PITHAPUR RAJAH'S GOVERNMENT COLLEGE

(AUTONOMOUS)

NAAC A GRADE

KAKINADA

XXIII–BOARD OF STUDIES

DEPARTMENT OF BIOTECHNOLOGY

2023-24

(CHOICE BASED CREDIT SYSTEM)

P.R.GOVT.COLLEGE (AUTONOMOUS)
2023-24, 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 thefollowing Resolutions.

Resolution I: Resolved to implement the Four-year honours degree programme in biotechnology from this academic year 2023-24.

Resolution II: Resolved to implement the single major system prescribed by APSCHE in the four years honours degree programme.

Resolution III: Resolved to follow three major system for the second the third-year students.

Resolution IV: Resolve to offer Biotechnology minor from this academic year.

Resolution V: Resolved to continue 50% external and 50% internal marks for theory for all semesters from the academic year 2023-24. 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: Resloved 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 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 X: It is mandatory that each student has to complete one MOOCS 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: Resolve 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 the semesters.

Resolution XIV: Resolved to offer certificate course in Bioinformatics by biotechnology department.

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

G.P. Chairperson
31/8/2023

Chairperson
Board of Studies

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (A)

2023-24, XXII 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 2023-24

S.No	Title of the new course	Programmes in which it is introduced
1	Introduction to Classical Biology	I B.Sc Biotechnology (Honors)
2	Introduction to Applied Biology	I B.Sc Biotechnology (Honors)
3	Microbiology & Cell Biology	I B.Sc Biotechnology (Honors)
4	Apiculture	III B.Sc Biotechnology
5	Pearl Culture	III B.Sc Biotechnology

B. Nageshwari 31/08/2023

University Nominee

G.P. [illegible] 31/8/2023

Chairperson
Board of Studies

DEPARTMNENT 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	**Paper – I** - Introduction to Classical Biology	**Theory**	**5**	**50**	**50**	**4**
2		**Paper – II** - Introduction to Applied Biology	**Theory**	**5**	**50**	**50**	**4**
3	II	**Paper – III** - Biomolecules and Analytical Techniques	**Theory**	**3**	**50**	**50**	**3**
4		Biomolecules and Analytical Techniques	**Lab**	**2**	**50**	**-**	**1**
		Paper – IV - 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	**Paper – III** - Immunology and rDNA technology	**Theory**	**4**	**50**	**50**	**4**
6		Immunology and rDNA technology Lab	**Lab**	**2**	**50**	**-**	**1**
7	IV	**Paper – IV** - Plant and Animal Biotechnology	**Theory**	**4**	**50**	**50**	**4**
8		Plant and Animal Biotechnology Lab	**Lab**	**2**	**50**	**-**	**1**
9		**Paper – V** - Environmental &Industrial Biotechnology	**Theory**	**4**	**50**	**50**	**4**
10		Environmental &Industrial Biotechnology Lab	**Lab**	**2**	**50**	**-**	**1**
11	V	**Paper – 6A** - Techniques in Nursery Development	**Theory**	**4**	**50**	**50**	**4**
12		Techniques in Nursery Development Lab	**Lab**	**2**	**50**	**-**	**1**
13		**Paper – 7A** - Hydroponics Cultivation	**Theory**	**4**	**50**	**50**	**4**
14		Hydroponics Cultivation Lab	**Lab**	**2**	**50**	**-**	**1**
		(Or)					
15	V	**Paper – 6B** - Organic Farming	**Theory**	**4**	**50**	**50**	**4**
16		Organic farming Lab	**Lab**	**2**	**50**	**-**	**1**
17		**Paper – 7B** - Biofertilizers and Biopesticides production	**Theory**	**4**	**50**	**50**	**4**
18		Bio fertilizers and Bio pesticides Production Lab	**Lab**	**2**	**50**	**-**	**1**
(Or)							
19		**Paper – 6C** - Apiculture	**Theory**	**4**	**50**	**50**	**4**
20		Apiculture Lab	**Lab**	**4**	**50**	**-**	**1**
21		**Paper – 7C** - Pearl Culture	**Theory**	**4**	**50**	**50**	**4**
22		Pearl Culture Lab	**Lab**	**4**	**50**	**-**	**1**

PITHAPUR RAJA'S GOVERNMENT COLLEGE

KAKINADA

DEPARTMENT OF BIOTECHNOLOGY

LIST OF EXAMINERS

S.NO	NAME OF THE LECTURER	NAME OF THE COLLEGE
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

PITHAPUR RAJA'S GOVERNMENT COLLEGE
KAKINADA.
DEPARTMENT OF BIOTECHNOLOGY
XXIII-BOARD OF STUDIES MEETING 2023-24

Time: 10.30 A.M. **Date: 31.08.2023**

Venue: ***Department of Biotechnology***

The XXIII BOARD OF STUDIES Meeting of the Department of Biotechnology took place 10.30 A.M. on 31.08.2023 in the Department of Biotechnology P.R. Govt. College, (A) Kakinada for the year 2023-24. The following members attended.

