

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE  
(AUTONOMOUS)  
NAAC A GRADE  
KAKINADA**



**XXII-BOARD OF STUDIES**

**DEPARTMENT OF  
BIOTECHNOLOGY**

**2022-23**

**(CHOICE BASED CREDIT SYSTEM)**

**P.R.GOV.T.COLLEGE (AUTONOMOUS) KAKINADA.**

**2022-23, XXII BOARD OF STUDIES MEETING.**

**DEPARTMENT OF BIOTECHNOLOGY**

-----  
The members present have discussed the syllabi and model question papers (Theory and Practical) related to I to VI semesters in Biotechnology and made the following Resolutions.

**Resolution I:** Resolved to Continue CBCS System as instructed by Commissioner of Collegiate Education( CCE ), Amaravati.

**Resolution II:** Resolved to continue 50% external and 50% internal marks for both theory and practical's for first year and second year for the academic year 2022- 23.

**Resolution III:** Resolved to split 50 marks of theory internal as 25 marks for mid exams and 25 marks for co-curricular activities (project / seminar / assignment / quiz / group discussion).

**Resolution IV:** Resolved to continue 60% external and 40% internal marks for both theory and practical's for final year for the academic year 2022-23.

**Resolution V:** Resolved to split 40 marks of theory internal as 20 marks for mid exams and 20 marks for co-curricular activities (seminar/assignment/quiz/group discussion).

**Resolution VI:** Resolved to implicate CSP (Community service project) by the end of I Year, second internship after second year and OJT in the sixth semester as prescribed by APSCHE.

**Resolution VII:** Resolved to adapt 7<sup>th</sup> hour time table as prescribed by the APCCE.

**Resolution VIII:** Resolved to follow the benchmark of 75% attendance to appear in the Examinations without the payment of fine.

**Resolution IX:** Resolve to adapt skill enhancement course – Elective papers 6A/7A or 6B/7B in the V semester.

**Resolution X:** Resolved to continue the same paper setters and examiners for all the semesters.

**Resolution XI:** Resolved to continue certificate course in diagnostics techniques and one Value added course by biotechnology department.

**Resolution XII:** Resolve to continue Remedial coaching for slow learners and Project for Advanced learners

**Chairperson  
Board of Studies**

**P.R. GOVERNMENT COLLEGE (AUTONOMOUS)  
KAKINADA  
DEPARTMENT OF BIOTECHNOLOGY**

XXII-BOARD OF STUDIES MEETING 2022- 23  
CHOICE BASED CREDIT SYSTEM

Time: 10.30 AM.

Date: 05.11.2022

Venue: Department of BIOTECHNOLOGY

The XXII BOARD OF STUDIES Meeting of the Department of Biotechnology took place 10.30 AM on 05.11.2022 in the Department of Biotechnology P.R. Govt. College, (A) Kakinada for the year 2022-23. The following members attended.

Sl No	Name and affiliation	Designation	Signature
01	Sri.G.P.Chakravarthi Lecturer in-charge Dept of Biotechnology P R College(Autonomous) KAKINADA.	Chairperson	G.P. Chakravarthi 5/11/22
02	Dr.B.Nageshwari Asst. Professor Dept. of Biotechnology Govt. Arts College (A) RAJAHMAHENDRAVARM	University Nominee	B. Nageshwari 5/11/22
03	Smt.D. Jayasree Asst. Professor A.S.D College for Women's KAKINADA	Subject Expert	D. Jayasree 5/11/22
04	Dr. A.Sreenivasulu Director V.S.Lakshmi Research Centre	Industrial nominee / Research expert	A. Sreenivasulu 5/11/22
05	P. Rajeswari Student Alumni	Student Alumni	P. Rajeswari
06	G.N.V.Satish Guest Lecturer	Member	G.N.V. Satish
07	S. Divya Mounika II B.Sc Biotechnology	Student Member	S.D. Mounika
08	M. Veera Kumar Reddy I B.Sc Biotechnology	Student Member	M. Veerakumar Reddy


