

**Syllabus for**  
**UG0805-Three/Four Year Bachelor of Science (Botany)**  
**(From the Academic Year 2024-25 onwards)**  
**(Syllabus as per NEP-2020 and Choice Based Credit System)**

**For Semester - III and IV**  
**Session 2024-25**  
**(For students - admitted in the year 2023)**



**University of Rajasthan,**  
**Jaipur-302004**

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**Vision:**

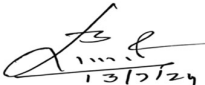
To create potential and competent professionals in Botany through the courses with practical training and advanced technical skills; equipped with knowledge and aptitude for higher education and research.

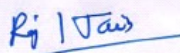
**Mission:**

- Dissemination of global demand-based knowledge through teaching with technical professionalism.
- Creation of individuals with social and environmental concern.
- Training the students to create economically and environmentally viable solutions in the field of plant science.

**Programme Outcomes**

- PO1. Developing the potential for vertical career growth in plant sciences, academic and service sectors and related fields.
- PO2. Development of in-depth analytical and critical thinking, so that students would be able to identify and solve the problems with the help of botany.
- PO3. Creating proficient knowledge in the major domains of plant sciences including plant identification, plant diseases, microbiology, Plant biotechnology etc.
- PO4. Students can successfully learn tools and techniques related to plant research.
- PO5. After completion of course, students would be able to execute their professional roles in society as botanist, plant taxonomist, plant pathologist, etc.
- PO6. Students will be able to learn skills to work as a team with the people from multidisciplinary environment.
- PO7. To design and develop sustainable solutions to major biological problems by applying appropriate tools.
- PO8. Develop skills, attitude and values required for self-directed, lifelong learning and professional development.

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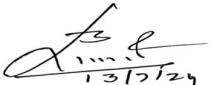
  
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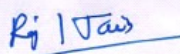
PO9. Acquire knowledge and understanding of norms and ethics in the field of botany.

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<b>Name of Faculty</b>	<b>Science</b>
<b>Name of Discipline</b>	<b>Botany</b>
<b>Type of Discipline</b>	<b>Major</b>
<b>List of Programmes where offered as Minor Discipline</b>	-----
<b>Offered to Non-Collegiate Students</b>	<b>No</b>

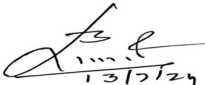
## SEMESTER-WISE PAPER TITLES WITH DETAILS

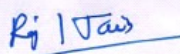
UG0805-Three/Four Year Bachelor of Science (Botany)								
#	Level	Semester	Type	Title	Credits			
					L	T	P	Total
1.	5	I	MJR	UG0805 - BOT-51T-151 - Cell Biology and Diversity of Lower Plants	4	0	0	4
2.	5	I	MJR	UG0805 - BOT-51P-152 - Practical-I	0	0	2	2
3.	5	I	MJR	UG0805 - BOT-51T - 153 - Genetics, Plant Breeding and Diversity of Higher Plants	4	0	0	4
4.	5	I	MJR	UG0805 - BOT-51P-154 - Practical-II	0	0	2	2
5.	5	II	MJR	UG0805 - BOT-52T-155 - Plant Biochemistry and Physiology	4	0	0	4
6.	5	II	MJR	UG0805 - BOT-52P-156 - Practical-I	0	0	2	2
7.	5	II	MJR	UG0805 - BOT-52T-157 - Ecology and Plant Resource Utilization	4	0	0	4
8.	5	II	MJR	UG0805 - BOT-52P-158 - Practical-II	0	0	2	2
9.	6	III	MJR	UG0805 - BOT-63T-251 - Molecular Biology	4	0	0	4
10.	6	III	MJR	UG0805 - BOT-63P-252 - Practical-I	0	0	2	2
11.	6	III	MJR	UG0805 - BOT-63T-253 - Microbiology	4	0	0	4
12.	6	III	MJR	UG0805 - BOT-63P-254 - Practical-II	0	0	2	2
13.	6	IV	MJR	UG0805 - BOT-64T-255 - Fundamentals of	4	0	0	4

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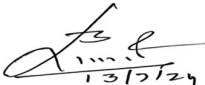
UG0805-Three/Four Year Bachelor of Science (Botany)								
#	Level	Semester	Type	Botany Title	Credits			
					L	T	P	Total
				<b>Plant pathology</b>				
14.	6	IV	MJR	UG0805 - BOT-64P-256 - Practical-I	0	0	2	2
15.	6	IV	MJR	UG0805 - BOT-64T-257 - Basics of Analytical Techniques	4	0	0	4
16.	6	IV	MJR	UG0805 - BOT-64P-258 - Practical-II	0	0	2	2
17.	7	V	MJR	UG0805 - BOT-75T-351 - Plant Biotechnology-I	4	0	0	4
18.	7	V	MJR	UG0805 - BOT-75P-352 - Practical-I	0	0	2	2
19.	7	V	MJR	UG0805 - BOT-75T-353 - Systematics of Angiosperms	4	0	0	4
20.	7	V	MJR	UG0805 - BOT-75P-354 - Practical-II	0	0	2	2
21.	7	VI	MJR	UG0805 - BOT-76T-355 - Plant Biotechnology-II	4	0	0	4
22.	7	VI	MJR	UG0805 - BOT-76P-356 - Practical-I	0	0	2	2
23.	7	VI	MJR	UG0805 - BOT-76T-357 - Morphology and Anatomy of Angiosperms	4	0	0	4
24.	7	VI	MJR	UG0805 - BOT-76P-358 - Practical-II	0	0	2	2
25.	8	VII	MJR	UG0805 - BOT-87T-451 - Environmental Biology	4	0	0	4
26.	8	VII	MJR	UG0805 - BOT-87P-452 - Practical-I	0	0	2	2
27.	8	VII	MJR	UG0805 - BOT-87T-453 - Embryology of Angiosperms	4	0	0	4
28.	8	VII	MJR	UG0805 - BOT-87P-454 - Practical-II	0	0	2	2
29.	8	VIII	MJR	UG0805 - BOT-88T-455 - Biostatistics and Evolution	4	0	0	4
30.	8	VIII	MJR	UG0805 - BOT-88P-456 - Practical-I	0	0	2	2
31.	8	VIII	MJR	UG0805 - BOT-88T-457 - Applied Botany	4	0	0	4
32.	8	VIII	MJR	UG0805 - BOT-88P-458 - Practical-II	0	0	2	2

