

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



**XXIV-BOARD OF STUDIES**

**DEPARTMENT OF  
BIOTECHNOLOGY**

**2024-25**

**(CHOICE BASED CREDIT SYSTEM)**

**P.R.GOV.T.COLLEGE (AUTONOMOUS)**  
**2024-25, XXIV 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 implement the Four-year honours degree programme in biotechnology from the academic year 2023-24.
- Resolution II:** Resolved to implement the single major system prescribed by APSCH in the four years honours degree programme.
- Resolution III:** Resolved to follow three major CBCS system for the third-year students.
- Resolution IV:** Resolved to offer Biotechnology minor from the academic year 2023-24
- Resolution V:** Resolved to continue 50% external and 50% internal marks for theory for all semesters from the academic year 2024-25. 50 marks are allotted for practicals.
- Resolution VI:** For the 50 marks for CIA, 25 marks are allocated for Mid examinations. In each semester two mid examinations to be conducted and the average of the two will be considered.
- Resolution VII:** Resolved to conduct I mid examination in offline mode at college level and II mid examination is conducted in online mode at department level.
- Resolution VIII:** Resolved to follow the question paper pattern and CIA as per the structure given in the proceedings
- Resolution IX:** Resolved to implement CSP (Community service project) by the end of I Year, second internship after second year and OJT in the sixth semester as prescribed by APSCH.
- Resolution X:** It is mandatory that each student has to complete one MOOC course from SWAYAM per year.
- Resolution XI:** Resolved to follow the benchmark of 75% attendance to appear in the Examinations without the payment of fine.
- Resolution XII:** Resolved to adapt skill enhancement course – Elective papers 6A/7A or 6B/7B or 6C/7C in the V semester.
- Resolution XIII:** Resolved to continue the same paper setters and examiners for all these semesters.
- Resolution XIV:** Resolved to offer certificate course in Bioinformatics by biotechnology department.
- Resolution XV:** Resolved to continue Remedial coaching for slow learners and Project for Advanced learners



**Chairperson  
Board of Studies**

P.R. GOVT. COLLEGE (A), KAKINADA  
**TENTATIVE ACTION PLAN 2024 - 25**  
DEPARTMENT OF BIO TECHNOLOGY

Sl.	MONTH & YEAR	ACTIVITY	Tentative Date	
1	Aug - 2024	<b>Commencement of Certificate Course</b>	<b>3<sup>rd</sup> week of Aug</b>	
2	Sep- 2024	<b>National level Work shop (Theme will be decided after confirmation from resource person)</b>	<b>4<sup>th</sup> week of Sep</b>	
3	Oct - 2024	<b>Industrial visit / educational tour</b>	<b>4<sup>th</sup> week of October</b>	
4	Nov - 2024	<b>Guest Lecture</b>	<b>4<sup>th</sup> week of November</b>	
5	Dec - 2024	<b>National level seminar</b>	<b>3<sup>rd</sup> week of December</b>	
6	Feb - 2025	<b>National science day celebrations</b>	<b>4<sup>th</sup> week of February</b>	
7	Mar - 2025	<b>Visit to water purification plant</b>	<b>2<sup>nd</sup> week of March</b>	
8				

*B. Nagarajaram*

**University Nominee**

*G.P. Chatterjee*

**Chairperson  
Board of Studies**

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

**KAKINADA.**

**DEPARTMENT OF BIOTECHNOLOGY**

**BUDGET ESTIMATION FOR THE ACADEMIC YEAR – 2024-25**

S.NO	NAME OF THE DEPARTMENT	BUDGET ESTIMATION	TOTAL AMOUNT
1	BIOTECHNOLOGY	Guest Faculty – 14400 × 10months	1,44,000
2		Lab equipment	
		Consumable	30,000.00
		Non – Consumable	2,00,000.00
3		Seminar	1,00,000.00
4		Guest Lecture	10,000.00
5		Field Trip / Tour	50,000.00
6		AMC for Lab	50,000.00
7		Certificate Course	30,000.00
8		Seed Money	1,00,000.00
9		Furniture	1,00,000.00
10		Stationary	10,000.00
11	Computers and peripherals	65,000.00	
12	Books	30,000.00	

*B. Nageeswari*

Dr.B.Nageeswari

University Nominee

*G.P.Chakravarthi*

G.P.Chakravarthi

Lecturer In-Charge

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A)**

**2024-25, XXIV BOARD OF STUDIES MEETING**

**DEPARTMENT OF BIOTECHNOLOGY**

It is resolved to introduce the following new courses in the programme B.Sc. Biotechnology from the AY 2024-25

<b>S.No</b>	<b>Title of the new course</b>	<b>Programmes in which it is introduced</b>
1	Plant and Animal Biotechnology	II B.Sc Biotechnology (Honors)
2	Molecular Biology	II B.Sc Biotechnology (Honors)
3	Genetic Engineering	II B.Sc Biotechnology (Honors)
4	Metabolism	II B.Sc Biotechnology (Honors)
5	Immunology	II B.Sc Biotechnology (Honors)
6	Bioinformatics and Biostatistics	II B.Sc Biotechnology (Honors)
7	Medical Biotechnology	II B.Sc Biotechnology (Honors)

*B. Nageshwar*

**University Nominee**

*G.P. d. thir*

**Chairperson  
Board of Studies**

**PITHAPUR RAJA'S GOVERNMENT COLLEGE  
KAKINADA.  
DEPARTMENT OF BIOTECHNOLOGY  
XXIV-BOARD OF STUDIES MEETING 2024-25**





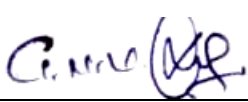

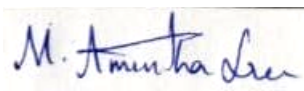


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Time: 10.30 A.M.

