2023-24

# GOVERNMENT COLLEGE FOR WOMEN(A) GUNTUR

# COURSE INFORMATION BOOKLET

## DEPARTMENT OF BIOTECHNOLOGY

# DEPARTMENT OF BIOTECHNOLOGY

## VISION

To cultivate graduates equipped with comprehensive education and practical skills in biotechnology, fostering their ability to innovatively and responsibly contribute to the environment and society, while advancing knowledge and understanding in the field.

## MISSION

- **To** provide students with a comprehensive understanding of biotechnology, encouraging innovative and critical thinking to solve real-world problems.

- **To** equip students with practical skills through hands-on lab training, specialized courses, and industry-relevant programs for future career success.

- **To** prioritize high-quality teaching and promote strong industry connections, ensuring students gain valuable experience through internships and research opportunities.

- **To** foster a holistic learning environment that supports ethical values, social responsibility, and teamwork through active participation in co-curricular and extracurricular activities.

- **To** encourage a spirit of scientific inquiry and lifelong learning, preparing students to contribute meaningfully to advancements in biotechnology and related fields.

# Program Specific Outcomes: B.Sc. Biotechnology

Biotechnology has made significant advances in recent years and emerged as a frontline area of research and development, with an overwhelming impact on the society.

Upon completion of the B.Sc. in Biotechnology, students will be able to:

1. PSO 1: Demonstrate in-depth knowledge of key concepts in Biotechnology, Botany, Zoology and Chemistry concepts in pursuing higher studies in Biotechnology and its allied areas.
2. PSO 2: Comprehensive understanding of biomolecules and their properties, microbes and their laboratory protocols along with proficiency in utilizing microbial, biophysical and biochemical techniques for the characterization and validation.
3. PSO 3: Command on the principles of r-DNA Technology and equippe with the knowledge and skills to apply biotechnological principles in various fields which helps in employment.

## Subject: BIOTECHNOLOGY

## w.e.f. AY 2023-24 COURSE STRUCTURE

## MINOR

| Year | Semester | Course | Title of the Course | No. of Hrs /Week | No. of Credits |
|---|---|---|---|---|---|
| I | II | 1 | Biomolecules and Analytical Techniques – (T) | 3 | 3 |
| | | | Biomolecules and Analytical Techniques – (P) | 2 | 1 |
| II | III | 2 | Plant and Animal Biotechnology - (T) | 3 | 3 |
| | | | Plant and Animal Biotechnology – (P) | 2 | 1 |
| | IV | 3 | Immunology – (T) | 3 | 3 |
| | | | Immunology – (P) | 2 | 1 |
| | | 4 | Bioinformatics and Biostatistics – (T) | 3 | 3 |
| | | | Bioinformatics and Biostatistics – (P) | 2 | 1 |
| III | V | 5 | Industrial Biotechnology – (T) | 3 | 3 |
| | | | Industrial Biotechnology – (P) | 2 | 1 |
| | | 6 | Food & Nutritional Biotechnology – (T) | 3 | 3 |
| | | | Food & Nutritional Biotechnology – (P) | 2 | 1 |

## B.Sc. Biotechnology - Course Structure

**(*with effect from the Academic Year 2020-21*)**

| SEMESTER | TITLE OF THE PAPER |
|---|---|
| I | Bio-Molecules & Analytical Techniques |
| II | Microbiology, Cell & Molecular Biology |
| III | Immunology & r-DNA Technology |
| IV | (i) Plant & AnimalBiotechnology |
| | (ii) Environmental & Industrial Biotechnology |

## Skill Enhancement Courses (SECs) for Semester V, from 2022-23 (Syllabus-Curriculum)

### Structure of SECs for Semester – V

***(To choose One pair from the Three alternate pairs of SECs)***

| **Courses 6&7** | **Name of Course** | **Th. Hrs/** We Ek | **IE Marks** | **EE Mar** ks | **Credits** | **Prac. Hrs/wk** | **Marks** | **Credits** |
|---|---|---|---|---|---|---|---|---|
| 6A | Techniques in nursery Development | 3 | 30 | 70 | 3 | 3 | 50 | 2 |
| 7A | Hydroponics Cultivation | 3 | 30 | 70 | 3 | 3 | 50 | 2 |

OR

| Courses 6&7 | Name of Course | Th. Hrs/ Week | IE Marks | EE Marks | Credits | Prac. Hrs/wk | Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 6B | Organic Farming | 3 | 30 | 70 | 3 | 3 | 50 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7B | Bio fertilizers and<br><br>Bio pesticides production | 3 | 30 | 70 | 3 | 3 | 50 | 2 |

OR

| Courses 6&7 | Name of Course | Th. Hrs/ Week | IE Mark s | EE Mar ks | Credits | Prac. Hrs/wk | Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| 6C | Apiculture | 3 | 30 | 70 | 3 | 3 | 50 | 2 |
| 7C | Pearl Culture | 3 | 30 | 70 | 3 | 3 | 50 | 2 |

Note-1: For Semester–V, for the domain subject Biotechnology any, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C. The pair shall not be broken (ABCD allotment is random, not on any priority basis).