**P.R.GOVERNMENT COLLEGE(A)**

**KAKINADA.**

**DEPARTMENT OF BIOTECHNOLOGY**

**ALLOCATION OF CREDITS**

S.No	Sem ester	Title of the course	Course type	Hrs/ Week	Max.Marks (SEE)	Marks in CIA	credit
1	I	<b>Paper – I</b> - Bio-molecules &Analytical Techniques	<b>Theory</b>	4	50	50	4
2		Bio-molecules &Analytical Techniques Lab	<b>Lab</b>	2	50	-	1
3	II	<b>Paper – II</b> - Microbiology, Cell and MolecularBiology	<b>Theory</b>	4	50	50	4
4		Microbiology, Cell and MolecularBiology Lab	<b>Lab</b>	2	50	-	1
5	III	<b>Paper – III</b> - Immunology and rDNA technology	<b>Theory</b>	4	50	50	4
6		Immunology and rDNA technology Lab	<b>Lab</b>	2	50	-	1
7	IV	<b>Paper – IV</b> - Plant and AnimalBiotechnology	<b>Theory</b>	3	50	50	4
8		Plant and AnimalBiotechnology Lab	<b>Lab</b>	2	50	-	1
9		<b>Paper – V</b> - Environmental &Industrial Biotechnology	<b>Theory</b>	3	50	50	4
10		Environmental &Industrial Biotechnology Lab	<b>Lab</b>	2	50	-	1
11	V	<b>Paper – 6A</b> - Techniques in Nursery Development	<b>Theory</b>	3	60	40	4
12		Techniques in Nursery Development Lab	<b>Lab</b>	2	35	15	1
13		<b>Paper – 7A</b> - Hydroponics Cultivation	<b>Theory</b>	3	60	40	4
14		Hydroponics Cultivation Lab	<b>Lab</b>	2	35	15	1
		<b>(Or)</b>					
15	V	<b>Paper – 6B</b> - Organic Farming	<b>Theory</b>	3	60	40	4
16		Organic farming Lab	<b>Lab</b>	2	35	15	1
17		<b>Paper – 7B</b> - Biofertilizers and Biopesticides production	<b>Theory</b>	3	60	40	4
18		Bio fertilizers and Bio pesticides Production Lab	<b>Lab</b>	2	35	15	1

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester I B.Sc Semester -I</b>			
CourseCode	<b>Bio-molecules &amp; Analytical Techniques</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	1	-	4

### Course Objectives:

To ensure students gain knowledge about the structure, properties and functions of bio molecules and characterization of biomolecular using analytical techniques

### Course Outcomes:

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

CO1	Impart complete knowledge about structure and function of different biomolecules (Proteins, lipids, nucleic acids, and carbohydrates) found in living cells.
CO2	Impart knowledge on enzyme activity.
CO3	Course will impart knowledge on the principle, working, maintain and calibrations of Bio analytical tools and techniques for industrial and research purpose.
CO4	Imparts knowledge on radioisotopes and their role in biology

SkillDevelopment			Employability			Entrepreneurship	
------------------	--	--	---------------	--	--	------------------	--

### Syllabus:

#### UNIT-I:

##### Scope of Biotechnology and Biomolecules

- 1.1 Scope of Biotechnology, Biotechnology as a branch of science and Opportunities.
- 1.2 Classification, structure, properties of carbohydrates.
- 1.3 Classification, structure and properties of amino acids. Peptide bond. Structure (primary, secondary, tertiary, quaternary) of proteins.
- 1.4 Denaturation and Renaturation of proteins.
- 1.5 Classification structure and properties of saturated and unsaturated fatty acids. Structure and functions of glycolipids, phospholipids, and cholesterol.

## **UNIT-II:**

### **Nucleic acid & Bioenergetics:**

- 2.1 Structure and functions of DNA and RNA
- 2.2 Watson Crick model of DNA.
- 2.3 Types of DNA
- 2.4 Free energy, entropy, enthalpy and redox potential
- 2.5 High energy compounds.

## **UNIT-III:**

### **Centrifugation and Chromatography:**

- 3.1 Basic principles of sedimentation – RCF, Types of rotors.
- 3.2 Types of centrifugation - differential and Density gradient Centrifugation.
- 3.3 Principle, instrumentation and application of partition, absorption chromatography
- 3.4 Paper chromatography, thin layer chromatography.
- 3.5 Ion exchange, gel permeation and affinity chromatography.

## **UNIT-IV:**

### **Spectroscopy and Electrophoresis**

- 4.1 Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric colorimeter. UV-visible spectrophotometer.
- 4.2 Basic principles and types of electrophoresis. Factors affecting electrophoretic migration.
- 4.3 PAGE (Native, SDS-PAGE)
- 4.4 Principles of microscopy, Electron microscopy - TEM, SEM
- 4.5 Introduction to radioisotopes, measurement of radioactivity - GM Counter

## **UNIT – V**

### **Biostatistics:**

- 5.1 Mean, median, mode.
- 5.2 Standard deviation.
- 5.3 ANOVA - One-way Anova.
- 5.4 F-test.
- 5.5 chi-square.