Date: 30.04.2024

Venue: **Department of Biotechnology**

The XXIV BOARD OF STUDIES Meeting of the Department of Biotechnology took place 10.30 A.M. on 30.04.2024 in the Department of Biotechnology P.R. Govt. College, (A) Kakinada for the year 2024-25. The following members attended.

S. No	Name of the Person	Designation	Signature
1	Sri G P Chakravarthi Lecturer In-Charge Dept. of Biotechnology Kakinada.	Chairperson	
2	Dr B Nageswari Government Arts College Rajamahendravaram	University Nominee	
3	B. Preethi Chandrakala Lecturer Rajiv Gandhi Institute of Sciences Kakinada.	Subject Expert	
4	Dr A Sreenivasulu Director V.S. Lakshmi Research Center Kakinada.	Industry / Research Expert	
5	Sri GNV Satish	Member	
6	V. Naga Eswari	Student Alumini	
7	M Amrutha sree II BtZC	Student member	
8	K. Vinayaka II BBKA	Student member	
9	K. Jagadeesh I Biotech	Student member	

**DEPARTMENT OF BIOTECHNOLOGY**  
**ALLOCATION OF CREDITS**

S.No	Semester	Title of the course	Course type	Hrs/Week	Max.Marks (SEE)	Marks in CIA	Credits
1	I	<b>Paper – I</b> - Introduction to Classical Biology	Theory	5	50	50	4
2		<b>Paper – II</b> - Introduction to Applied Biology	Theory	5	50	50	4
3	II	<b>Paper – III</b> - Biomolecules and Analytical Techniques	Theory	3	50	50	3
4		Biomolecules and Analytical Techniques	Lab	2	50	-	1
		<b>Paper – IV</b> - Microbiology, Cell Biology	Theory	3	50	50	3
		Microbiology, Cell Biology	Lab	2	50	-	1
	MINOR	Biomolecules and Analytical Techniques	Theory	3	50	50	3
		Biomolecules and Analytical Techniques	Lab	2	50	-	1
5	III	<b>Paper – V</b> - Plant and Animal Biotechnology	Theory	3	50	50	3
6		Plant and Animal Biotechnology Lab	Lab	2	50	-	1
7		<b>Paper – VI</b> - Molecular Biology	Theory	3	50	50	3
8		Molecular Biology Lab	Lab	2	50	-	1
9		<b>Paper – VII</b> - Genetic Engineering	Theory	3	50	50	3
10		Genetic Engineering Lab	Lab	2	50	-	1
		<b>Paper – VIII</b> – Metabolism	Theory	3	50	50	3
		Metabolism Lab	Lab	2	50	-	1
	MINOR	Plant and Animal Biotechnology	Theory	3	50	50	3
		Plant and Animal Biotechnology Lab	Lab	2	50	-	1
	IV	<b>Paper – IX</b> - Immunology	Theory	3	50	50	3
		Immunology Lab	Lab	2	50	-	1
		<b>Paper – X</b> - Bioinformatics and Biostatistics	Theory	3	50	50	3
		Bioinformatics and Biostatistics Lab	Lab	2	50	-	1
		<b>Paper – XI</b> - Medical Biotechnology	Theory	3	50	50	3
		Medical Biotechnology Lab	Lab	2	50	-	1

	<b>MINOR</b>	Immunology	<b>Theory</b>	<b>3</b>	<b>50</b>	<b>50</b>	<b>3</b>
		Immunology Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
		Bioinformatics and Biostatistics	<b>Theory</b>	<b>3</b>	<b>50</b>	<b>50</b>	<b>3</b>
		Bioinformatics and Biostatistics Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
<b>11</b>	<b>V</b>	<b>Paper – 6A - Techniques in Nursery Development</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>12</b>		Techniques in Nursery Development Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
<b>13</b>		<b>Paper – 7A - Hydroponics Cultivation</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>14</b>		Hydroponics Cultivation Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
		<b>(Or)</b>					
<b>15</b>	<b>V</b>	<b>Paper – 6B - Organic Farming</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>16</b>		Organic farming Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
<b>17</b>		<b>Paper – 7B - Biofertilizers and Biopesticides production</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>18</b>		Bio fertilizers and Bio pesticides Production Lab	<b>Lab</b>	<b>2</b>	<b>50</b>	<b>-</b>	<b>1</b>
		<b>(Or)</b>					
<b>19</b>		<b>Paper – 6C - Apiculture</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>20</b>		Apiculture Lab	<b>Lab</b>	<b>4</b>	<b>50</b>	<b>-</b>	<b>1</b>
<b>21</b>		<b>Paper – 7C - Pearl Culture</b>	<b>Theory</b>	<b>4</b>	<b>50</b>	<b>50</b>	<b>4</b>
<b>22</b>		Pearl Culture Lab	<b>Lab</b>	<b>4</b>	<b>50</b>	<b>-</b>	<b>1</b>