Note-2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented.

Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations

## ASSESSMENT COMPONETS (2023-24)

## I year Assessment in the ration of 60:40

## Continuous Internal Assessment for I Year:

Mid Semester 1= 25 marks

Mid Semester 2= 25 marks

5 Assignments= 20 marks

Semesnars/ Project/GD/Quiz= 10 marks

Total 80 marks scaled down to 40 marks

## Semester End Examination for I Year:

Section 1: 5x4=20marks (5 out of 8 without internal choice)

Section 2: 5x8= 40 marks (5 out of 8 with internal choice from each unit)

## II & III year Assessment in the ration of 70:30

## Continuous Internal Assessment for II & III Year:

Mid Semester 1= 20 marks

Mid Semester 2= 20 marks

5 Assignments= 10 marks

Seminars/ Project/GD/Quiz= 10 marks

Total 60 marks scaled down to 30 marks

## Semester End Examination for III Year:

Section 1: 5x2=10marks (5 out of 8 without internal choice)

Section 2: 5x4=20marks (5 out of 8 without internal choice)

Section 3: 5x8= 40 marks (5 out of 8 with internal choice from each unit)

## SEMESTER-II

# COURSE 1: BIOMOLECULES AND ANALYTICAL TECHNIQUES

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Theory Credits: 3 3 hrs/week

## I. COURSE OUTCOMES

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

1. Demonstrate a comprehensive understanding of the fundamental principles and structures of bioorganic compounds, including carbohydrates, proteins, lipids, nucleic acids, vitamins, and their functions in biological systems.
2. Apply knowledge of various separation and analytical techniques, such as centrifugation, chromatography, electrophoresis, spectroscopy, microscopy, and PCR, for the qualitative and quantitative analysis of biomolecules and their applications in research and diagnostics.
3. Gain proficiency in basic statistical techniques, including descriptive statistics, analysis of variance, t-tests, and chi-square tests, to interpret and analyze experimental data, making informed decisions in biochemical and biotechnological research

## I. Syllabus

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

1. Classification, structure, properties of carbohydrates, amino acids, peptide bond and peptides.
2. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins.Denaturation and renaturation of proteins.
3. Classification structure and properties of saturated and unsaturated fatty acids.

### Unit-II- Nucleic acid, Vitamins, and Bioenergetics

1. Structure and functions of DNA and RNA.
2. Source, structure, biological role, and deficiency manifestation of vitamin A, B, C, D, E, and K.
3. Free energy, entropy, enthalpy, and redox potential.High energy compounds.
4. Glycolysis, Krebs cycle, Electron-Transport System and Oxidative Phosphorylation.

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

1. Basic principles of sedimentation and types of centrifugations.
2. Principle, instrumentation, and application of partition, absorption, paper, TLC, ion exchange,gel permeation, and affinity chromatography.
3. Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE). Introduction to 2D & Isoelectric Focusing.

## Unit - IV-Spectroscopy, Microscopy and PCR

1. Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application of photoelectric calorimeter and UV-visible spectrophotometer.
2. Types and design of microscopes - compound, phase contrast, fluorescent electron microscopy (TEM, SEM).
3. PCR: Principle, Types and applications of PCR

## Unit –V- Biostatistics

1. Mean, median, mode, standard deviation,
2. One-way ANOVA, Two-way Anova
3. 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

## SEMESTER-II

## COURSE 1: BIOMOLECULES AND ANALYTICAL TECHNIQUES

Practical Credits: 1 2 hrs/week

1. Introduction to basic instruments (Principle standard operation procedure) demonstration andrecord
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

## V. 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 andSons, 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 McGrawHill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods,1st Edition, (1995), S.Sadashivam, A.Manickam; New Age InternationalPublishers, 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
**10.** Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
**11.** Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K.Upadhyay, and N. Nath
**12.** Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher:Horwood Pub. Co., England.
**13.** Analytical Biochemistry, 3rdedition, (1998), David Holmes, H.Peck, Prentice-Hall, UK
**14.** Introductory Biostatistics, 1st edition, (2003), Chap T. Le; John Wiley, USA.
**15.** Methods in Biostatistics, (2002), B. K. Mahajan –Jaypee Brothers.
**16.** Statistical methods in biology, (1995), Bailey, N. T.; Cambridge university press