### Textbooks

1. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher: Horwood Pub. Co., England.
2. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath.

### Referencebooks:

1. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & MichaelCox; W.H. Freeman and Company, NYPrinciples of Biochemistry, 4th edition, (1997), Jeffory Zubey; McGraw-Hill College, USA
2. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
3. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY

### WebLinks:

### CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High];:No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	1	2	3	2	1	3	1	2
CO2	3	2	3	3	2	3	3	2	2	3	2	2
CO3	2	3	2	2	3	3	2	3	2	2	3	2
CO4	3	2	3	3	2	2	3	2	2	1	2	3

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-I**

**BIOMOLECULES AND ANALYTICAL TECHNIQUES**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Describe the Structure of proteins.
2. Explain the structure of DNA.
3. Explain the principle and procedure of paper chromatography.

**SECTION – B**

4. Explain the Mechanism of PAGE.
5. Explain the one-way ANOVA method.
6. Describe the process of differential centrifugation.


**PART – II**

**Answer any Four Questions from the following**

**4 X 5 = 20 Marks**

7. phospholipids
8. peptide bond
9. High energy compounds
10. RCF
11. Beer lambert law
12. Chi square test.



	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester I B.Sc Semester -I</b>			
CourseCode	<b>Bio-molecules &amp; Analytical Techniques</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1


### **Course 1: Bio-molecules & Analytical Techniques Lab**

**Total Hours: 30**

**Credits: 1**

Details of Lab/Practical/Experiments/Tutorials syllabus:

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.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester I B.Sc Semester -II</b>			
CourseCode	<b>Microbiology, Cell and Molecular Biology</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	1	-	4

### 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.

### Outcomes:

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

CO1	Explain relationship and apply appropriate terminology relating to the structure, Genetics, metabolism and ecology of prokaryotic microorganisms, Algae, viruses and Fungi.
CO2	Demonstrate appropriate laboratory skill and techniques related to isolation, staining, identification and control of microorganisms.
CO3	Course will impart knowledge on role of cell organelles, cell division and its regulation.
CO4	Imparts knowledge on mechanism of replication, transcription and translation.

SkillDevelopment		Employability		Entrepreneurship	
------------------	--	---------------	--	------------------	--

### Syllabus:

#### UNIT-I:

#### Scope and Techniques of Microbiology:

- 1.1 History and contribution of Leeuwenhoek, Louis Pasteur and Robert Koch.
- 1.2 Bacteria, Ultra structure of a bacterial cell and growth curve.
- 1.3 Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration),
- 1.4 Chemical methods of sterilization and radiation methods.
- 1.5 Staining- Simple, gram and acid-fast staining.

## **UNIT-II:**

### **Microbial Taxonomy and Metabolism:**

- 2.1 Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment.
- 2.2 General characteristics of viruses.
- 2.3 Structure of TMV and HIV.
- 2.4 Structure, infection, diagnosis and treatment of and SARS- CoV
- 2.5 Introduction to fungi,algae and Mycoplasma

## **UNIT-III:**

### **Cell Biology:**

- 3.1 Differentiation between plant and animal cell.
- 3.2 Chemical composition and dynamic nature of the membrane.
- 3.3 Structure, properties and functions of cellular organelles (E.R, Golgibodies, Mitochondria, Ribosomes and Vacuoles) of eukaryotic cells.
- 3.4 Cell cycle and cell division (mitosis and meiosis).
- 3.5 Cell signaling via G- protein coupled receptors.

## **UNIT-IV:**

### **DNA Replication, Damage and Repair:**

- 4.1 Genome organization of prokaryotic organisms.
- 4.2 DNA replication in prokaryotes (semiconservative, dispersive, conservative, uni and bi-direction, rolling circle).
- 4.3 Enzymes and Proteins involved in DNA replication.
- 4.4 Mechanism of DNA replication,
- 4.5 DNA damage and repair.