**PITHAPUR RAJA'S GOVERNMENT COLLEGE**

**KAKINADA**

**DEPARTMENT OF BIOTECHNOLOGY**

**LIST OF EXAMINERS**

<b>S.NO</b>	<b>NAME OF THE LECTURER</b>	<b>NAME OF THE COLLEGE</b>
1	Dr. B. Nageswari	GOVERNMENT ARTS COLLEGE, RAJAMAHENDRAVARAM
2	Dr. K. Vasudha	GOVERNMENT DEGREE COLLEGE, MOVVA
3	Dr. K. Rekha	V.S. KRISHNA COLLEGE, VISHAKHAPATNAM
4	Dr. I.J.N. Padmavathi	ADI KAVI NANNAYA UNIVERSITY
5	Dr. J. Naveena Lavanya Latha	KRISHNA UNIVERSITY
6	Dr. J. Balaji Chandra Mouli	ADI KAVI NANNAYA UNIVERSITY

*B. Nageswari*  
**University Nominee**

*G.P. Chandra*  
**Chairperson  
Board of Studies**



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

**Program  
&Semester  
I B.Sc  
Semester -I**

CourseCode	Introduction to Classical Biology				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		5	1	-	4

### **Learning objectives**

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

### **Learning Outcomes**

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

### **Unit 1: Introduction to systematics, taxonomy and ecology.**

- 1.1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
- 1.2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology – Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

### **Unit 2: Essentials of Botany.**

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4 Mushroom cultivation, floriculture and landscaping.

### **Unit 3: Essentials of Zoology**

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

### **Unit 4: Cell biology, Genetics and Evolution**

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

### **Unit 5: Essentials of chemistry**

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

### **References**

1. Sharma O.P., 1993. Plant taxonomy. 2<sup>nd</sup> Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4<sup>th</sup> edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4<sup>th</sup> Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5<sup>th</sup> Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1<sup>st</sup> Edition. Oxford publishers

**PITHAPUR RAJAH'S GOVERNMENT COLLEGE(A)**

**KAKINADA**

**DEPARTMENT OF BIOTECHNOLOGY**

**SEMESTER - I**

**Time: 2 Hours**

**Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks. 3 X 10 = 30M**

**Part – A**

1. Essay Question from Unit - I
2. Essay Question from Unit - II
3. Essay Question from Unit - III

**Part - B**

4. Essay Question from Unit - IV
5. Essay Question from Unit - V
6. Essay question from anyone of the five units based on its weightage in the syllabus

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short Answer Question from Unit - I
8. Short Answer Question from Unit - II
9. Short Answer Question from Unit - III
10. Short Answer Question from Unit - IV
11. Short Answer Question from Unit - V
12. Short answer question from anyone of the five units based on its weightage in the syllabus
13. Short answer question from anyone of the five units based on its weightage in the syllabus



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

**Program  
&Semester  
I B.Sc  
Semester -I**

CourseCode	<b>INTRODUCTION TO APPLIED BIOLOGY</b>			
Teaching	<b>Hours Allocated: 60 (Theory)</b>			
Pre-requisites:	5	1	-	4

### Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

### Learning Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

### Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
- 1.4. Immune system – Immunity, types of immunity, cells and organs of immune system.

### Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I – Carbohydrates, Lipids.
- 2.2. Biomolecules II – Amino acids & Proteins.
- 2.3. Biomolecules III – Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism – Anabolism and catabolism.

### Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.

3.3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

#### **Unit 4: Analytical Tools and techniques in biology – Applications**

4.1. Applications in forensics – PCR and DNA fingerprinting

4.2. Immunological techniques – Immunoblotting and ELISA.

4.3. Monoclonal antibodies – Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

#### **Unit 5: Biostatistics and Bioinformatics**

5.1. Data collection and sampling.

5.2. Measures of central tendency – Mean, Median, Mode. Standard deviation.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

#### **REFERENCES**

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11<sup>th</sup> Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5<sup>th</sup> Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. U. Sathyanarayana, 2005. Biotechnology. 1<sup>st</sup> Edition. Books and Allied Publishers pvt. ltd., Kolkata.
7. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
8. Arthur M. Lesk. Introduction to Bioinformatics. 5<sup>th</sup> Edition. Oxford publishers.
9. AP Kulkarni, 2020. Basics of Biostatistics. 2<sup>nd</sup> Edition. CBS publishers.