## VI. CO-Curricular Activities

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts preparation on vitamins

**GOVERNMENT COLLEGE FOR WOMEN (A) GUNTUR**

**B.sc Biotechnology semester II -2023-24**

# Paper I: BIOMOLECULES AND ANALYTICAL TECHNIQUES

**Model question paper**

**Time:3Hrs** **Marks:60M**

## Section:A

**l.Answer any 5 questions each question carries 4M** **5×4=20M**

1. Explain Glycolysis.
2. Define the Density gradient centrifugation.
3. Describe the Compound microscope.
4. Extend Real time PCR.
5. Write about Standard deviation.
6. Discuss Isoelectric focusing.
7. What are Saturated fatty acids
8. Describe the principle of TLC

## Section: B

**ll Answer the following questions** **5×8=40**

9 .a) Give an account on structural classification and properties of amino acids.

(Or)

b) Describe the structural classification and properties of carbohydrates.

10.a) Outline the TCA cycle.

(Or)

b) Write about structure and functions of DNA.

11.a) Describe the separation of the compounds by using paper chromatography.

(Or)

b) Write about SDS- PAGE Electrophoresis.

12.a) Define Beer – Lambert's law and applications of UV – visible spectrophotometer.

(Or)

b) Illustrate the principle and procedure of PCR.

12.Explain the following:

a) Mean, Median.

(Or)

b) Anova.

## SEMESTER-III

# COURSE 2: PLANT AND ANIMAL BIOTECHNOLOGY

Theory Credits: 3 3 hrs/week

## I. COURSE OUTCOMES

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

1. Understand the principles and applications of plant tissue culture techniques, including micropropagation and somatic embryogenesis, along with the importance of secondary metabolites in plants.
2. Proficiency in plant transformation technology, transgenic plant production, and the application of molecular markers (RAPD, RFLP) for genetic analysis.
3. Develop practical skills in animal tissue culture, transfection methods, and gain insights into the ethical considerations of biotechnology, biosafety measures, and intellectual property rights.

## II. Syllabus

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

1. totipotency, media preparation – nutrients and plant hormones; sterilization techniques; establishment of cultures – callus culture, cell suspension culture
2. applications of tissue culture-micro propagation; Somatic embryogenesis
3. synthetic seed production; protoplast culture and somatic hybridization - applications. Cryopreservation, Plant secondary metabolites- concept and their importance

### Unit – II_Transgenesis and Molecular markers

1. Plant transformation technology—Agrobacterium-mediated Gene

transfer (Ti plasmid), hairy root features of Ri plasmid, Transgenic plants as bioreactors.

2. Herbicide resistance – glyphosate, Insect resistance- Bt cotton

3. Molecular markers - RAPD, RFLP and DNA fingerprinting-principles and applications.

## Unit – III Animal tissue culture techniques

1. cell culture media and reagents; culture of mammalian cells, tissues and organs; primary culture,secondary culture, cell lines,stem cell cultures;
2. Tests: cell viability and cytotoxicity, Cryopreservation.
3. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) andapplications.

## Unit – IV Transgenic animals & Gene Therapy

1. Production of vaccines, diagnostics, hormones and other recombinant DNA products inmedicine (insulin, somatostatin, vaccines),IVF in animals
2. Concept of Gene therapy,
3. Concept of transgenic animals – Merits and demerits

## Unit V Bioethics, Biosafety and IPR

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

## III . Skills Outcome

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

1. Learn about different plant tissue media
2. Learn about the induction of callus from explants
3. Learn about plant propagation of through various tissue culture
4. Learn about cell lines
5. Learn about cell viability by various methods

## SEMESTER-III

## COURSE 2: PLANT AND ANIMAL BIOTECHNOLOGY

Practical Credits: 1 2 hrs/week

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

## V. REFERENCES


1. 1..Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers
2. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
4. Biotechnology – By U. Satyanarayana ;1997
5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A.Reinhard ,2001
6. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers

7. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing

8. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications

9. R. Ian Freshney, "Culture of animal cells – A manual of basic techniques" 4th edition, John Wiley &Sons, 2000 ,Inc, publication, New York
10. Daniel R. Marshak, Richard L. Gardner, David Gottllieb "Stem cell Biology" edited by Daniel2001,Cold Spring Harbour Laboratory press, New York
11. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.