S. No	Name of the Person	Designation	Signature
1	Sri G P Chakravarthi Lecturer In-Charge Dept. of Biotechnology Kakinada.	Chair Person	G.P.C 31/8/23
2	Dr B Nageswari Government Arts College Rajamahendravaram	University Nominee	B. Nageshwari 31/08/2023
3	D. Jayasree Lecturer A.S.D. Govt. College (W) Kakinada.	Subject Expert	D. Jayasree 31/8/23
4	B. Preethi Chandrakala Lecturer Rajiv Gandhi Institute of Sciences Kakinada.	Subject Expert	B. Preethi
5	Dr A Sreenivasulu Director V.S. Lakshmi Research Center Kakinada.	Industry / Research Expert	
6	Sri GNV Satish	Member	G.N.V.S.
7	V. Naga Eswari	Student Alumini	
8	S. Sanjay Deepak II BtZC	Student member	S. sanjay deepak.
9	M. Veerakumar Reddy II BtZC	Student member	M. Veerakumar Reddy
10	M Amrutha sree I BtZC	Student member	M. Amrutha Sree

13/09/2023 11:05

	Pithapur Rajah's Government College (Autonomous) Kakinada	Program &Semester I B.Sc Semester -I			
CourseCode	Introduction to Classical Biology				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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. 2nd Edition. McGraw Hill publishers.

2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th 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. 4th 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. 4th 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. 5th Edition. Pearson publishers.

9. Subrata Sen Gupta, 2014. Organic chemistry. 1st 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	**INTRODUCTION TO APPLIED BIOLOGY**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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. Measures of central tendency – Mean, Median, Mode.

5.2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

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. 11th Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th 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. 1st 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. 5th Edition. Oxford publishers.

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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 -II			
Course Code	**BIOMOLECULES AND ANALYTICAL TECHNIQUES**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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 Classification, structure, properties of carbohydrates, amino acids, peptide bond and peptides.

1.2 Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins.

1.3 Denaturation and renaturation of proteins

1.4 Classification structure and properties of saturated and unsaturated fatty acids.

Unit-II- Nucleic acid, Vitamins, and Bioenergetics

2.1 Structure and functions of DNA and RNA.

2.2 Source, structure, biological role, and deficiency manifestation of vitamin A, B, C, D, E, and K.

2.3 Free energy, entropy, enthalpy, and redox potential.

2.4 High energy compounds, Electron-Transport System and Oxidative Phosphorylation.

Unit-III-Centrifugation, Chromatography, and Electrophoresis

3.1 Basic principles of sedimentation and types of centrifugations.

3.2 Principle, instrumentation, and application of partition, absorption, paper, TLC, ion exchange, gel permeation, and affinity chromatography.

3.3 Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE).

3.4 Introduction to 2D & Isoelectric Focusing.

Unit - IV-Spectroscopy, Microscopy and Laser Techniques

4.1 Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric calorimeter and UV-visible spectrophotometer. Introduction to crystallography and application.

4.2 Types and design of microscopes - compound, phase contrast, fluorescent

4.3 Electron microscopy (TEM, SEM).

4.4 Introduction to radioisotopes, measurement of radioactivity (scintillation counter and autoradiography.

Unit –V- Biostatistics

5.1 Mean, median, mode

5.2 Standard deviation

5.3 One-way ANOVA, Two-way ANOVA

5.4 t-test, F-test and chi-square.

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 Quantitaive 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

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 form 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	**BIOMOLECULES AND ANALYTICAL TECHNIQUES**				
Teaching	**Hours Allocated: 45 (Lab)**	**L**	**T**	**P**	**C**
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, 1st edition, (2001), Gary Walsch; Wiley, USA

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester I B.Sc Semester -II**			
CourseCode	**MICROBIOLOGY, CELL BIOLOGY**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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.

1.3 Pure culture techniques.

1.4 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).

