. Estimation of protein by Biuret method
8. Estimation of glucose by DNS method
9. Estimation of glucose by Benedicts titrimetric method
10. Estimation of total carbohydrates by anthrone method