## VI. CO-Curricular Activities

a) **Suggested C0-Curricular Activities**

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on different medias
4. Visit to plant tissue culture lab

**GOVERNMENT COLLEGE FOR WOMEN (A) GUNTUR**

**B.sc Biotechnology semester III -2023-24**

**Minor Paper: Plant & Animal Biotechnology**

**Model question paper**

**Time:3Hrs** **Marks:60M**

**Section:A**

**I. Answer any 5 questions. Each question carries 4M.** **5×4=**20M

1. Describe MS Medium
2. Explain Suspension culture
3. Discuss the importance of Bt Cotton
4. Elaborate the mechanism of Micro injection
5. Summarize the production of recombinant Insulin
6. Explain Micro Propagation
7. Define Animal rights
8. Explain Edible Vaccines

**Section-B**

**III. Answer the following questions.** **5×8=40M**

9. a) Explain different types of Sterilization techniques

(Or)

b) Describe the composition &Preparation of Callus Culture

10. Illustrate the following:

a) Ti plasmid

Ri plasmid

(or)

b) RAPD

RFLP

11. a) Give an detail account on Animal cell culture

(Or)

b) Calcium phosphate precipitation

Electroporation

12. a) Give an detail account on IVF

(Or)

b) Write about Gene therapy

13. a) Explain Bioethics in Cloning &Stem Cell research

(Or)

b) Define Bio safety? Write Primary Containment for biohazards.

**B.Sc., Biotechnology: Choice based credit system**

**B.Sc., -III- Semester W.E.F. 2023-24**

# Immunology and rDNA technology

**Course Code – BT405-3**

## Course outcomes:

1. Gain a comprehensive understanding of immune system concepts, cells, and organs, including antigen-antibody interactions, innate and adaptive immunity, and the role of complement components, MHC, and cytokines.
2. Develop knowledge of vaccinology and clinical immunology, including various types of vaccines, adjuvants, and techniques like hybridoma technology and ELISA for immunodiagnosis. Introduction to hypersensitivity and autoimmunity.
3. Acquire expertise in rDNA technology, including cloning steps, tools (cloning vectors, enzymes), PCR, Southern Blotting, and DNA sequencing. Understand cloning strategies, cDNA libraries, transformation methods, and the application of rDNA technology in agriculture and medicine. Additionally, gain insights into bioinformatics tools, databases, BLAST analysis, phylogenetic tree construction, and the concept of omics.

## Unit- I Concepts, Cells and Organs of the Immune System

Terminology, antigen, hapten, antibody (types), antigenicity, immunogenicity and types of immunity. Innate and adaptive immunity. Hematopoiesis, organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines). Introduction to complement

components,MHC. Basic concepts of humoral and cell-mediated immune response.

## Unit-II-Vaccinology and Clinical Immunology

Live, killed, attenuated, subunit and recombinant vaccines. Role and properties of adjuvants. Hybridoma technology, monoclonal antibodies and their application in immunodiagnosis. Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA. Introduction to hypersensitivity and autoimmunity.

## Unit-III- Introduction, Tools and Techniques of rDNA Technology

Introduction to rDNA technology, steps involved in cloning, tools of genetic engineering (Cloning vectors - plasmids and cosmids, Enzymes – restriction endonucleases and DNA Ligase, Principles and application of PCR. Southern Blotting. Introduction to DNA sequencing (Sanger Sequencing).

## Unit-IV-Cloning Strategies and Application of rDNA Technology

cDNA library, construction, methods of transformation, recombinant selection and screening methods. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis)

## Unit-V-Bioinformatics

Databases (PubMed, NCBI, EMBL and ExPASy), nucleotide and protein BLAST analysis, and phylogenetic tree construction. Introduction to omics (proteomics, genomics and transcriptomics).

## List of Practicals:-

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ocuteroloney immunodiffusion
5. Radial immune diffusion
6. ELISA
7. Production of antibodies (theory exercise)
8. Bleeding, separation of serum and storage
9. Lymphoid organs (theory exercise)
10. Isolation of plasmid DNA (alkaline lysis method)
11. Analysis of plasmid DNA by Agarose gel electrophoresis
12. Southern blotting (theory exercise)
13. PCR Amplification (theory exercise)

## Textbooks forImmunology and rDNA technology


1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House
6. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
7. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
8. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
9. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
10. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
11. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
12. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
13. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.

14. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution.

Elsevier Academic Press, USA.

15. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington

16. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

17. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

18. Introduction to Bioinformatics – 2007, By V. Kothekar

19. Introduction to Bioinformatics – 2013, By Arthur M. Lesk

20. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press

21. Biological Sequence Analysis: 1st Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press

22. Bioinformatics: 2004, A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience

23. Bioinformatics tools and Resources – free online tools, software packages, Bioinformatics books and Journals, Bioinformatics web-portals

**GOVERNMENT COLLEGE FOR WOMEN (A),GUNTUR.**

**B.Sc. Biotechnology semester-III ,2023-24.**

**Paper-III: Immunology & r – DNA Technology**

**Model Question Paper**

**Time : 3Hrs** **Marks:70M**

**Section- A**

**I. Answer any 5 questions. Each question carries 2M.** **5×2=10M**

1. Define Antigen

2. What are NK Cells

3. What is Attenuated Vaccines

4. Explain B – Cells

5. Define Plasmid

6. What are Endonuclease

7. Elaborate EMBL

8 .Explain Passive immunity

**Section-B**

**II. Answer any 5 questions. Each question carries 4M.** **5×4=20M**

9. Write about the structure of Lymph node

10. Elaborate the structure of Immunoglobulin (antibody)

11. Explain the applications of Agglutination reaction

12. Appraise the importance of Hybridoma technology in Medical field.

13.List out the mechanism and uses of DNA Ligase

14.What are Cosmids?

15. Summarize the mechanism of Western Blotting

16.Explain Blue – white Screening

## Section-C

**III. Answer the following questions.** **5×8=40M**

17. a) Write about Organs of Immune system

(Or)

b) Explain the Cells of Immune system

18. a) Describe the mechanism of ELISA

(Or)

b) Explain about Hypersensitivity

19. a) Write about Principle & applications of PCR

(Or)

b) Discuss about Blotting techniques

20. a) Explain cDNA library & gene transfer method Micro injection

(Or)

b) Write about r-DNA technology of Transgenic plants

21. Discuss the following:

a) NCBI

(Or)

b) Protein BLAST analysis

**B.Sc., Biotechnology: Choice based credit system**

**B.Sc., -IV- Semester W.E.F. 2023-24**

## Plant & Animal Biotechnology

**Course Code – BT405-4**

COURSE OUTCOMES

1. Develop expertise in plant tissue culture techniques, including totipotency, media preparation, sterilization, and the establishment of cultures. Understand applications such as micropropagation, somatic embryogenesis, synthetic seed production, protoplast culture, and cryopreservation.
2. Gain proficiency in transgenesis and molecular markers, including plant transformation technology, transgenic plant production, herbicide and insect resistance, and principles and applications of molecular markers (RAPD, RFLP, and DNA fingerprinting).
3. Acquire practical knowledge in animal tissue culture techniques, covering cell culture media, primary and secondary culture, cell viability assessment, cryopreservation, and transfection methods. Understand the production of vaccines and recombinant DNA products, the concepts of gene therapy and transgenic animals, and the ethical and biosafety considerations in biotechnology, including intellectual property rights (IPR).

## Unit I

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

Plant tissue culture: totipotency , media preparation – nutrients and plant hormones; sterilization techniques; establishment of cultures – callus culture, cell suspension culture ,applications of tissue culture-micro propagation; Somatic embryogenesis; synthetic seed production; protoplast culture and somatic hybridization - applications. Cryopreservation,Plant secondary metabolites- concept and their importance

## Unit II

**Transgenesis and Molecular markers**

Plant transformation technology-- Agrobacterium mediated Gene transfer (Ti plasmid), hairy root features of Ri plasmid,Transgenic plants as bioreactors. Herbicide resistance – glyphosphate, Insect resistance- Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting-principles and applications**.**

## Unit III

**Animal tissue culture techniques**

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

## Unit IV

**Transgenic animals & Gene Therapy**

Production of vaccines, diagnostics, hormones and other recombinant DNA

products in medicine (insulin,somatostatin, vaccines),IVF (in Animals) , Concept of Gene therapy, Concept of transgenic animals – Merits and demerits.

## Unit V

**Bioethics,Biosafety and IPR**

Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare. Bio safety-introduction to biological safety cabinets; primary containment for biohazards;

biosafety levels; Introduction to IP-Types of IP: patents, trademarks & copyright.

## PLANT AND ANIMAL BIOTECHNOLOGY-PRACTICALS

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

## List of Reference Books ;


1. Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers
2. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
4. Biotechnology – By U. Satyanarayana ;1997
5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard ,2001
6. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers
7. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
8. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
9. R. Ian Freshney, ìCulture of animal cells – A manual of basic techniques" 4th edition, John Wiley & Sons, 2000 ,Inc, publication, New York

**GOVERNMENT COLLEGE FOR WOMEN (A),GUNTUR.**

**B.Sc. Biotechnology semester-IV ,2023-24.**

**Paper-IV: Plant & Animal Biotechnology**

**Model Question Paper**

**Time : 3Hrs** **Marks:70M**

**Section- A**

**I. Answer any 5 questions. Each question carries 2M.** **5×2=10M**

1. Explain Totipotency
2. Define Sterilization
3. What are Plasmids
4. Give an account on Cryopreservation
5. Discuss on Cell lines
6. What is IVF
7. Explain Bioethics
8. What is a Callus