## **UNIT – V**

### **Transcription and Translationin prokaryotes:**

- 5.1 Promoters and structure of RNA Polymerase.
- 5.2 Mechanism of Transcription in prokaryotes.
- 5.3 Genetic code, Activation of tRNA.
- 5.4 Mechanism of translation in prokaryotes.
- 5.5 Regulation of gene expressionwith reference to Lac operon.

## Textbooks

1. Textbook of Microbiology, Anantnarayan and Paniker (2017)
2. Molecular Biology, 5th Edition, (2011), Weaver R.; McGraw Hill Science. USA.
3. George M. Malacinski. 2013. Freifeder's Essentials of Molecular Biology. Narosa Publishing House.

## Referencebooks:

1. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc.USA
2. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.; Cold Spring Harbour Lab. Press, Pearson Pub.
3. The Cell: A Molecular Approach. 5th edition. Cooper, G.M. and Hausman, R.E. 2009. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

## Weblinks

### CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High] :No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	3	3	3	3	2	2	2
CO2	3	2	3	2	3	1	3	3	3	2	2	2
CO3	1	2	3	2	3	2	3	3	3	1	2	1
CO4	2	3	3	2	2	2	3	2	2	2	2	1

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-II**

**MICROBIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Describe the ultra-structure of a prokaryotic cell with a neat labelled diagram.
2. Explain the structure and infection of SARS-CoV 2.
3. Explain the structure and function of Mitochondria

**SECTION – B**


4. Explain the Enzymology of DNA Replication.
5. Describe the process of Transcription in Prokaryotes.
6. Explain the Post Transcriptional modifications.

**PART – II**

**Answer any Four Questions from the following**

**4 X 5 = 20 Marks**

7. Grams Staining
8. HIV
9. GPCRs
10. Rolling Circle model of DNA Replication
11. Wobble hypothesis
12. Cell Cycle Check points

	<b>Pithapur Rajah's Government College(Autonomous)Kakinada</b>	<b>Program &amp;Semester I B.Sc Semester -II</b>			
CourseCode	<b>Microbiology, Cell and Molecular Biology</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	3	1


### **Course 2: Microbiology, Cell and Molecular Biology Lab**

Total Hours: 30

Credits: 1

List of Practical's:-

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

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -III</b>			
Course Code	<b>IMMUNOLOGY AND rDNA TECHNOLOGY</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	1	-	4

### 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-

CO1	The course will provide an insight into basic aspects of immunology and rDNA technology.
CO2	Course will provide sound knowledge of how immune system deals with various pathogens, different processes and cell types involved in prevention of disease.
CO3	Understand the mechanism of action and the use of restriction enzymes in biotechnology research and recombinant protein production.
CO4	Explain the steps of a bacterial transformation and various selection processes for identifying transformants

Skill Development			Employability			Entrepreneurship	
-------------------	--	--	---------------	--	--	------------------	--

### Syllabus:

#### UNIT-I:

#### Cells and Organs of the Immune System:

- 1.1 Hematopoiesis, Types of Immunity.
- 1.2 Cells and organs of the immune system.
- 1.3 Antigen, Hapten, Role and properties of adjuvants.
- 1.4 Structure and types of Antibody. Introduction to complement components.
- 1.5 Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA.

## **UNIT-II:**

### **Hybridoma technology, Hypersensitivity and Vaccines:**

- 2.1 MHC: Types.
- 2.2 Hybridoma technology.
- 2.3 Monoclonal antibodies and their application.
- 2.4 Introduction to Hypersensitivity and auto immunity,
- 2.5 Vaccines - Live, killed, attenuated, subunit and recombinant vaccines

## **UNIT-III:**

### **Tools and Techniques of rDNA Technology:**

- 3.1 Introduction to rDNA technology, Steps involved in cloning
- 3.2 Tools of genetic engineering (Enzymes – restriction endonucleases and DNA Ligase, Hosts bacteria and yeast Genes,
- 3.3 Cloning vectors - plasmids and Cosmids,.
- 3.4 Methods of transformation, recombinant selection and screening methods – Blue-White Screening
- 3.5 Construction of Genomic and cDNA libraries.

## **UNIT-IV:**

### **Cloning Strategies and Application of rDNA Technology:**

- 4.1 Principles and application of PCR.
- 4.2 Blotting techniques - Southern Blotting,
- 4.3 Northern and Western Blotting.
- 4.4 Introduction to DNA sequencing (Sanger Sequencing).
- 4.5 DNA fingerprinting.