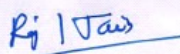
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## Examination Scheme

1. 1 credit = 25 marks for examination/evaluation
2. For Regular Students there will be Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% weightage) and (End of end-semester examination) EoSE (80% weightage).
3. For Regular Students, 75% Attendance is mandatory for appearing in the EoSE.
4. To appear in the EoSE examination of a course/subject a regular student must appear in the mid-semester examination and obtain at least a “C” grade in the course/subject.
5. Credit points in a Course/Subject will be assigned only if, the regular student obtains at least a “C” grade in the CA and EoSE examination of a Course/Subject.

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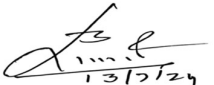
# Examination Scheme for Continuous Assessment (CA)

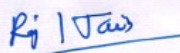
## DISTRIBUTION OF CONTINUOUS ASSESSMENT (CA) MARKS

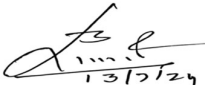
S. No.	CATEGORY	Weightage (out of total internal marks)	THEORY					PRACTICAL			
			CORE (Only Theory )	CORE (Theo ry + Practi cal)	A E C	SE C	VA C	CORE (Theor y +Practi cal)	SE C	VA C	
	Max Internal Marks		30	20	20	10	10	10	10	10	
1.	Mid-term Exam	50%	15	10	10	5	5	5	5	5	
2.	Assignment	25%	7.5	5	5	2.5	2.5	2.5	2.5	2.5	
3.	Attendance	25%	7.5	5	5	2.5	2.5	2.5	2.5	2.5	
		Regular Class Attendance	= 75%	3	2	2	1	1	1	1	1
			75- 80%	4	3	3	1.5	1.5	1.5	1.5	1.5
			80- 85%	5	4	4	2	2	2	2	2
> 85%	7.5		5	5	2.5	2.5	2.5	2.5	2.5		

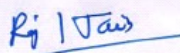
### Note:

1. Continuous assessment will be the sole responsibility of the teacher concerned.
2. For continuous assessment, no remuneration will be paid for paper setting, evaluation, invigilation etc.
3. For continuous assessment, Paper setting and Evaluation will solely be the responsibility of the teacher concerned.
4. For continuous assessment, no Answer sheets/question papers etc. will be provided by the University.
5. Colleges are advised to keep records of continuous assessment, attendance etc.

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## Examination Scheme for EoSE for Semester-III

CA – Continuous Assessment

EoSE – End of Semester Examination

### Regular Students –

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
		CA	01 Hr	CA	20 Marks	CA	08 Marks
Theory	UG0805 - BOT-63T-251 - Molecular Biology	EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
		CA	01 Hr	CA	10 Marks	CA	04 Marks
Practical	UG0805 - BOT-63P-252 - Practical-I	EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 Marks
		CA	01 Hr	CA	20 Marks	CA	08 Marks
Theory	UG0805 - BOT-63T-253 - Microbiology	EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
		CA	01 Hr	CA	10 Marks	CA	04 Marks
Practical	UG0805 - BOT-63P-254 - Practical-II	EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 Marks
		CA	01 Hr	CA	20 Marks	CA	08 Marks

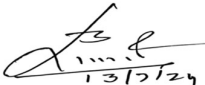
The theory question paper will consist of **two** parts A & B.

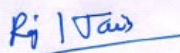
#### **PART-A: 20 Marks**

Part A will be compulsory having 10 very short answer-type questions (with a limit of 20 words) of two marks each.

#### **PART-B: 60 Marks**

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 15 marks.

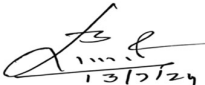
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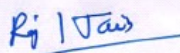
  
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**Syllabus**  
**UG0805-Three/Four Year Bachelor of Science (Botany)**  
**Semester-III**  
**UG0805 - BOT-63T-251 - Molecular Biology**

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	BOT-63T-251	Molecular Biology			6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method
		Theory	Practical	Total		
Intermediate level	Major	4	2	6	No	60 lectures with diagrammatic and informative assessments during lecture hours
List of Programme Codes in which Offered as Minor Discipline		-----				
Prerequisites		Botany Course of Foundation or Introductory Level				

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<b>Objectives of the Course</b>	<ul style="list-style-type: none"> <li>➤ To understand structure of nucleic acid (DNA and RNA).</li> <li>➤ To understand DNA organization in chromosomes and the mechanism of DNA replication.</li> <li>➤ To understand the genetic code and structure of gene.</li> <li>➤ To understand molecular mechanism of transcription and translation.</li> <li>➤ To understand gene regulation at all levels, and the structure-function relationships of nucleic acids and proteins.</li> <li>➤ To provide the students practical skills in molecular biology.</li> </ul>
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## Detailed Syllabus

### BOT-63T-251 - Molecular Biology

#### Course outcome:

- CO1: Gain foundational knowledge of the central dogma of molecular biology and its significance, including chemical and molecular processes within cells.
- CO2: Develop a strong understanding of the structure and functions of nucleic acids and proteins, and their roles in cell growth, division, and development.
- CO3: Illustrate the structural organization of genes and comprehend genome organization.
- CO4: Demonstrate proficiency in understanding genetic code concepts and features.
- CO5: Acquire a solid foundation in the replication, transcription and translation of genetic material in prokaryotes.