2.3 Structure, infection, diagnosis and treatment of and SARS- CoV 2

2.4 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

3.4 Cell division – 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 Genome organization of prokaryotic organism

5.2 Genome organization of eukaryotic organisms

5.3 Enzymes involved in Replication, Transcription, and Translation

5.4 DNA repair Mechanism

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 microrganisms from different sources
3. Learn about staining techniques and biochemical identification of bacteria
4. Learn about different stages of cell division

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester I B.Sc Semester -II			
CourseCode	**MICROBIOLOGY, CELL BIOLOGY**				
Teaching	**Hours Allocated: 40 (Theory)**	**L**	**T**	**P**	**C**
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
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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,

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.

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester II B.Sc Semester -III**			
CourseCode	**IMMUNOLOGY AND rDNA TECHNOLOGY**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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, Immunogen, Hapten, Characteristics of immunogen.

1.4 Structure and types of Antibody.

1.5 Structure and function of MHC.

UNIT-II:

Vaccinology and clinical immunology:

2.1 Vaccines - Live, killed, attenuated, subunit and recombinant vaccines.

2.2 Hybridoma technology - Monoclonal antibodies and their application.

2.3 Antigen and antibody interactions I - Precipitation, agglutination,

2.4 Antigen and antibody interactions II - Immuno diffusion and ELISA.

2.5 Types of Hypersensitivity.

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, Likers and adapters).

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 and Western Blotting

4.3 . Introduction to DNA sequencing (Sanger Sequencing).

4.4 DNA fingerprinting.

4.5 Application of rDNA technology in molecular genetics.

UNIT – V

Bioinformatics:

5.1 Nucleotide and protein Databases (PubMed, NCBI, EMBL and ExPASy)

5.2 BLAST

5.3 Phylogenetic tree construction.

5.4 Introduction to omics (proteomics, genomics and transcriptomics)

5.5 Introduction to nano technology.

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 andApplications of recombinant DNA. ASM Press, Washington

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	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 form 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 different types of hypersensitivity.

PART – II

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

7. Antigens
8. Immunodiffusion
9. Plasmids
10. Sanger sequencing
11. BLAST
12. Restriction enzymes.
13. Thymus.

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester II B.Sc Semester -III**			
CourseCode	IMMUNOLOGY AND rDNA TECHNOLOGY				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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. Radial immune diffusion
5. Dot - ELISA
6. Isolation of plasmid DNA (alkaline lysis method)
7. Analysis of plasmid DNA by Agarose gel electrophoresis
8. Lymphoid organs (theory exercise).
9. Southern blotting (theory exercise).
10. PCR Amplification (theory exercise).

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

MODEL QUESTION PAPER

UG DEGREE EXAMINATIONS

Semester: III

Course 3: Immunology and rDNA technology Lab

Exam: 2 hrs **Max Marks: 50M**

1. Write principle and procedure for isolation of plasmid DNA and carryout experiment 20M

2. Determination of blood groups 10M

3. Identify the spotters 5 x2 =10M

    1) Lymhoid organs

    2) Cosmids

    3) ELISA

    4) BLAST

    5)RIA

4. Record 5M

5. Viva-voce 5M

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester II B.Sc Semester -IV**
CourseCode	**PLANT AND ANIMAL BIOTECHNOLOGY**	

Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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: Introduction, totipotency, dedifferentiation and redifferentiation.

1.2 Media preparation – nutrients and plant hormones

1.3 Sterilization techniques

1.4 Establishment of cultures – callus culture, cell suspension culture, Micro propagation, Somatic embryogenesis.

1.5 Plant secondary metabolites – concept and their importance.

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 Herbicide resistance – glyphosate,

2.4 Insect resistance- Bt cotton.

2.5 Molecular markers- RAPD, RFLP and AFLP.

UNIT-III:

Animal tissue culture techniques:

3.1 Facilities for animal cell culture

3.2 Culture media for animal cells.

3.3 Types of cell culture - Primary culture, secondary culture and Cell lines

3.4, Stem cell cultures;

3.5 Cell viability and cytotoxicity tests, Cryopreservation.

UNIT-IV:

Transgenic animals & Gene Therapy:

4.1 Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

4.2 Production of Recombinant insulin and Hepatitis B Vaccine

4.3 IVF

4.4 Gene therapy and retroviral vectors in gene therapy

4.5 Concept of transgenic animals – Merits and demerits

UNIT – V

Bioethics, Biosafety and IPR:

5.1 Bioethics in cloning and stem cell research.

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 Gottllieb "Stem cell Biology" edited by Daniel 2001,Cold Spring Harbour Laboratory press, New York.

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 form 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. Write an essay on stem cell cultures.

SECTION – B

4. Explain the process of gene therapy.
5. Explain the methods of transfection in animal cells.
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.
13. Plant secondary metabolites.