## **UNIT – V**

### **Bioinformatics:**

- 5.1 Nucleotide and protein Databases (PubMed, NCBI, EMBL and ExPASy)
- 5.2 BLAST
- 5.3 FASTA.
- 5.4 Phylogenetic tree construction.
- 5.5 Introduction to omics (proteomics, genomics and transcriptomics)



## Textbooks

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House
3. Molecular Biology - 4 th Edition, 2008, By D. Freifelder, Publ: Narosa Publishinghouse New York, Delhi

## Referencebooks:

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

## Weblinks

## CO-PO Mapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High];:No Correlation]

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2	3	3	3	2	1	2	1	3
CO2	3	2	3	3	2	3	2	2	1	2	1	3
CO3	3	2	2	2	3	3	3	1	2	2	1	3
CO4	2	3	2	3	2	2	2	1	3	3	1	3

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-III**

**IMMUNOLOGY & rDNA TECHNOLOGY**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Describe the types of immunity.
2. Explain the production of monoclonal antibodies.
3. Explain the procedure of gene cloning.


**SECTION – B**

4. Explain the principle and application of PCR.
5. Write an essay on different types of databases
6. Describe the structure of an antibody molecule with a neat labelled diagram.

**PART – II**

**Answer any Four Questions from the following 4 X 5 = 20 Marks**

7. Antigens
8. Type I Hypersensitivity
9. Plasmids
10. Sanger sequencing
11. BLAST
12. Restriction enzymes.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -III</b>			
CourseCode	IMMUNOLOGY AND rDNA TECHNOLOGY				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1


### Course 3: Immunology and rDNA technology Lab

Total Hours: 30

Credits: 1

List of Practical: -

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ouchterlony 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)

	<b>Pithapur Rajah's Government College(Autonomous)Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -IV</b>			
CourseCode	<b>PLANT AND ANIMAL BIOTECHNOLOGY</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	-	-	4

### Course Objectives:

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

### Outcomes:

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

CO1	Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications
CO2	The course will provide complete exposure as how plant and animal cells are isolated, cultured and genetically manipulated in laboratory.
CO3	Understand the mechanism of different gene transfer methods in plants and animals.
CO4	Understand the applications of Transgenic plants and animals.

SkillDevelopment			Employability			Entrepreneurship	
------------------	--	--	---------------	--	--	------------------	--

### Syllabus:

#### UNIT-I:

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

- 1.1 Plant tissue culture: totipotency, media preparation – nutrients and plant hormones
- 1.2 Sterilization techniques
- 1.3 Establishment of cultures – callus culture, cell suspension culture.
- 1.4 Micro propagation, Somatic embryogenesis,
- 1.5 Synthetic seed production, protoplast culture - applications.

#### UNIT-II:

##### **Transgenesis and Molecular markers**

- 2.1 Plant transformation technology- *Agrobacterium* mediated Gene transfer (Ti plasmid).
- 2.2 Hairy root features of Ri plasmid
- 2.3 Transgenic plants as bioreactors.
- 2.4 Herbicide resistance – glyphosphate, Insect resistance- Bt cotton.

2.5 Molecular markers- RAPD, RFLP.

### **UNIT-III:**

#### **Animal tissue culture techniques:**

3.1 Animal cell culture: cell culture media and reagents; culture of mammalian cells, tissues and organs

3.2 Primary culture, secondary culture

3.3 Cell lines, stem cell cultures;

3.4 Cell viability and cytotoxicity, Cryopreservation.

3.5 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

4.5 Ethical issues in animal biotechnology.

### **UNIT – V**

#### **Bioethics, Biosafety and IPR:**

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

5.2 Bio safety-introduction to biological safety cabinets

5.3 Primary containment for biohazards

5.4 Biosafety levels; GLP,GMP

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

#### **Textbooks**

1. Biotechnology – By U. Satyanarayana ;1997
2. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
3. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing

#### **Referencebooks:**

4. Introduction to Plant Tissue Culture, M. K. Razdan, 2003,Science Publisher
5. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.
6. Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited byDaniel 2001,Cold Spring Harbour Laboratory press, New York.

## WebLinks

## CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High]:No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	2	3	3	3	2	3	3	2	2
CO2	3	2	2	3	2	2	3	2	3	2	3	2
CO3	2	3	3	2	3	3	2	3	2	2	2	3
CO4	3	2	3	2	3	2	3	3	2	3	2	2

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-IV**

**PLANT & ANIMAL BIOTECHNOLOGY**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Describe the methods of sterilization in a tissue culture laboratory.
2. Explain the Agrobacterium mediated transformation of plant cells.
3. Explain the methods of transfection in animal cells.