#### Unit-I

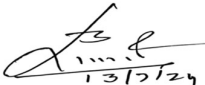
**Nucleic Acids:** Discovery of Nuclein by Fredrich Miescher. Nucleic Acids as genetic material; Experiments by Griffith, Hershey and Chase, Avery, McLeod and McCarty. Building blocks of nucleic acid: Nucleotide, Nucleoside, Ribose sugar, Purine, Pyrimidine, phosphate.

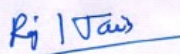
**DNA and RNA:** Structure of DNA and RNA, Watson and Crick's model of DNA, DNA types (A, B, Z type), RNA structure and functions (tRNA, mRNA, rRNA, miRNA and siRNA)

**15 Lectures**

#### Unit-II

**Nucleosome-** Chromatin structure; Euchromatin and Heterochromatin.

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**DNA Replication:** Semi-conservative mode of DNA replication; bidirectional and semi-discontinuous replication. Various models of DNA replication including rolling circle, D-loop (mitochondrial), theta mode of replication, replication of linear ds-DNA, replicating the 5' end of linear chromosome. Okazaki fragments. Enzymes involved in DNA replication.

**15 Lectures**

### Unit-III

**Central Dogma of Life:** Concept of Central dogma; Salient features of genetic code, deciphering the genetic code (Contribution of Nirenberg and H.G. Khorana). Gene, ORF, Intron, Exon, Gene expression. Prokaryotic and eukaryotic gene structure.

**Transcription in prokaryotes:** mechanism, initiation, elongation and termination. Introduction to split genes, splicing and Ribozymes.

**15 Lectures**

### Unit-IV

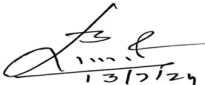
**Translation in prokaryotes:** Ribosome structure and assembly, charging of tRNA, aminoacyl tRNA synthetases; Mechanism; initiation, elongation and termination. Inhibitors of protein synthesis.

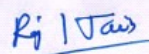
**Gene regulation in Prokaryotes-** Operon concept: inducible and repressible operon; regulation of lactose (lac) and tryptophan (trp) in *Escherichia coli*; attenuation regulation.

**15 Lectures**

### Suggested Books and References:

- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). **Molecular Biology of the Gene**, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
- De Robertis, E.D.P. and De Robertis, E.M.F. 2006. **Cell and Molecular Biology**. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. 2010. **Cell and Molecular Biology: Concepts and Experiments**. 6th edition. John Wiley & Sons. Inc.
- Snustad, D.P. and Simmons, M.J. (2010). **Principles of Genetics**. John Wiley and Sons Inc., U.S.A. 5th edition.

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- **The World of the Cell.** 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). **Concepts of Genetics.** Benjamin Cummings. U.S.A. 9th edition.
- Russell, P. J. (2010). **i-Genetics- A Molecular Approach.** Benjamin Cummings, U.S.A. 3rd edition.
- Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). **Introduction to Genetic Analysis.** W. H. Freeman and Co., U.S.A. 10th edition.
- Latest research articles/review articles relevant to the respective topics will be provided to the students by the concerned faculty.

### Suggested E-resources:

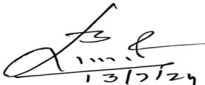
#### Online Lecture Notes and Course Materials:

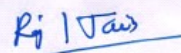
1. [https://onlinecourses.nptel.ac.in/noc24\\_bt07/preview](https://onlinecourses.nptel.ac.in/noc24_bt07/preview)
2. <https://nptel.ac.in/courses/102106025>
3. <https://archive.nptel.ac.in/courses/102/106/102106096/>

## B.Sc. Botany Semester-III Practical-I Syllabus

### BOT-63P-252

1. Preparation of LB medium and raising *E. Coli*.
2. Isolation of DNA from bacterial or plant samples.
3. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
4. Separation of DNA using Agarose gel electrophoresis.
5. Determination of DNA fragment size comparing with DNA marker using Agarose gel electrophoresis.
6. Perform or digitally demonstrate DNA amplification by PCR.
7. Perform or digitally demonstrate Southern Blot Hybridization.
8. Perform or digitally demonstrate Northern Blotting.
9. Perform or digitally demonstrate Western Blotting.
10. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments).
11. Study of semiconservative replication of DNA through micrographs/schematic representations.

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12. Any other exercise based on theory syllabus.

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**B.Sc. Botany Semester-III Practical-I**

**Scheme of Practical Examination and Distribution of marks**

**BOT-63P-252**

**Max. Marks: 10\*+40**

**Min. Marks: 4\*+16**

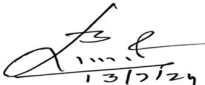
**Time: 4 Hours**

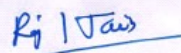
<b>Exercise</b>	<b>Regular</b>	<b>Ex-students</b>
1. Exercise A	<b>5</b>	<b>8</b>
2. Exercise B	<b>5</b>	<b>8</b>
3. Exercise C	<b>5</b>	<b>7</b>
4. Exercise D	<b>5</b>	<b>7</b>
5. Comment upon the spots- identify giving reasons (1 to 5).	<b>10</b>	<b>15</b>
6. Viva-voce	<b>5</b>	<b>5</b>
7. Record	<b>5</b>	<b>-</b>
<b>Total</b>	<b>10*+40=50</b>	<b>50</b>
<b>*Internal marks for regular students only</b>		
Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

**Course Learning Outcomes:**

At the completion of the course, the student would be able to:

- Develop sufficient knowledge about the characteristics of the genetic material and structure of DNA and RNA.
- Recognize DNA organization in chromosomes and molecular mechanism of DNA replication, and transcription.