**KAKINADA**  
**DEPARTMENT OF BIOTECHNOLOGY**  
**SEMESTER - I**

**Time: 2 Hours**

**Max Marks: 50M**

**Section -I**

**Answer any three of the following questions. Must attempt atleast one question from each part. Each question carries 10 Marks.**

**3 X 10 = 30M**

**Part – A**

1. Essay Question from Unit - I
2. Essay Question from Unit - II
3. Essay Question from Unit - III

**Part - B**

4. Essay Question from Unit - IV
5. Essay Question from Unit - V
6. Essay question from anyone of the five units based on its weightage in the syllabus

**Section II**

**Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M**

7. Short Answer Question from Unit - I
8. Short Answer Question from Unit - II
9. Short Answer Question from Unit - III
10. Short Answer Question from Unit - IV
11. Short Answer Question from Unit - V
12. Short answer question from anyone of the five units based on its weightage in the syllabus
13. Short answer question from anyone of the five units based on its weightage in the syllabus



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

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

Course Code	<b>BIOMOLECULES AND 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	-	3

## LEARNING OUTCOMES

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

1. Learn about classification, structure and properties of Carbohydrates, Proteins and Lipids.
2. Learn about structure and function of DNA, RNA, Vitamins and Bioenergetics.
3. Learn about basic principles of Centrifugation, Chromatography and Electrophoresis.
4. Learn about principles of Spectroscopy, Microscopy and Techniques.
5. Learn about basics of Biostatistics.

## II. Syllabus

### Unit-I-Carbohydrates, Protein and Lipids

- 1.1 Carbohydrates - Classification, structure of any one Monosaccharide, Disaccharide, Polysaccharide. Properties of Monosaccharides.
- 1.2 Proteins – Structure of amino acids, peptide bond, Structure (primary, secondary, tertiary, quaternary) and proteins.
- 1.3 Lipids – Fatty acids (Unsaturated and saturated), Classification lipids.

### Unit-II- Nucleic acid and Bioenergetics

- 2.1 Structure of DNA and RNA.
- 2.2 Free energy, entropy, enthalpy, and redox potential.
- 2.3 High energy compounds.

### Unit-III-Centrifugation, Chromatography, and Electrophoresis

- 3.1 Centrifugation - Basic principles of sedimentation and types of centrifugations.
- 3.2 Chromatography – Partition Coefficient, Principle, instrumentation, and application of paper, ion exchange chromatography.
- 3.3 Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE).

## **Unit - IV-Spectroscopy, Microscopy and Laser Techniques**

4.1 Spectroscopy - Beer-Lambert law, Instrumentation and applications of UV-visible spectrophotometer.

4.2 Types and design of microscopes - Compound, Electron microscopy (TEM, SEM).

4.3 Introduction to radioisotopes, measurement of radioactivity (scintillation counter)

## **Unit -V- Biostatistics**

5.1 Probability

5.2 Tests of significance - Chi-square test

5.3 One-way ANOVA.

## **III . Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. learn about basic instruments and their operation
2. learn about Qualitative and Quantitative analysis of carbohydrates
3. Learn about estimations nucleic acids and protein by various methods
4. learn about the separation of molecules by chromatography and electrophoresis
5. Learn about problems on mean median mode



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

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

Course Code

**BIOMOLECULES AND ANALYTICAL  
TECHNIQUES**

**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	1	1	15
3	UNIT - III	2	1	25
4	UNIT - IV	1	2	20
5	UNIT - V	1	1	15
	TOTAL	6	7	95

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

**Semester-II**

**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. Write an essay on electron microscopy.

**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.
13. Scintillation counter.



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

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

CourseCode	<b>BIOMOLECULES AND ANALYTICAL TECHNIQUES</b>				
Teaching	<b>Hours Allocated: 45 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1

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

## REFERENCES

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffory Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1<sup>st</sup> edition, (2001), Gary Walsch; Wiley, USA



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

Program  
& Semester  
I B.Sc  
Semester -II

Course Code	<b>MICROBIOLOGY, CELL 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	-	3

### LEARNING OUTCOMES

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

1. Learn about Scope and Techniques of Microbiology.
2. Learn about concept of Microbial species and strains,
3. Learn about cell structure and function.
4. Learn about cell signaling and control mechanisms.
5. Learn about genome organization of prokaryotic and eukaryotic organisms

### Syllabus

#### Unit-I- Scope and Techniques of Microbiology

1.1 History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming.

1.2 Ultrastructure of bacteria and growth curve. Pure culture techniques.

1.3 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

2.1 Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics of viruses.

2.2 Structure and properties of plant (tobacco mosaic virus, TMV), human (Human immunodeficiency virus, HIV). Structure, infection, diagnosis and treatment of SARS- CoV 2

2.3 Introduction to fungi, algae and mycoplasma.

#### Unit-III- Cell Structure and Functions

3.1 Structure, properties and functions of cellular organelles (E.R, Golgi bodies, Mitochondria, Ribosomes, lysosomes, nucleus) of eukaryotic cells.