**Section-B**

**II. Answer any 5 questions. Each question carries 4M.** **5×4=**20M

9. Describe MS Medium
10. Explain Suspension culture
11. Discuss the importance of Bt Cotton
12. Elaborate the mechanism of Micro injection
13. Summarize the production of recombinant Insulin
14. Explain Micro Propagation
15. Define Animal rights
16. Explain Edible Vaccines

## Section-C

**III. Answer the following questions.** **5×8=40M**

17. a) Explain different types of Sterilization techniques

(Or)

b) Describe the composition &Preparation of Callus Culture

18. Explain the following:

a) Ti plasmid

Ri plasmid

(Or)

b) RAPD

RFLP

19. a) Give an detail account on Animal cell culture

(Or)

b) Calcium phosphate precipitation

Electroporation

20. a) Give an detail account on IVF

(Or)

b) Write about Gene therapy

21. a) Explain Bioethics in Cloning &Stem Cell research

(Or)

b) Define Bio safety? Write Primary Containment for biohazards.

**B.Sc., Biotechnology: Choice based credit system**

## B.Sc., -IV- Semester W.E.F. 2023-24

## Environmental & Industrial Biotechnology

## Course Code – BT405-5

### COURSE OUTCOMES

1. Understand various pollution types and their control, with a focus on environmental biotechnology methods such as biofilters, bioscrubbers, and biotrickling filters for air pollution, as well as microbiological processes for water pollution management.
2. Gain knowledge of bioremediation concepts and principles, including the degradation of hydrocarbons, pesticides, and toxic chemicals by microorganisms. Explore the role of genetically engineered microbes and the environmental safety guidelines for bioremediation.
3. Develop an understanding of biofuels, biofertilizers, and biopesticides, with a focus on microbial groups involved in biogas production and interactions, nitrogen-fixing bacteria, and Bacillus thuringiensis. Additionally, learn about the basic principles of microbial technology, strain improvement, and the commercial production of microbial products such as organic acids, amino acids, and fermented food additives.

### Unit I

**Pollution Types and Control**

Environmental Biotechnology-Environmental Pollution : Types of pollution, air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Biotrickling filter. Water pollution and its management: Measurement of water, pollution, sources of waterpollution.

Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters,and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

## UNIT-II

**Bioremediation**

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

## UNIT III

**Biofuels**

Bio fuels-biogas, microbial groups involved in biogas production & interactions, factorsaffecting biogas production, Biofertilizers- Nitrogen fixing bacteria (Rhizobium, Azotobacter, Azospirillum), Biopesticides-Bacillus thuringiensis, Vermiculture.

## Unit IV

**Basic principles of Microbial technology**

Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Strain Improvement, Basic concepts of fermentation; Structure of a typical fermenter and applications

## Unit V

**Commercial Production of Microbial products**

Microbial technology products and applications; Microbial production of Organic acids (citric acid), Amino acids (Glutamic acid). Fermentation by microbes for food additives: dairy products (Cheese), beverages (Wine) and antibiotics (Pencillin)

## ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY - PRACTICALS

- Detection of coliforms for determination of the purity of potable water.
- Determination of total dissolved solids of water
- Determination of Hardness and alkalinity of water sample.
- Determination of dissolved oxygen concentration of water sample
- Determination of biological oxygen demand of sewage sample
- Determination of chemical oxygen demand (COD) of sewage sample.
- Isolation of industrially important microorganisms from soil.
- Isolation of amylase producing organisms from soil.
- Production of α – amylase from Bacillus Spp. by shake flask culture.
- Production of alcohol or wine using different substrates.
- Estimation of citric acid by titrimetry.

### List of reference books;


1. K. Vijaya Ramesh, Environmental Microbiology, 2004,MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory &Techniques, 2005,MJP Publishers
3. Environmental microbiology by Raina M.Maier Ian L.Pepper & Charles P.Gerba,2000,Academic press
4. Environmental Chemistry, A.K. De. Wiley Eastern Ltd.,2001, New Delhi
5. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold,2008
6. Power un seen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994,Oxford.
7. Environmental Microbiology. By. Mitchell. R. Wiley,1992, New York
8. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications
9. Creueger W. & Crueger A.A Text of Industrial Microbiology,2000, 2nd