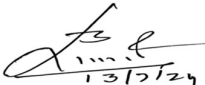
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- Understand characteristic and importance of genetic code and molecular mechanism of translation.
- Understand molecular structure of the gene and regulatory mechanisms for gene expression.
- Understand the structure, function, and variations in DNA and RNA.
- Have insights into the various models for chromatin organization.
- Understand step wise processes of replication, transcription and translation.
- Develop knowledge and understanding of the operon concept and gene regulation mechanisms.
- Understand the role of protein and its modification in DNA packaging.
- Have knowledge about the differentiation of molecular mechanism of replication, transcription and translation.
- Understand the role of protein/transcriptional factor in gene regulation.
- Develop acumen about the variation in gene regulation processes.
- Use scientific methods, and critical thinking skills to ask questions and solve problems.

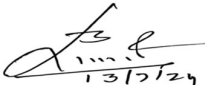
**Syllabus**  
**UG0805-Three/Four Year Bachelor of Science (Botany)**  
**Semester-III**  
**BOT-63T-253 - MICROBIOLOGY**

Semester	Code of the Course	Title of the Course/Paper	NHEQF Level	Credits
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<b>III</b>	<b>BOT-63T-253</b>	<b>MICROBIOLOGY</b>			<b>6</b>	<b>4</b>
<b>Level of Course</b>	<b>Type of the Course</b>	<b>Credit Distribution</b>			<b>Offered to NC Student</b>	<b>Course Delivery Method</b>
		<b>Theory</b>	<b>Practical</b>	<b>Total</b>		
<b>Intermediate level</b>	<b>Major</b>	<b>4</b>	<b>2</b>	<b>6</b>	<b>No</b>	<b>60 lectures with diagrammatic and informative assessments during lecture hours</b>
<b>List of Programme Codes in which Offered as Minor Discipline</b>		-----				
<b>Prerequisites</b>		Botany Course of Foundation or Introductory Level				
<b>Objectives of the Course</b>		<ul style="list-style-type: none"> <li>➤ The objective of the course is to make students aware of the diversity, distribution and characteristic features of various microorganisms.</li> <li>➤ The course also aims to make students aware of the indispensable role of microorganisms in the environment, biotechnology, fermentation, medicine and other industries important to human welfare.</li> <li>➤ In addition to this, the course shall also prepare students for higher education in microbiology-related disciplines.</li> </ul>				

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# Detailed Syllabus

## BOT-63T-253 - MICROBIOLOGY

### Course outcome:

- CO1: Understand the contributions of prominent scientists in microbiology.
- CO2: Comprehend standard microbiological culture techniques.
- CO3: Acquire knowledge of the principles underlying microbial classification.
- CO4: Learn the rules of bacterial nomenclature and taxonomy for prokaryotic microorganisms, including major phyla of bacteria and archaea.
- CO5: Gain knowledge of virus structure, replication, various forms of viruses, and insight into mycoplasma.
- CO6: Acquire knowledge of nutritional requirements of microbes and applications of microbiology

### UNIT-I

**History of Microbiology:** History of development of microbiology, Spontaneous generation versus biogenesis, major contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming, and contribution of Indian microbiologists.

**Virus:** Characteristics and Classification of Viruses (Baltimore), Cryptograms, structure with special reference to TMV, Bacteriophage, Multiplication of Viruses (Lytic and Lysogenic). Viroids, Virusoids, Prions.

**15 Lectures**

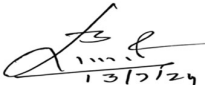
### UNIT-II

**Bacteria:** General Characteristics, Classification by Bergey's Manual, Cell structure, Cell-wall: Composition and detailed structure of Gram positive and Gram-negative cell walls, mechanism of Gram's staining, endospore formation, Asexual Reproduction and Sexual Recombination (Conjugation, Transformation and Transduction), Archaeobacteria and Eubacteria.

**Mycoplasma:** General Characteristics, Morphology and Reproduction.

**15 Lectures**

### UNIT-III

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**Microbial Nutrition and Growth:** Nutritional types of microorganisms, growth factors, culture media-synthetic and complex, types of media; isolation of pure cultures, growth curves, mean growth rate constant, generation time; influence of environmental factors on growth of microbes: effect of pH, temperature, solute, oxygen concentration, pressure and radiations. Sterilization, disinfection and antiseptics. Use of physical methods (heat, low temperature, filtration, radiation) and chemical agents (phenolics, halogens, heavy metals, sterilizing gases) in microbial control.

15 Lectures

#### UNIT-IV

**Applications of Microbiology:** Importance of microbes in agriculture and food industries. Basic design of fermenter, continuous and discontinuous culture. Preparation of fermented food products (yogurt, curd and cheese). Preparation of alcoholic beverages (wine and beer). Treatment of waste water (Municipal treatment plant) and Sewage, Bioremediation.