**SECTION – B**

4. Explain the process of gene therapy.
5. Describe the process of micro propagation.
6. Write an essay on intellectual property rights.

**PART – II**

**Answer any Four Questions from the following**

**4 X 5 = 20 Marks**

7. Callus culture
8. Glyphosate resistance
9. RFLP
10. Role of serum in animal cell culture
11. copyright
12. Recombinant insulin.



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

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

CourseCode	<b>PLANT AND ANIMAL BIOTECHNOLOGY</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1

**Course 4: Plant and Animal Biotechnology Lab**


Total Hours: 30

Credits: 1

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



	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -IV</b>			
Course Code	<b>ENVIRONMENTAL &amp; INDUSTRIAL BIOTECHNOLOGY</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	-	-	4

### Course Objectives:

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.

### Outcomes:

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

CO1	Course will impart knowledge on principles and techniques which underline the application of biosciences, address environmental issues including pollution, mineral resource, renewable energy and water recycling.
CO2	Understand the various techniques involved in waste water management.
CO3	Develop skills associated with screening of Industrially Important Strains.
CO4	Understand principles underlying design of Fermentor and Fermentation Process

Skill Development		Employability		Entrepreneurship	
-------------------	--	---------------	--	------------------	--

### Syllabus:

#### UNIT-I:

##### Pollution Types and Control:

- 1.1 Environmental Biotechnology - Environmental Pollution: Types of pollution.
- 1.2 Air pollution & its control through Biotechnology - Biofilters, Bioscrubbers, Bio trickling filter.
- 1.3 Water pollution and its management: Measurement of water, pollution, sources of water pollution.
- 1.4 Microbiology of waste water treatment - aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors.
- 1.5 Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

## **UNIT-II:**

### **Bioremediation**

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

## **UNIT-III:**

### **Biofuels:**

- 3.1 Biofuels-biogas,
- 3.2 Microbial groups involved in biogas production & interactions.
- 3.3 Factors affecting biogas production
- 3.4 Biofertilizers
- 3.5 Vermiculture.

## **UNIT-IV:**

### **Basic principles of Microbial technology**

- 4.1 Industrially important microbes, its screening
- 4.2 Selection and identification.
- 4.3 Maintenance and preservation of industrially important microbial cultures.
- 4.4 Strain Improvement
- 4.5 Basic concepts of fermentation; Design of fermenter and applications.

## **UNIT – V**

### **Commercial Production of Microbial products**

- 5.1 Microbial technology products and applications; Microbial production of Organic acids (Lactic acid, citric acid)
- 5.2 Microbial production of Amino acids (Glutamic acid, Aspartic acid).
- 5.3 Fermentation by microbes for food additives - dairy products (Cheese, Yogurt)
- 5.4 Beverages (Beer, Wine)
- 5.5 Microbial production of antibiotics – Penicillin

### **Textbooks**

1. Biotechnology – By U. Satyanarayana ;1997
2. Industrial Microbiology by A.H.Patel,2009
3. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications

**Referencebooks:**

4. Prescott & Dum (2002) Industrial Microbiology, Agrabios (India), 2005, Publishers
5. Environmental Chemistry, A.K. De. Wiley Eastern Ltd., 2001, New Delhi

**Weblinks****CO-PO Mapping:**

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High];,;No Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	2	2	3	2	3	2	3	3
CO2	3	2	3	3	2	3	3	2	3	1	1	1
CO3	3	2	2	2	3	2	2	3	2	3	1	1
CO4	2	3	2	3	2	3	1	2	1	2	3	3

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-IV**

**ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Write an essay on pollution.
2. Explain the Bioremediation of hydrocarbons.
3. Explain the production mechanism of biogas.


**SECTION – B**

4. Explain the screening of industrially important microorganisms.
5. Describe the process of penicillin production.
6. Explain the production of lactic acid.