Edition, Panima Publisher

**GOVERNMENT COLLEGE FOR WOMEN (A),GUNTUR.**

**B.Sc. Biotechnology semester-IV , 2023-24.**

**Paper-IV: Environmental & Industrial Biotechnology**

**Model Question Paper**

**Time : 3Hrs** **Marks:70M**

**Section- A**

**I. Answer any 5 questions. Each question carries 2M.** **5×2=10M**

1. What is a Pollutant

2. Explain Oxidation Ponds

3. Give an account on Water Pollution

4.What are Pesticides

5. What is screening

6. Explain Wine

7.What are the uses of Biofertilizers

8.What is Fermentaion

**Section-B**

**II. Answer any 5 questions. Each question carries 4M.** **5×4=**20M

9. Discuss UASB

10. Listr out the Sources of water pollution

11.Give an account on Azatobacter

12Write about. Maintenace and preservation of microbial cultures

12. Outline the production of Lysine

13.What is Phytoremediation

14 .Write down the production of Streptomycin

15.Write down the Production of beer

## Section-C

**III. Answer the following questions.** **5×8=40M**

17.a) Describe the air pollution, sources and their control

(Or)

b) Explain about microbiology of waste water treatment

18.a) Write about concepts and principles of bioremediation

(Or)

b) Describe the degradation of pesticides

19.a) Explain Nitrogen fixing bacteria-Rhizobium

(Or)

b) Give detail on biogas production and their factors

20.a) Write about screening, selection and identification of industrially important microbes

(Or)

b) Define Fermentation write about their design and applications

21.a) Write about microbial production of citric acid

(Or)

b) Explain about production of pencillin

Domain Subject : Biotechnology

B.Sc Semester- V

**Course: 6B – Organic Farming**

(Skill enhancement course (Elective), 05 credits)

Course Code: **BT405-6B**

## I. COURSE OUTCOMES

Students after successful completion of the course will be able to

1. Appreciate the importance of organic manure and bio fertilizers
2. Produce vermi compost, farmyard manure from bio waste
3. Acquire skill on isolation and maintenance of bio fertilizers

## *II.* SYLLABUS

### UNIT -1 - Soil

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

### UNIT-2 - 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 -3 - 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- 4 - 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 –5- Biofertilizers

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

## Practical syllabus: Course 6B Organic farming

### III. Skill outcomes:

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

1. Estimate NPK levels in the soil

2. Demonstrate the collection and processing of raw material
3. Develop skill of vermi compost production
4. Learn the technique of establishing organic farms
5. Equip with the skill of preparation of microbial media

## IV. Practical syllabus:

**1.** Collection of different soil samples
**2.** Qualitative estimation of nitrogen, phosphorus and potassium in soil samples
**3.** Collection of fruit, vegetable and other domestic waste
**4.** Preparation of compost beds and introducing earthworms
**5.** Collection of vermi castings
**6.** Sieving, drying and packing of vermi compost
**7.** Visit to animal shed and observing farm yard manure production
**8.** Preparation of media and isolation of bio fertilizers

## V. 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


## VI. Co-curricular activities:

**a) Mandatory**:(Training of students by teacher on field related skills;15hrs)

1. **For teacher;** Training of students by teacher in laboratory and field for a total of 15hrs on soil sample collection, NPK analysis, collection of biodegradable waste, vermi composting, collection of castings, processing, drying& packing. In addition teacher should demonstrate the media preparation, sterilization, and isolation of microorganisms from soil.
2. **For students:** Visit to local organic farm, collection of earthworms, observing the crop growth raised in organic farms. Submission of field work report of 10 pages in the prescribed format.

3. Maximum marks for field work report:05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE)

**b) Suggested co-curricular activities**

1.Comparing mineral content in different agricultural soil

2 .Learning techniques of basic instruments handling related to field work

3.Preparation of videos on compost preparation and application

4.Visit to local organic field

5.Attending special lectures, group discussions and seminars on organic farming.

**GOVERNMENT COLLEGE FOR WOMEN (A) GUNTUR**

**B.sc Biotechnology semester V -2023-24**

**Paper 5: Organic farming**

**Model question paper**

**section : A**

**Time:3Hrs** **Marks:70M**

**l. Answer any 5 questions each question carries 2M** **5×2=10M**

1. What are Micronutrients?

2. What is Organic farming ?

3. Explain Bio fertilizer?

4. Discuss Crop rotation?

5. List the uses of Compost?

6. Write on Breeding goals?

7. Explain Harvesting of vermicompost?

8. Give the Field application methods?

**Section:B**

**ll. Answer any 5 questions each question carries 4M** **5×4=20M**

9. What are the Types of soils

10. Compare the Effects of chemical dependent farming on yield and soil health

11. Distinguish the Advantages & disadvantages of chemical fertilizers

12. Explain Mixed farming system

13 Discuss on .Inter cropping

14 What are .Nutrient content of vermi compost

15 List out importance of .Bacillus biofertilizer

16.Explain use of Anabaena biofertilizer

## Section: C

**lll Answer the following questions** **5×8=40**

17.a) Write about organic farming, soil formation, compostion & characteristics.