15 Lectures

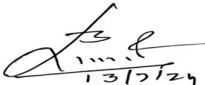
#### Suggested Books and References:

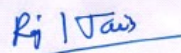
- Pelczar, M.J. (2001) **Microbiology**, 5th edition. New Delhi, Delhi: Tata Mc-Graw- Hill Co.
- J. Willey, L. Sherwood & C. Woolverton. (2017). **Prescott's Microbiology**. McGraw Hill international.
- M. J Chan, ECS Krieg & NR Pelczar. (2004). **Microbiology**, McGraw Hill. International. J. G. Cappuccino, and N. Sherman. (2013). **Microbiology: A Laboratory manual**, Benajamin/Cummings.
- M. T. Madigan, J. M. Martinko & D. A. Stahl, Brock. (2010). **Biology of Microorganisms**, Pearson Education International.
- Latest research articles/review articles relevant to the respective topics will be provided to the students by the concerned faculty.

#### Suggested E-resources:

##### Online Lecture Notes and Course Materials:

1. Vidhya Mitra Integrated E-Content Portal
2. eGyanKosh-Introductions to Microbiology
3. e-Krishi Shiksha- Introduction Microbiology

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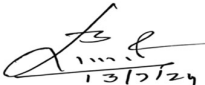
## **B.Sc. Botany Semester- III Practical-II Syllabus**

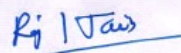
### **BOT-63P-254**

1. Preparation of the liquid culture media for the growth of microorganisms.
2. Preparation of the solid culture media for the growth of microorganisms
3. Study of physical methods of sterilization.
4. Study of chemical methods of sterilization.
5. Study of bacterial cultures using streak plate culture method.
6. Study of bacterial cultures using pour plate culture method.
7. Study of bacterial cultures using serial dilution method.
8. Simple Staining of bacteria.
9. Perform Gram staining.
10. Demonstration of antibiotic resistance in bacteria.
11. Study of the growth curve of bacteria.
12. Study of the effect of pH and temperature on bacterial growth.
13. Measurement of microbial cell using micrometry.
14. Study of different shapes of TMV, Bacteriophage, Viroids, Bacteria, Mycoplasma using permanent slides/pictographs.
15. Any other exercise based on theory syllabus.

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### **B.Sc. Botany Semester- III Practical -II**

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### Scheme of Practical Examination and Distribution of marks

**BOT-63P-254**

**Max. Marks: 10\*+40**

**Min. Marks: 4\*+16**

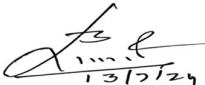
**Time: 4 Hours**

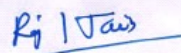
<b>Exercise</b>	<b>Regular</b>	<b>Ex students</b>
1. Exercise A	<b>5</b>	<b>8</b>
2. Exercise B	<b>5</b>	<b>8</b>
3. Exercise C	<b>5</b>	<b>7</b>
4. Exercise D	<b>5</b>	<b>7</b>
5. Comment upon the spots- identify giving reasons (1 to 5).	<b>10</b>	<b>15</b>
6. Viva-voce	<b>5</b>	<b>5</b>
7. Record	<b>5</b>	<b>-</b>
<b>Total</b>	<b>10*+40=50</b>	<b>50</b>
<b>*Internal marks for regular students only</b>		
Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

### Course Learning Outcomes:

At the completion of the course, the student would be able to:

1. To understand about general characteristics and structural details of various microbes.
2. To understand about various microbiological techniques including sterilization, media preparation, maintenance of microbial culture and staining.
3. Students will learn about various parameters required for optimum growth of microbes.
4. To understand various commercial applications of microbiological techniques.
5. Economic importance of Microbes
6. Acquire skills in several laboratory methods
7. Study of gram staining, microscopy, and biochemical assays.

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## Examination Scheme for EoSE for Semester IV

CA – Continuous Assessment

EoSE – End of Semester Examination

### Regular Students –

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
		CA	01 Hr	CA	20 Marks	CA	08 Marks
Theory	UG0805 - BOT-64T-255-Fundamentals of Plant Pathology	EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
		CA	1 Hr	CA	10 Marks	CA	04 Marks
Practical	UG0805 - BOT-64P-256-Practical I	EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 Marks
		CA	1 Hr	CA	10 Marks	CA	04 Marks
Theory	UG0805 - BOT-64T-257-Basics of Analytical Techniques	EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
		CA	1 Hr	CA	10 Marks	CA	04 Marks
Practical	UG0805 - BOT-64P-258-Practical II	EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 Marks
		CA	1 Hr	CA	10 Marks	CA	04 Marks

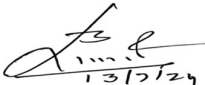
The theory question paper will consist of **two** parts A & B.

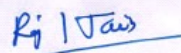
#### **PART-A: 20 Marks**

Part A will be compulsory having 10 very short answer-type questions (with a limit of 20 words) of two marks each.

#### **PART-B: 60 Marks**

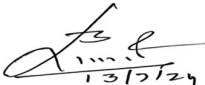
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 15 marks.

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**Syllabus**  
**UG0805-Three/Four Year Bachelor of Science (Botany)**  
**Semester-IV**  
**UG0805 - BOT-64T-255-Fundamentals of Plant Pathology**

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	BOT-64T-255	Fundamentals of Plant pathology			6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method
		Theory	Practical	Total		
Intermediate level	Major	4	2	6	No	60 lectures with diagrammatic and informative assessments during lecture hours
List of Programme Codes in which Offered as Minor Discipline		-----				
Prerequisites		Botany Course of Foundation or Introductory Level				
Objectives of the Course		<ul style="list-style-type: none"> <li>➤ To acquire understanding of plant pathogens.</li> <li>➤ To explore the relationships between plants and microorganisms.</li> <li>➤ To understand the factors contributing to disease development and methods of control.</li> <li>➤ To recognize the economical disadvantages of the important crops by the pathogens.</li> <li>➤ To understand the need to protect important crops from pathogens.</li> </ul>				

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## Detailed Syllabus

### UG0805 - BOT-64T-255 - Fundamentals of Plant Pathology

#### Course outcome:

- CO1: Gain foundational knowledge of plant pathology.
- CO2: Understand concepts, nomenclature, classification, and characteristics of plant pathogens.
- CO3: Identify diseases, understand pathogen nature, and explore strategies for plant disease management.
- CO4: Develop skills in identifying crop diseases, selecting relevant pesticides, and applying management principles.
- CO5: Differentiate between fungicides and antibiotics based on pathogen nature, mode of action, and formulations.