3.2 Cell cycle and its regulation

3.3 Cell division – mitosis, meiosis

## **Unit-IV- CELL SIGNALLING**

4.1 Chemical composition and dynamic nature of the membrane

4.2 Cell Surface Receptors

4.3 Cell signaling and communication (GPCR, cAMP, cGMP, IP3, DAG)

## **Unit – V - Central Dogma of Molecular Biology**

5.1 Mutations – Types of mutations


5.2 DNA Damage

5.3 DNA repair Mechanism – Excision repair – BER and NER

### **Skills Outcome**

On Successful Completion of this Course, Student shall be able to

1. Learn about preparation of media for culturing of various microorganisms
2. Learn about isolation of microorganisms from different sources
3. Learn about staining techniques and biochemical identification of bacteria
4. Learn about different stages of cell division

	<b>Pithapur Rajah's Government College(Autonomous)Kakinada</b>		<b>Program &amp;Semester I B.Sc Semester -II</b>			
CourseCode	<b>MICROBIOLOGY, CELL BIOLOGY</b>					
Teaching	<b>Hours Allocated: 40 (Theory)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:			-	-	2	1

1. Cleaning and preparation of glassware
2. Preparation of nutrient agar medium for bacteria
3. Preparation of PDA medium for fungi
4. Sterilization techniques (autoclave, hot air oven, filter)
5. Isolation of bacteria from soil
6. Simple staining technique
7. Differential staining technique
8. Microbial counting by Haemocytometer
9. Identification of different bacteria
10. Motility test by hanging drop
11. Biochemical identification of bacteria
12. Preparation of pure culture by slab, slant, streak culture
13. Study of stages of cell division
14. Extraction and isolation of DNA from bacteria

#### REFERENCES

1. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY
2. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA
3. Textbook of Microbiology, Anantnarayan and Paniker (2017)
4. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., &Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003.
5. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc. USA
6. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell,



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

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

CourseCode

**MICROBIOLOGY, CELL BIOLOGY**

**BLUE – PRINT**

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

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

**Semester-II**

**MICROBIOLOGY and CELL BIOLOGY**

**MODEL PAPER**

**PART-I**

Answer any **THREE** questions by attempting at least **ONE** question form 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. Write an essay on GPCR's.
6. Write essay on cell cycle and its regulation.

**PART – II**

Answer any **Four Questions from the following**

**4 X 5 = 20 Marks**

7. Grams Staining.
8. Satellite DNA.
9. Mitosis.
10. Chemical composition of membrane.
11. Enzymes in transcription.
12. Nutritional classification of bacteria.
13. Contributions of Robert Koch.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -III</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	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-

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

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



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


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

CourseCode

**PLANT AND ANIMAL BIOTECHNOLOGY**

**BLUE - PRINT**

<b>S.NO</b>	<b>UNIT</b>	<b>NO.OF ESSAY QUESTIONS (10M)</b>	<b>NO.OF SHORT ANSWER QUESTIONS (5M)</b>	<b>TOTAL</b>
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
	<b>TOTAL</b>	<b>6</b>	<b>7</b>	<b>95</b>

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester II B.Sc Semester -III</b>			
CourseCode	PLANT AND ANIMAL BIOTECHNOLOGY				
Teaching	<b>Hours Allocated: 30 (Lab)</b>	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

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>		<b>Program &amp; Semester II B.Sc Semester -III</b>			
CourseCode	<b>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	-	-	3

### Outcomes:

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

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

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.



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


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

CourseCode

**MOLECULAR BIOLOGY**

**BLUE – PRINT**

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

	<b>Pithapur Rajah's Government College(Autonomous)Kakinada</b>		<b>Program &amp;Semester II B.Sc Semester -III</b>			
CourseCode	<b>MOLECULAR BIOLOGY</b>					
Teaching	<b>Hours Allocated: 30 (Lab)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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

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

### Outcomes:

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

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

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 ( $\lambda$  & 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**

**BLUE – PRINT**

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

	<b>Pithapur Rajah's Government College(Autonomous)Kakinada</b>		<b>Program &amp;Semester II B.Sc Semester -III</b>			
CourseCode	<b>GENETIC ENGINEERING</b>					
Teaching	<b>Hours Allocated: 30 (Lab)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>		<b>Program &amp; Semester III B.Sc Semester -III</b>			
CourseCode	<b>METABOLISM</b>					
Teaching	<b>Hours Allocated: 60 (Theory)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:			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 stunt pathway ,
- 1.4 Disorders of Carbohydrate metabolism- Diabetesmellitus

### 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




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

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

CourseCode	<b>METABOLISM</b>				
Teaching	<b>Hours Allocated: 60 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
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

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

## I. LEARNING OUTCOMES

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

1. Learn about types of immunity and cells of immunity
2. Learn about Antigen and Antibody
3. Learn about cell , humoral immunity and MHC molecules
4. Learn about Hypersensitivity and vaccines
5. Learn about immunological techniques

## II. Syllabus

### UNIT I Immune system:

- 1.1 History and scope of immunology.
- 1.2 Cells of the immune system -T cells , B cells
- 1.3 Immunity, innate immune mechanism, Acquired immune mechanism
- 1.4 Organs of the immune system (Bone marrow, spleen thymus MALT)

### UNIT II Antibody and Antigen:

- 2.1 Antibody structure and classes(Ig G,Ig M Ig A Ig E I g D , Antibody diversity
- 2.2 Antigen -Types of Antigens
- 2.3 Antigenicity (factors affecting antigenicity).
- 2.4 Antigenic determinants – adjuvants and haptens , epitopes