(Or)

b) Give an detail account on Acidic, Alkaline and heavy metal contaminated soil.

18.a) Discribe the macro & micro nutrients and their functions in plant growth and development

(Or)

b) Explain organic, inorganic & bio fertilizers

19.a) Write about integrated farming system

(Or)

b) Write the crop nutrients and effective micro organisms in organic farming

20.a) Give a detail account on types of compost

(Or)

b) Discuss about vermi composting material & process of vermi compost

21.a) Write about structure & characteristics features of Rhizobium bio fertilizer

(Or)

b) Explain AM mycorrhiza fungal bio fertilizer

Domain Subject : Biotechnology

B.Sc Semester-V

Course: **7B :Biofertilizers & Bio pesticides production**

(Skill enhancement course (Elective),05 credits)

Course Code: **BT405-7B**

1.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 solubilisation
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

**II. SYLLABUS**

## UNIT -1-Biofertilizers

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 – 2- Mycorrhizal bio fertilizers

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

## UNIT-3 - Bio pesticides

Definition, concept, history, scope and importance of bio pesticides.

Classification - botanicals, bacterial, fungal and viral based bio pesticides. Mechanism of action of

*Bacillus thuringiensis* and *Trichoderma viridae* as bio control agents.

## UNIT -4 - 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- 5 - 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.

## II. Skill outcomes:

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

1. Prepare bacterial and fungal media
2. Isolate and identify symbiotic and free living nitrogen fixing bacteria
3. Isolate fungal bio control agents from soil samples.
4. Develop skill for large scale production of micro organisms
1. Learn field application techniques of biofertilizers and biopesticides

## III. Practical syllabus:

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azatobacter* from soil samples
4. Isolation of *Trichoderma*
5. Gram staining of bacteria
6. VAM root staining
7. Raising of legume seedlings with *Rhizobium* treatment
8. Visit to commercial bio control units and Krishi seva Kendra

## IV. 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, 2013by Ram Singh & Vikas Jindal G.S. Dhaliwal

## V. Cocurricular activities:

a) **Mandatory:** (Training of students by teacher on field related skills: 15hrs)

1. **For teacher:** Training of students by teacher on preparation of different microbial media, isolation techniques – streak plate , spread plate, pour plate, Grams staining of bacteria , VAM and Trichoderma observation. Preparation of Rhizobium inoculum and application to legume seedlings.

2. **For students:** Raising of seedlings of Leguminaceae species, maintaining of the seedlings in nursery/green house. Comparing the growth of seedlings treated with biofertilizer and chemical fertilizer. Visit to Bio fertilizer and Bio pesticides commercial lab. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report:05
4. Suggested format for field work book; Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test (IE).

### b) Suggested co-curricular activities;

1. Training of students by the industrial experts
2. Identification and collection of botanical pesticides
3. Assignments/seminars/group discussion /quiz on bio fertilizers and bio pesticides
4. Preparation of videos, charts on inoculum development and field application
5. Attending invited guest lectures on the concern topics

**GOVERNMENT COLLEGE FOR WOMEN (A) GUNTUR**

**B.sc Biotechnology semester V -2023-24**

**Paper 5: Biofertilizers and Bio Pesticides Production**

**Model question paper**

**section : A**

**Time:3Hrs** **Marks:70M**

**l. Answer any 5 questions each question carries 2M** **5×2=10M**

1. What are Symbiotic organisms

2. Explain ecto mycorrhiza

3. Discuss Bio pesticides

4. What is Mass Production

5 Explain. Inoculum

6. Discuss Peat

7. What is Root dressing

8. Define Packing

**Section:B**

**ll.Answer any 5 questions each question carries 4M** **5×4=20M**

9. What are symbiotic Micro organisms

10. Dicuss Uptake of phosphates by roots

11. Compare the History & importance of bio pesticides

12.Explain Mass Production media and Preparation

13. Classify Botanical bio pesticides

14. What is Trichoderma Viridae

15. Give an account on Spread plate method

16. Write about Seed treatment

## Section: C

**lll Answer the following questions** **5×8=40**

17.a) Write about history and Scope of bio fertilizers in india

(Or)

b) Give an detail account on algal biofertilizers

18.a) Explain importance & types of endo mycorrhiza

(Or)

b) Describe the mechanism of Phosphorus Solubulization

19.a) Explain the Classification of Viral based bio pesticides

(Or)

b) Describe the mechanism of Bacillus turingenesis

20.a) Write the methods of Isolation Plating techniques

(Or)

b) Write about Purification & identification of microorganisms used as biofertilizers

21.a) Write about applications of Foliar and Soil

(Or)

b) i) Vermiculite

ii) Sphagnum