#### UNIT -I

**Concepts of Plant Pathology:** History of plant pathology, Definitions (Primary and Secondary inoculum; Infection, Pathogenicity, Pathogenesis, Disease Cycle), biotic and abiotic factors, General symptoms caused by Viruses, Viroids, Bacteria, Fungi, Mycoplasma, Nematodes, Insects (smut, rust, mildews, canker, mosaic, vein clearing, spots, lesion, nodules, galls).

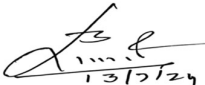
**15 Lectures**

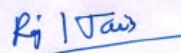
#### UNIT-II

**Host-Pathogen interaction:** Disease triangle, recognition of host by pathogens, mode of host penetration, role of enzymes, toxins, growth regulators and polysaccharides in disease development.

**Plant Defense:** Strategies- Physical and biochemical (preformed and post- infectious). Induced Systemic Resistance (ISR) and Systemic acquired Resistance (SAR), Physiological changes in host after infection.

**15 Lectures**

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### UNIT -III

**Viral, Viroidal, Mycoplasmal and Bacterial diseases:** Occurrence, disease symptoms, Etiology, treatment & control of the following plant diseases:- Tobacco Mosaic, Bunchy top of Banana, Coconut Cadang Cadang, Little leaf of Brinjal, Citrus canker and Angular leaf spot of Cotton.

**Diseases caused by insect and nematode:** Brief account and histopathology of root knot of vegetables (tomato), Ear Cockle of Wheat, leaf gall of *Pongamia*. **15 Lectures**

### UNIT-IV

**Fungal Diseases:** Occurrence, Disease symptoms, Etiology, Treatment & Control of the following plant diseases with special reference to Rajasthan: White rust of crucifers, Downy mildew/green ear disease of Bajra, Black/stem rust of Wheat, Loose and covered smut of Barley, Smut of Bajra, Early blight of Potato,

**Control Methods:** Quarantine, Cultural practices, Physical methods, Chemical methods, Biological control (Antibiosis, Hyper-parasitism, Predation), Integrated Pest Management. **15 Lectures**

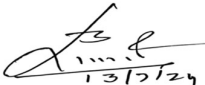
### Suggested Books and References:

- Alexopolus, C.J., Mims, C.W. and Blackwell, M. 1996. **Introductory Mycology**, John Wiley Estern Private Limited, New York
- Agrios G.N. (2004) **Plant Pathology**, 5<sup>th</sup> Edition, Academic Press, New Delhi
- Pandey B.P. (2001) **Plant Pathology (Pathogen and Plant Disease)**, S. Chand Publishing
- Sharma P.D. (2014). **Plant Pathology**, Rastogi Publications Meerut,UP
- Mehrotra, R.S. and Aggarwal, A. 2007. **Plant Pathology**. Tata McGraw Hill Publishing Co. Ltd., New Delhi
- Singh, R.S. 1996. **An Introduction to Principles of Plant Pathology**. Oxford & IBH, New Delhi.
- Singh, R.S. (2021). **Plant Diseases 10th revised edition**, Medtech, New Delhi.
- Nene Y.L. and Thapliyal, P.N. 1993. **Fungicides in Plant Diseases Control**. 3rd Edn. Oxford & IBH published Co. Pvt. Ltd., New Delhi.
- Gupta, V.K. and Sharma, R.C. (2020) **Integrated Disease Management and Plant Health**, Scientific Publishers, India.
- Latest research articles/review articles relevant to the respective topics will be provided to the students by the concerned faculty.

### Suggested E-resources:

#### Online Lecture Notes and Course Materials:

1. <https://www.pdfdrive.com/fundamentals-of-plant-pathology-e42642753.html>
2. [https://onlinecourses.swayam2.ac.in/cec21\\_bt16/preview](https://onlinecourses.swayam2.ac.in/cec21_bt16/preview)

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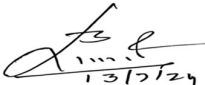
  
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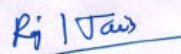
3. <https://www.pdfdrive.com/plant-pathology-concepts-and-laboratory-exercises-e179105354.html>

## B.Sc. Botany Semester-IV Practical-I Syllabus

### BOT-64P-256

1. Study of morphology and symptomology of TMV, Viroids, Mycoplasma, Bacteria, Nematode, Insects, Mites and other causal organisms mentioned in the syllabus. (Photographs/3D Models)
2. Study of Bacteria by Gram Staining, Negative Staining)
3. Preparation of Liquid and solid media for culturing microbes from infected plant tissues (Nutrient Agar/ Broth , Potato Dextrose Agar).
4. Histological study of different plant defense structures with the help of charts/ 3D models/farm or field visits.
5. Study of symptoms of plant diseases (specimen/permanent slide)- Downy mildew/green ear disease of Bajra, Tobacco Mosaic, Citrus canker, Little leaf of Brinjal,
6. Study of spores of *Alternaria* from Early blight of Potato.
7. Study of histopathology using temporary slide preparation of infected part of root knot of tomato.
8. Study of histopathology using temporary slide preparation of Leaf gall of *Pongamia* .
9. Study and identification of spores from temporary slide preparation from infected plant material:- white rust of crucifers (conidia stage).
10. Study and identification of spores from temporary slide preparation from infected plant material Black stem rust of Wheat (all stages).
11. Demonstration and application of basic control techniques such as soil solarization, roguing in the field.
12. Demonstration of biocontrol of diseases using *Trichoderma viridae* /*Bacillus thuringiensis* and other biocontrol microorganisms.