### UNIT III Immunity:

- 3.1 Humoral immunity,
- 3.2 Cell-mediated immunity -TC-mediated immunity, NK cell-mediated immunity, ADCC.
- 3.3 Brief description of cytokines , Interleukins
- 3.4 Major histocompatibility complex (MHC )-Structure and Functions of Class I ,II MHC Molecules

#### **UNIT IV - Hypersensitivity and vaccination**

- 4.1 General features of hypersensitivity,
- 4.2 Types of hypersensitivity,
- 4.3 Vaccination: Discovery, principles, significance,
- 4.4 Types of Vaccines -live, attenuated, killed , recombinant, subunit

#### **UNIT V Immunological Techniques**

- 5.1 Antigen-antibody reactions: Precipitation, agglutination, complement fixation,
- 5.2 Immunodiffusion, - Radial immune diffusion, Ouchterlony double immune diffusion
- 5.3 Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.
- 5.4 ELISA , RIA , immunoelectrophoretic , Rocket electrophoresis




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

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

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

1. Antigen – antibody reaction – determination of Blood group , Cross reactivity
2. Pregnancy test
3. Widal test
4. Ouchterloney immunodiffusion
5. Radial immunodiffusion
6. ELISA
7. Isolation of casein by isoelectric precipitation
8. Production of antibodies and their titration

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

## I. LEARNING OUTCOMES

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

1. Learn about concept and branches of bioinformatics
2. Learn about searching sequences using databases
3. Learn about computer phylogenetics
4. Learn about the measurement of central tendency
5. Learn about test hypothesis

### UNIT - I

- 1.1 Scope of computers in biological research, Introduction to Bioinformatics: Definition, nature and scope of bioinformatics.
- 1.2 Bioinformatics versus computational biology.
- 1.3 Branches of bioinformatics.
- 1.4 Basic concepts in bioinformatics.

### UNIT – II

- 2.1 Basic concepts of system biology. Protein Data Bases -visualization of proteins using database
- 2.2 Overview of computer-aided drug design.
- 2.3 Searching sequence database using BLAST.
- 2.4 Concept of genomics and proteomics

### UNIT – III

- 3.1 Computational phylogenetics – various applications.
- 3.2 Phylip software.
- 3.3 Microarray,
- 3.4 Bio informatics – Experimental design & Over view of data analysis.

## **UNIT – IV**

- 4.1 Measurement of central tendency (mean, mode and range)
- 4.2 Dispersion (standard error and standard deviation).
- 4.3 Probability and distribution. Poisson and binomial distributions.
- 4.4 Normal distribution

## **UNIT – V**

- 5.1 Population and sampling test of significance. Test hypothesis.
- 5.2 Student t-test for small samples. ANOVA – Two – Way ANOVA,
- 5.3 Correlation and regression.
- 5.4 Computer applications in Biotechnology




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

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

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

1. Mean, Median, Mode
2. Standard deviation, variance and coefficient of variation
3. Testing of hypotheses regarding population mean
4. Testing of hypotheses about the difference between population means
5. Chi-square test
6. Testing of Correlation Coefficient
7. Fitting of simple linear regression
8. Sequence retrieval (protein and gene) from NCBI, Structure download (protein and DNA) from PDB

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

## I. LEARNING OUTCOMES

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

1. Learn about diseases caused by microbial sources
2. Learn about epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of bacterial diseases
3. Learn about fungal, viral and protozoan diseases
4. Learn about gene therapy and vectors used in gene therapy
5. Learn about drug discovery, therapeutic applications

### UNIT -I

- 1.1 Diseases, introduction, types : genetic, chromosomal aberrations, numerical and structural autoimmune disorders
- 1.2 Disease caused by microbial sources, mechanism of pathogenicity, pathogenic islands.
- 1.3 Molecular basis of diseases
- 1.4 Antimicrobial compounds and their mode of action

### Unit -II

- 2.1 Characteristics of infectious diseases, herd immunity
- 2.2 Disease cycle (source of disease, reservoir, carries).
- 2.3 Transmission of pathogens (air borne ,contact transmission , and vector transmission)
- 2.4 Bacterial diseases – epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of the following diseases – tuberculosis, typhoid, tetanus, leprosy

### Unit -III


- 3.1 General account of fungal diseases : mycosis , subcutaneous and deep
- 3.2 General account of viral and protozoan diseases- pneumonia, mumps,
- 3.3 AIDS, malaria
- 3.4 Brief account of sexually transmitted diseases

## **Unit -IV**

- 4.1 Gene therapy – *Exvivo, Invivo, Insitu* gene therapy
- 4.2 strategies of gene therapy, gene augmentation
- 4.3 Vectors used in gene therapy, biological vectors – retrovirus, adeno virus, herpes.
- 4.4 Syntheticvectors - liposomes, receptor medicate gene transfer

## **Unit -V**

- 5.1 Introduction to drug discovery. Stem cell-based drug discovery.
- 5.2 Drug screening and toxicology
- 5.3 Therapeutic applications – neurological disorders - Parkinson's diseases, Alzheimer's disease
- 5.4 Antiviral therapy for AIDS, DNA/RNA based diagnosis, hepatitis

	<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:		4	-	-	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	
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### 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, Role of plant growth regulators.
- 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

- 1.1 Selection of seed, Seed treatment methods.
- 3.2 Different sowing methods.
- 3.3 Use of different plant parts for vegetative propagation to raise nursery.
- 3.4 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.