**PART – II**

**Answer any Four Questions from the following 4 X 5 = 20 Marks**

7. Biofilters
8. Phytoremediation
9. biofertilizers
10. vermiculture
11. Preservation techniques
12. Wine production.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -IV</b>			
CourseCode	<b>ENVIRONMENTAL &amp; INDUSTRIAL BIOTECHNOLOGY</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1


Course-5: Environmental & Industrial Biotechnology Lab

Total Hours: 30

Credits: 1

List of Practicals:

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  $\alpha$  – 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

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester III B.Sc Semester -V</b>			
Course Code	<b>TECHNIQUES IN NURSERY DEVELOPMENT</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	-	-	4

### Course Objectives:

This course aims to introduce fundamentals of Nursery development. The course will also give an insight in Various techniques used in nursery development and management practices

### Outcomes:

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

CO1	Understand different types of nurseries
CO2	Identify various facilities required to set up of a nursery.
CO3	Understood expertise related to various practices in a nursery.
CO4	Acquire skills to get an employment or to become an entrepreneur.

Skill Development		Employability		Entrepreneurship	
-------------------	--	---------------	--	------------------	--

### Syllabus:

#### UNIT-I:

##### Introduction to Nursery:

- 1.1 Definition, objectives and importance.
- 1.2 Basic requirements for a nursery layout and components of a good nursery.
- 1.3 Types of nurseries.
- 1.4 Bureau of Indian standards (BIS - 2008) related to nursery.

#### UNIT-II:

##### Nursery inputs

- 2.1 Tools, implements and containers.
- 2.2 Nursery media.
- 2.3 Electricity, equipment and machinery management.
- 2.4 Types of nursery beds and their preparations.
- 2.5 Precautions and maintenance of nursery beds.

### **UNIT-III:**

#### **Seeds and Propagules**

- 3.1 Selection of seed and different sowing methods.
- 3.2 Use of different plant parts for vegetative propagation to raise nursery.
- 3.3 Different techniques of vegetative propagation.

### **UNIT-IV:**

#### **Management Practices**

- 4.1 Routine seasonal operations in a nursery.
- 4.2 Supply of water, nutrients and removal of weeds.
- 4.3 Identification of pests and diseases, control and prevention methods.

### **UNIT – V**

#### **Grafting techniques**

- 5.1 Introduction to grafting, definition, types and tools for grafting.
- 5.2 Steps involved in simple, splice graft, tongue graft, Whip graft, cleft graft and wedge graft.
- 5.3 Grafting of horticultural & floricultural crops and applications

#### **Textbooks**

1. Ratha Krishnan, M., et al. (2014) Plant Nursery
2. P.K.Ray, (2020) Essentials of plant nursery management.
3. P.K.Ray, (2012) How to start and operate a Plant Nursery.

#### **Referencebooks:**

4. Management: Principles and Practices, Central Arid Zone Research Institute – ICMR, Jodhpur, Rajasthan.
5. Vikas Kumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, New Delhi.

#### **Weblinks**

### Activities&BenchmarksProposed (Table)

1. Assignments
- 2.Seminars
- 3.Group Discussion
4. Quiz

### CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High];:No Correlation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C01													
C02													
C03													
C04													
C05													



**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-V**

**PAPER 6A TECHNIQUES IN PLANT NURSERY DEVELOPMENT**

**MODEL PAPER**

**PART-I**

Answer any **THREE** questions by attempting at least **ONE** question from each section.

**SECTION – A**

**3 X 10 = 30 Marks**

1. Explain Bureau of Indian standards related to Nursery.
2. Write an essay on necessary precautions to be taken in the maintenance of nursery beds.
3. Explain the different techniques involved in asexual propagation

**SECTION – B**

4. Write about the control and prevention of pests.
5. Describe the Grafting of horticultural and floricultural crops.
6. Write an essay on different tools for land preparation in a plant nursery.

**PART – II**

Answer any **SIX** Questions from the following

**6 X 5 = 30 Marks**

7. Write a note on basic requirements of a nursery
8. Explain about any two types of nurseries
9. Describe the nursery media
10. Write a short note on selection of seed
11. Types in grafting
12. Tongue graft
13. Tools in nursery
14. sowing methods
15. different types in nursery beds
16. Seed selection.




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

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

CourseCode	<b>TECHNIQUES IN NURSERY DEVELOPMENT</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1

Practical syllabus:

1. Demonstration of different types of nurseries.
2. Handling of nursery tools, equipment and types of containers.
3. Laying of nursery bed with soil and compost.
4. Seed collection, treatment and rising of seedlings on nursery bed.
5. Handling of grafting and layering techniques in the nursery.
6. Watering, weeding and management of nursery.
7. Maintaining of the seedlings / cuttings in the nursery.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester III B.Sc Semester -V</b>			
CourseCode	<b>HYDROPONICS CULTIVATION</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	-	-	4

### Course Objectives:

This course aims to introduce fundamentals hydroponics. The course will also give an insight in Various techniques used in hydroponics cultivation system.