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester II B.Sc Semester -IV			
CourseCode	**PLANT AND ANIMAL BIOTECHNOLOGY**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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. Explant sterilization.
3. Induction of callus from Carrot.
4. Plant propagation through shoot tip culture.
5. Establishing a plant cell culture in solid media.
6. Establishing a plant cell culture in liquid media.
7. Cell count by hemacytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Estimation of cell viability by dye exclusion by Trypan blue.
10. ELISA – Demonstration.

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

UG DEGREE EXAMINATIONS

Semester: IV

Course 4: Plant and Animal Biotechnology Lab

Time: 3Hrs **Max Marks: 50M**

1. Write procedure for process of callus induction from different explants 20M
2. Suspension cultures 10M
3. Spotters 2 x 5 = 10M
   1) RFLP
   2) Bt-Cotton
   3) Bioreactor
   4) Plasmid
   5) Chick embryo fibroblast
4. Record 5M
5. Viva 5M

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester II B.Sc Semester -IV			
CourseCode	**ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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

SkillDevelopment			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 tricklingfilter.

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-bioethanol - introduction

3.2 Production of bioethanol.

3.3 Bioethanol Recovery and future directions for research and development.

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 (Glutamicacid, Lysine).

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:

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

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	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 form each section.

SECTION – A **3 X 10 = 30 Marks**

1. Write an essay biological methods of controlling air pollution.
2. Explain the Bioremediation of hydrocarbons.
3. Explain the production mechanism of bioethanol.

SECTION – B

4. Explain the methods of screening for 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. Anaerobic digesters
8. Phytoremediation
9. Biofertilizers
10. Oxidation ponds
11. Preservation techniques
12. Wine production.
13. Design of fermenter.

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester II B.Sc Semester -IV			
CourseCode	**ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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 α – amylase from Bacillus Spp. by shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Production of citric acid by submerged fermentation

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester II B.Sc Semester -IV**			
CourseCode	**ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
Pre-requisites:		-	-	2	1

MODEL QUESTION PAPER

UG DEGREE EXAMINATIONS

Semester: IV

Course-5: Environmental & Industrial Biotechnology Lab

Time: 2 Hrs Max Marks: 50M

1. Write procedure for BOD determination and carryout experiment 20M

2. Write procedure for determination of hardness of water 10M

3. Spotters 2 x 5 = 10M

   1) Fermenter

   2) Principle of wine preparation

   3) Identify given product from the spotter

   4) Biodegradation principle

   5) Identify structure of amino acid

4. Record 5M

5. Viva 5M

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester III B.Sc Semester -V**			
CourseCode	**TECHNIQUES IN NURSERY DEVELOPMENT**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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	

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

3.1 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 managemnet.
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-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
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

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.

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester III B.Sc Semester -V			
CourseCode	**TECHNIQUES IN NURSERY DEVELOPMENT**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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	**TECHNIQUES IN NURSERY DEVELOPMENT**				
Teaching	**Hours Allocated: 30 (Lab)**	**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

	Pithapur Rajah's Government College(Autonomous)Kakinada	**Program &Semester III B.Sc Semester -V**			
CourseCode	**HYDROPONICS CULTIVATION**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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_2, 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 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 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 NewYork.4th Edition
5. Howard M. Resh. Hobby Hydoponics. CRC Press, USA.

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
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	3	2	3	3	3	2	2	2	3	2	3	3	2
CO4	2	3	3	2	2	2	2	3	2	3	1	1	1

P.R. GOVERNMENT COLLEGE (A): KAKINADA

Semester-V

HYDROPONICS CULTIVATION

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 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	**HYDROPONICS CULTIVATION**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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.

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester III B.Sc Semester -V			
CourseCode	**HYDROPONICS CULTIVATION**				
Teaching	**Hours Allocated: 30 (Lab)**	**L**	**T**	**P**	**C**
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

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester III B.Sc Semester -V			
CourseCode	**Paper – 6B - ORGANIC FARMING**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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. Vermi 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 fertilizersAzospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia. Cynobacterial 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. Biofertizer 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	**Paper – 7B - BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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 byDr. 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, 2013by Ram Singh & Vikas Jindal G.S. Dhaliwal

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester III B.Sc Semester -V			
CourseCode	**Paper – 6C - APICULTURE**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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 Hon- ey (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 agri- culture. 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, IIIinois.
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, NewDelhi

	Pithapur Rajah's Government College(Autonomous)Kakinada	Program &Semester III B.Sc Semester -V			
CourseCode	**Paper – 7C - PEARL CULTURE**				
Teaching	**Hours Allocated: 60 (Theory)**	**L**	**T**	**P**	**C**
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.

4. 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