6.

#### CO-PO Mapping:

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	2	2	2	3	2	3	3	2
CO2	3	3	2	2	3	3	3	2	2	1	1	1	2
CO3	2	3	3	2	2	2	2	3	2	3	1	1	1
CO4	3	2	3	3	3	2	2	2	3	2	3	3	2



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

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

CourseCode

**TECHNIQUES IN NURSERY  
DEVELOPMENT**

**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

**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 form each section.

**SECTION – A**

**3 X 10 = 30 Marks**

1. Write an essay on basic requirements for a nursery layout.
2. Write an essay on types of nursery beds and their preparation
3. Explain the different techniques involved in asexual propagation

**SECTION – B**


4. Write about the control and prevention methods of pests.
5. Explain different types of Grafting techniques used in plant nursery.
6. Write an essay on different tools for land preparation in a plant nursery.

**PART – II**

Answer any **Four** Questions from the following

**4 X 5 = 20 Marks**

7. BIS – 2008 related to nursery.
8. Explain about any two types of nurseries.
9. Describe the nursery media.
10. Write a short note on selection of seed.
11. Routine seasonal operations in nursery.
12. Tools for grafting.
13. Short notes on sowing methods.

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>	<b>Program &amp; Semester III B.Sc Semester -V</b>			
CourseCode	<b>TECHNIQUES IN NURSERY DEVELOPMENT</b>				
Teaching	<b>Hours Allocated: 30 (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.



**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: 30 (Lab)</b>	L	T	P	C
Pre-requisites:		-	-	2	1

**Question Paper Model for Practical Examination**


**Semester – V**

**Biotechnology Course – 6 A (Skill EnhancementCourse) Techniques in Nursery Development**

**Exam: 2 hrs**

**Max Marks: 50M**

- |                          |           |
|--------------------------|-----------|
| 1. Major Experiment      | 20M       |
| 2. Minor Experiment      | 10M       |
| 3. Identify the spotters | 5 x2 =10M |
| 1)                       |           |
| 2)                       |           |
| 3)                       |           |
| 4)                       |           |
| 5)                       |           |
| 4. Record                | 5M        |
| 5. Viva-voce             | 5M        |

	<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	
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### 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, Quality, photoperiodism)
- 2.3 Temperature (Heating and cooling), Humidity, 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 Non-circulating hydroponic method (Kratky Method), Deep water culture.

4.2 Continuous-flow solution culture, Aeroponics

4.3 Best Plants for hydroponics.

### **UNIT – V**

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

5.1 Passive sub-irrigation, Ebb and flow or flood and drain 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.

	<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:		4	-	-	2

**BLUE – PRINT**

<b>S.NO</b>	<b>UNIT</b>	<b>NO.OF ESSAY QUESTIONS (10M)</b>	<b>NO.OF SHORT ANSWER QUESTIONS (5M)</b>	<b>TOTAL</b>
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
	<b>TOTAL</b>	<b>6</b>	<b>7</b>	<b>95</b>

**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 Macronutrients.
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 **Four** Questions from the following

**4 X 5 = 20 Marks**

7. Application of Hydroponics
8. Role of micro nutrients
9. Weed management
10. Solid state culture
11. Raft hydroponics
12. Photoperiodism
13. Aeroponics




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

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

CourseCode	<b>HYDROPONICS CULTIVATION</b>				
Teaching	<b>Hours Allocated: 30 (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.

	<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: 30 (Lab)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		-	-	2	1

**Question Paper Model for Practical Examination**


**Semester – V**

**Biotechnology Course – 7 A (Skill EnhancementCourse) Hydroponics cultivation**

**Exam: 2 hrs**

**Max Marks: 50M**

- |                          |           |
|--------------------------|-----------|
| 1. Major Experiment      | 20M       |
| 2. Minor Experiment      | 10M       |
| 3. Identify the spotters | 5 x2 =10M |
| 1)                       |           |
| 2)                       |           |
| 3)                       |           |
| 4)                       |           |
| 5)                       |           |
| 4. Record                | 5M        |
| 5. Viva-voce             | 5M        |

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>		<b>Program &amp; Semester III B.Sc Semester -V</b>			
CourseCode	<b>Paper – 6B - ORGANIC FARMING</b>					
Teaching	<b>Hours Allocated: 60 (Theory)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:			3	-	-	4

### Learning outcomes

Students after successful completion of the course will be able to

1. Understand the soil profile and nutrients in soil
2. Appreciate the importance of organic manure and bio fertilizers
3. Produce vermicompost, farmyard manure from bio waste
4. Acquire skill on isolation and maintenance of bio fertilizers

### UNIT I: Soil

Definition, soil formation, composition and characteristics. Types of soils. Distribution of soil groups in India. Acidic, Alkaline and heavy metal contaminated soil. Methods of reclamation. Effects of chemical dependent farming on yield and soil health.

### UNIT II: Plant Nutrition

Macro and micro nutrients, functions of nutrients in plant growth and development. Nutrient uptake and utilization by plant. Types of fertilizers. Organic, inorganic and bio fertilizers. Chemical fertilizer. Advantages & disadvantages of their use. Importance of organic and bio fertilizers.