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13. Comparative quantification of biomolecules in diseased v/s normal plant.
14. Any other exercise based on the syllabus.

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**B.Sc. Botany Semester- IV Practical-I**

**Scheme of Practical Examination and Distribution of marks**

**BOT-64P-256**

**Max. Marks: 10\*+40**

**Min. Marks: 4\*+16**

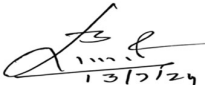
**Time: 4 Hours**

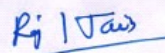
Exercise	Regular	Ex-students
1. Exercise A	5	8
2. Exercise B	5	8
3. Exercise C	5	7
4. Exercise D	5	7
5. Comment upon the spots- identify giving reasons (1 to 5).	10	15
6. Viva-voce	5	5
7. Record	5	-
<b>Total</b>	<b>10*+40=50</b>	<b>50</b>
<b>*Internal marks for regular students only</b>		
Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

**Course Learning Outcomes:**

At the completion of the course, the student would be able to:

1. Understand about various pathogens.
2. Understand about diagnosis of plant diseases, understanding their causes, and implementing management strategies to control and/or prevent them.

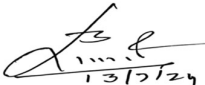
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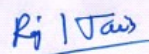
  
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3. Understand and perform different laboratory exercises to further understand about microorganisms.
4. Understand role of biotic and abiotic factors in disease development
5. Understand host pathogen interaction and its effects on plants.
6. Symptomology, disease cycle and control of different pathogens causing diseases.
7. Acquire proficiency in various laboratory techniques, such as culturing microorganisms, gram staining, microscopy and identification of plant diseases.
8. Develop further interest in agricultural research, crop protection, and pest management to improve crop yield and quality.
9. Work in disease prevention and control, focusing on plant diseases that impact food safety and public health.

**Syllabus**  
**UG0805-Three/Four Year Bachelor of Science (Botany)**  
**Semester-IV**  
**UG0805 - BOT-64T-257 - Basics of Analytical Techniques**

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	BOT-64T-257	Basics of Analytical Techniques			6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method
		Theory	Practical	Total		
Intermediate level	Major	4	2	6	No	60 lectures with diagrammatic and informative

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						<b>assessments during lecture hours</b>
<b>List of Programme Codes in which Offered as Minor Discipline</b>	-----					
<b>Prerequisites</b>	Botany Course of Foundation or Introductory Level					
<b>Objectives of the Course</b>	<ul style="list-style-type: none"> <li>➤ To equip students with appropriate tools of analysis and theoretical, technical, and analytical skills to tackle issues and problems in the field of plant sciences.</li> <li>➤ To gain knowledge on various techniques and instruments used for the study of plant biology.</li> <li>➤ To understand the principles of various biophysical techniques available for the characterization of biological molecules.</li> <li>➤ To investigate natural metabolic products of plants using various techniques.</li> <li>➤ To understand growth and development in plant cells through various techniques.</li> <li>➤ To use knowledge in diverse applications such as the separation of biomolecules.</li> </ul>					

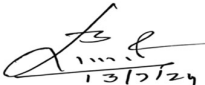
## Detailed Syllabus

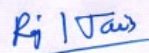
### UG0805 - BOT-64T-257 - Basics of Analytical Techniques

**Course outcomes:**

- CO1: Develop skills to understand the theory and practice of bio-analytical techniques.
- CO2: Study bio-analytical techniques, including theory, operational principles, instrumentation, and applications.
- CO3: Gain scientific understanding and interpret results from analytical techniques.
- CO4: Learn theoretical principles of Microscopy, Centrifugation, Electrophoresis, spectroscopy, radiotracer techniques and their applications.
- CO5: Acquire competence in utilizing chromatographic techniques to isolate and characterize biological molecules.

#### Unit-I

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### Imaging and related techniques

Stains and Basic staining procedure, Positive and Negative staining, Fixation and Freeze-fracture. Microscopy- Principles, Magnification, Resolving power, Types (Light, Bright Field, Phase Contrast, Fluorescence, Confocal), and Applications. Introduction to Scanning Electron Microscopy (SEM), and Transmission Electron Microscopy (TEM). Micrometry.

15 Lectures

### Unit-II

**Photometry:** Concept and types (UV-Visible) of spectroscopy, Beer-Lambert's law.

Principle and applications of Colorimetry. Principle and applications of Spectrophotometry in biological research.

**Chromatography:** Principles, Elementary knowledge,  $R_f$  value, Types: Thin Layer, Paper, Ion exchange, Gel permeation, and Applications.

15 Lectures

### Unit-III

**Centrifugation:** Basic Principles, Elementary knowledge, RCF, Sedimentation coefficient, Svedberg Unit, Types: Density Gradient and Differential and Applications. Ultracentrifuge, Microcentrifuge.

**Electrophoresis:** Agarose Gel Electrophoresis; Principle, Methodology and Applications.

Isoelectric focusing, Introduction to Native and SDS-PAGE.