### Outcomes:

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

CO1	Understand the concept of hydroponics.
CO2	Acquire the knowledge on soilless cultivation system.
CO3	Prepare media for hydroponics cultivation.
CO4	Learn the hydroponic cultivation technique.

SkillDevelopment		Employability		Entrepreneurship	
------------------	--	---------------	--	------------------	--

### Syllabus:

#### UNIT-I:

##### Introduction to Soilless culture

- 1.1 Definition, History and origin of soilless culture.
- 1.2 Present status of hydroponics-contrasts with soil based culture.
- 1.3 Applications & future developments.

#### UNIT-II:

##### Macronutrients, micronutrients

- 2.1 Functions and effect on plants, deficiency symptoms of the following essential minerals N, P, Mg, Ca, K, S, Fe, Mn, Cu, Zn, B, Mo.
- 2.2 Physical factors, light (Quantity, energy, photoperiodism etc)
- 2.3 Temperature (Heating and cooling), Humidity, CO<sub>2</sub>, ppm, pH and TDS.

### **UNIT-III:**

#### **Cultural conditions**

- 3.1 Plant nutrition. Inorganic salts (fertilizers) major and minor nutrients formulating, monitoring and analysing.
- 3.2 Selection of fertilizers, media used for hydroponics-expanded clay, rock wool, coir, perlite, pumice, vermiculite, sand gravel etc.
- 3.3 Weed management, diseases and pest control.

### **UNIT-IV:**

#### **Techniques in hydroponics**

- 4.1 Static solution culture
- 4.2 Continuous-flow solution culture
- 4.3 Aeroponics

### **UNIT – V**

#### **Cultivation of crop plants by hydroponics**

- 5.1 Passive sub-irrigation, Ebb and flow or flood and chain irrigation.
- 5.2 Deep water culture protocols for –Tomato cultivation through Dutch bucket method
- 5.3 Chilly cultivation through NFT system, Spinach through raft System and measurements of yield.

#### **Textbooks**

1. Prasad S and Kumar U. Green House management for Horticultural crops. Agro-Bios India.
2. Dahama A.K. Organic Farming for Sustainable Agriculture. Agrobios, India
3. Subba Rao N.S. (1995). Biofertilizers in Agriculture and Forestry. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi.

#### **Referencebooks:**

4. Keith Roberto, How to Hydroponics. The future Garden Press New York.4th Edition
5. Howard M. Resh. Hobby Hydroponics. CRC Press, USA.

#### **Weblinks**

**CO-PO Mapping:**

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High],:No Correlation]

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PS01	PS02	PS03
C01													
C02													
C03													
C04													
C05													

**P.R. GOVERNMENT COLLEGE (A): KAKINADA**

**Semester-V**

**HYDROPONICS CULTIVATION**

**MODEL PAPER**

**PART-I**

**Answer any THREE questions by attempting at least ONE question from each section.**

**SECTION – A**

**3 X 10 = 30 Marks**

1. Describe the applications and future developments of hydroponics.
2. Explain the deficiency symptoms of the Macro nutrients.
3. Explain in detail about the control of hydroponic pests

**SECTION – B**

4. Discuss about the technique of static solution culture in hydroponics.
5. Explain the process of tomato cultivation through Dutch bucket method.
6. Explain in detail about the different types of media used for hydroponics.

**PART – II**

**Answer any SIX Questions from the following**

**6 X 5 = 30 Marks**

7. Application of Hydroponics
8. Role of micro nutrients
9. Weed management
10. Solid state culture
11. Raft hydroponics
12. Photoperiodism
13. Aeroponics
14. TDS
15. Dutch bucket method
16. vermiculture



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

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

CourseCode	<b>HYDROPONICS CULTIVATION</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1

**Practical syllabus:**

1. Handling of tools required for hydroponic set up.
2. Preparation of macronutrients and micronutrients solutions/stock cultures.
3. Preparation of different media for hydroponic system.
4. Evaluating the effect of bio fertilizers on hydroponic cultivation.
5. Weeding management techniques - demonstration.
6. Demonstration of pests and diseases control and prevention methods.
7. Cultivation of tomato by hydroponic system.
8. Cultivation of chilli through hydroponic cultivation.