### UNIT III: Organic Farming

Definition, concept, benefits. Integrated farming system (combination of organic and inorganic). Mixed farming system. Concept of different cropping systems in relation to organic farming, Inter cropping, crop rotation. Organic farming process. Organic fertilizers, crop nutrients and effective microorganisms in Organic farming.

### UNIT IV: Organic compost

Definition, types of compost, farm yard compost, green leaf compost, animal husbandry, animal housing, animal feeding, animal health, breeding goals.

Vermi compost: Introduction, vermi composting material, species of earthworms, small scale, large scale composting process. Vermo castings, harvesting, processing and drying. Nutrient content of vermi compost. Field application methods.

## **UNIT V: Biofertilizers**

Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia. Cyanobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Mechanism of nitrogen fixation and phosphorus solubilization.

### **REFERENCES:**

1. Principles of Organic Farming:: by E Somasundaram,D Udhaya Nandhini,M Meyyappan ;2021
2. Organic farming in India:: by Arpita Mukherjee; 2017
3. Biofertilizer and biocontrol agents for agriculture;; by AM Pirttilä · 2021
4. Trends in Organic Farming in India;; by S. S. Purohit, 2006
5. Biofertilizers for Sustainable Agriculture and Environment;; by Bhoopander Giri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019



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

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

CourseCode	<b>Paper – 7B - BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION</b>				
Teaching	<b>Hours Allocated: 60 (Theory)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:		3	-	-	4

**Learning outcomes:**

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

1. Understand the importance of bio fertilizers for sustainable agriculture.
2. Appreciate the role of VAM in P solubilization
3. Define bio pesticide and its nature
4. Produce bio fertilizers and bio pesticides on large scale
5. Able to prepare inoculums for field application

**UNIT I: Bio fertilizers**

Introduction, history, concept, scope of bio fertilizers in India. Classification, microorganisms used as bio fertilizers. Bacterial, fungal and algal bio fertilizers. Symbiotic and a symbiotic microorganisms. Mechanism of nodulation and nitrogen fixation.

**UNIT II: Mycorrhizal bio fertilizers**

Importance, types, characteristic features of ecto and endo mycorrhiza. Mechanism of phosphorus solubilization. Uptake of phosphates by the roots. Consortium based inoculums and significance.

**UNIT III: Bio pesticides**

Definition, concept, history, scope and importance of biopesticides.

Classification - botanicals, bacterial, fungal and viral based biopesticides. Mechanism of action of Bacillus thuringiensis and Trichoderma viridae as bio control agents.

**UNIT IV: Mass production techniques**

Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques, purification and identification of microorganisms used as bio fertilizers and bio pesticides. Mass production and packing techniques.

## **UNIT V:Field application methods**


Preparation of carrier based inoculum. Sphagnum, peat, vermiculite as inoculums carriers. Dosage standardisation. Seed treatment, foliar application, root dressing and soil application techniques.

Storage and maintenance of inoculum.

### **REFERENCES:**

1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P. Hyma
2. Biofertilizers Technology, 2010, by S. Kaniyan, K. Kumar and K. Govinda rajan
3. Biofertilizers for Sustainable Agriculture, 2017; by Arun K Sharma
4. Advances In Plant Biopesticides 2021, by Dwijendra Singh, Springer India
5. A Textbook of Integrated Pest Management, 2013 by Ram Singh & Vikas Jindal G.S.

Dhaliwal

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>		<b>Program &amp; Semester III B.Sc Semester -V</b>			
Course Code	<b>Paper – 6C - APICULTURE</b>					
Teaching	<b>Hours Allocated: 60 (Theory)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:			3	-	-	4

### 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.

### 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.

### REFERENCES:

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, Illinois.
3. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication New Delhi.
4. Singh, S. (1971) Beekeeping in India, ICAR publication..
5. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.
6. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, New Delhi

	<b>Pithapur Rajah's Government College (Autonomous) Kakinada</b>		<b>Program &amp; Semester III B.Sc Semester -V</b>			
CourseCode	<b>Paper – 7C - PEARL CULTURE</b>					
Teaching	<b>Hours Allocated: 60 (Theory)</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
Pre-requisites:			3	-	-	4

### Learning outcomes

Students after successful completion of the course will be able to

1. Understand the basic concept of pearl culture.
  2. Obtain the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.
  3. Acquaint with the various types of implantation methods and pearl culture surgery techniques.
2. 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.

**REFERENCES:**

1. Haws Maria (2002). The basics of pearl farming: a Layman's manual: (U.S.A). CTSA publications.
2. Alexander E .Farn (1986) pearls :(U.S.A.).Butterworth Heinemann publications.
3. Le Jia Li (2014) new technologies to promote freshwater pearl culture (China) Ocean Press publications.
4. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and Sorting of Pearl. Marketing and economics concerned with Pearl Culture. Generation marine organisms
5. David Dobilet (1995) Pearl farming (Australia) Nat Geographic Mag publication
6. Yuan Cha Da (2014) Environmental effects Pearl farming (China) Jiangxi People publishing house