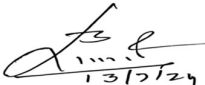
15 Lectures

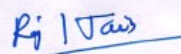
### Unit-IV

**Radiotracer techniques:** Nature of radioactivity, Use of Radioisotopes in biological research, Autoradiography, Radiolabelling techniques, Safety aspects.

**Instrumentation:** Working Principle, Operation and Application of pH meter, Weighing Balance, Water bath, Autoclave, Laminar Airflow chamber, Centrifuge, Hot Air Oven, Growth Chamber, Shaker Incubator, Microtome, Tissue Homogenizer, Spectrophotometer, Electrophoresis Apparatus, Thermal Cycler (PCR), Gel Documentation system (Gel DOC).

15 Lectures

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## Suggested Books and References:

- K. Wilson, J. Walker (2010), **Principles and Techniques of Biochemistry and Molecular Biology**, Seventh Edition, Cambridge University Press, New York, USA.
- Pearse, **Histochemistry-Theoretical and applied**, Volume I-III (1980-1993), Churchill Livingstones.
- Plummer, **An Introduction to Practical Biochemistry** (1989), 3<sup>rd</sup> edition, McGraw Hill, London.
- Simon Roe, ed. (2001), **Protein purification techniques: A practical approach**, 2<sup>nd</sup> edition, Oxford University Press.
- Phillip Sheeler and Donald E Bianchi (2006), **Cell and Molecular Biology**, John Wiley and Sons, Inc. U.K.
- Skoog and Leary (1992), **Principles of Instrumental analysis**, 4<sup>th</sup> Edition. Saunder's College Publishing, New York.
- R. Boyer (2000), **Modern Experimental Biochemistry**, Pearson Education, Asia.
- S.E. Ruzin (1999), **Plant Microtechnique and Microscopy**, Oxford University Press, New York.
- S.K. Sawhney, Randhir Singh (2000), **Introductory Practical Biochemistry**, Narosa Publishing House, New Delhi.
- L. Veerkumari (2011), **Bioinstrumentation**, MJP Publishers Chennai.
- N. Arumugam and V. Kumaresan (2015), **Biophysics and Bioinstrumentation**, Saras Publication, Nagercoil, Tamil Nadu.
- Latest research articles/review articles relevant to the respective topics will be provided to the students by the concerned faculty.

## Suggested E-resources:

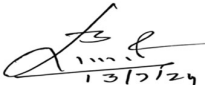
### Online Lecture Notes and Course Materials:

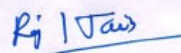
1. <http://ecoursesonline.iasri.res.in/course/view.php?id=282>
2. <https://www.docsity.com/en/subjects/biochemistry-and-instrumentation/>
3. NPTEL :: Biotechnology - Bioanalytical Techniques and Bioinformatics
4. Analytical Techniques - Course (swayam2.ac.in)

## B.Sc. Botany Semester-IV Practical-II Syllabus

### BOT- 64P-258

1. Preparation of permanent slide of any plant material (Whole mount/Section).

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2. Study of microscopic techniques using digital resources (Freeze-fracture, Negative staining).
3. Demonstration of microscopes.
4. Use of centrifuge for various applications.
5. Numerical exercise based on centrifugation.
6. Measurement of size of microscopic objects using Micrometry.
7. Quantification of biomolecules using Beer-Lambert's law (Numerical exercise).
8. Estimation of Optical Density (OD) using spectrophotometer.
9. Demonstration of SDS-PAGE Unit.
10. Demonstration of DNA gel electrophoresis.
11. Estimation of Protein by Bradford Method.
12. Separation of Amino acids using chromatography.
13. Separation of chloroplast pigments using chromatography.
14. Digital Demonstration of Thermal Cycler (PCR)
15. Demonstration of instruments in above-mentioned syllabus.
16. Visit to any tissue culture lab.
17. Any other exercise based on theory syllabus.

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**B.Sc. Botany Semester- IV Practical -II**

**Scheme of Practical Examination and Distribution of marks**

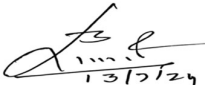
**BOT-64P-258**

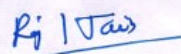
**Max. Marks: 10\*+40**

**Min. Marks: 4\*+16**

**Time: 4 Hours**

Exercise	Regular	Ex-students
1. Exercise A	5	8
2. Exercise B	5	8
3. Exercise C	5	7
4. Exercise D	5	7
5. Comment upon the spots- identify giving reasons (1 to 5).	10	15
6. Viva-voce	5	5

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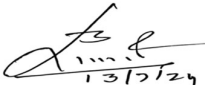
  
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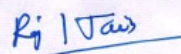
7. Record	5	-
<b>Total</b>	<b>10*+40=50</b>	<b>50</b>
<b>*Internal marks for regular students only</b>		
Candidates must keep a record of all work done in the practical classes and submit the same for inspection at the time of practical examination.		

### Course Learning Outcomes:

At the completion of the course, the student would be able to:

1. Develop ample disciplinary knowledge and understanding of biotechniques, principles, and applications of instrumentation.
2. Understand the various physiological responses in plants through techniques.
3. Recall procedures for microscopy, electrophoresis, and photometric methods.
4. Develop insights into various principles, precautions, laws, and applications behind various techniques.
5. Technically handle microscopes, pH meter, Colorimeter, Autoclave, Centrifuge, Oven, Incubator, Laminar air flow chamber, Spectrophotometer, etc.
6. Apply the concepts of biotechniques in other disciplines to make significant contributions in interdisciplinary sciences.
7. Apply these techniques to characterize proteins and nucleic acids, providing insights into their structure and function.

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