University of Rajasthan

Jaipur-302004

SYLLABUS

(UG0802 – Three/Four Year Bachelor of Science)

(Bio Group)

Subject: Botany

For Semester I & VI

(From the Academic Year 2025-26 onwards)

(Syllabus as per NEP-2020 and Choice Based Credit System)

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

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. 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.

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

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	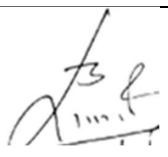	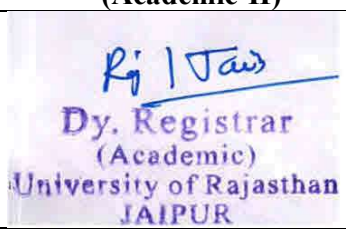

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	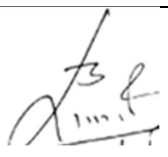	

Name of University	**University of Rajasthan, Jaipur**
Name of Faculty	**Science**
Name of Discipline	**Botany**
Type of Discipline	**Major/Minor**
List of Programme where offered as Minor Discipline	**UG0806, UG0812**
Offered to Non-Collegiate Students	**Yes**

SEMESTER-WISE PAPER TITLES WITH DETAILS

UG0802–Three/Four Year Bachelor of Science (Bio Group)								
				Botany	**Credits**			
#	**Level**	**Semester**	**Type**	**Title**	**L**	**T**	**P**	**Total**
1.	5	I	MJR	**UG0802 - BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I**	4	0	0	4
2.	5	I	MJR	**UG0802 - BOT-51P-102 – Practical-I**	0	0	2	2
3.	5	II	MJR	**UG0802 - BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II**	4	0	0	4
4.	5	II	MJR	**UG0802 - BOT-52P-104 – Practical-II**	0	0	2	2
5.	6	III	MJR	**UG0802- BOT-63T-201 – Microbiology and Plant Pathology**	4	0	0	4
6.	6	III	MJR	**UG0802- BOT-63P-202 – Practical –III**	0	0	2	2
7.	6	IV	MJR	**UG0802 - BOT-64T-203 Plant Taxonomy and Economic Botany**	4	0	0	4
8.	6	IV	MJR	**UG0802 BOT-64P-204 Practical-IV**	0	0	2	2
9.	7	V	MJR	**UG0802 BOT-75T-301 Plant Biochemistry and Physiology**	4	0	0	4
10.	7	V	MJR	**UG0802 BOT-75P-302 Practical-V**	0	0	2	2
11.	7	VI	MJR	**UG0802 BOT-76T-303 Angiosperm Morphology, Anatomy and Embryology**	4	0	0	4
12.	7	VI	MJR	**UG0802 BOT-76P-304 Practical VI**	0	0	2	2
13.	8	VII	MJR	**UG0802**	4	0	0	4
14.	8	VII	MJR	**UG0802**	0	0	2	2
15.	8	VIII	MJR	**UG0802**	4	0	0	4
16.	8	VIII	MJR	**UG0802**	0	0	2	2

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	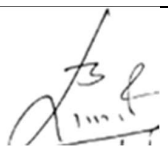	

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	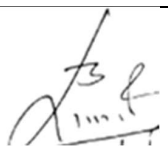	

Examination Scheme

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.
6. In the case of Non-Collegiate Students there will be no Continuous assessment and credit points in a course/subject will be assigned only if, the non-collegiate student obtains at least a C grade in the EoSE examination of a Course/Subject.

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	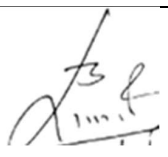	

Examination Scheme for Continuous Assessment (CA)

DISTRIBUTION OF CONTINUOUS ASSESSMENT (CA) MARKS

S. No.	CATEGORY	Weightage (out of total internal marks)		THEORY					PRACTICAL		
				CORE (Only Theory)	CORE (Theory + Practical)	AEC	SEC	VAC	CORE (Theory +Practical)	SEC	VAC
	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 responsibility will be of teacher concern.
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 I

CA – Continuous Assessment EoSE – End of Semester Examination

Regular Students –

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I	CA	01 Hr	CA	20 Marks	CA	08 Marks
		EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	BOT-51P-102 – Practical-ICell Biology and Diversity of Plant Kingdom-I	CA	1 Hr	CA	10 Marks	CA	04 Marks
		EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 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.

Non-Collegiate Students –

Type	Course Code and Nomenclature	Duration of Examination	Maximum Marks(EoSE)	Minimum Marks(EoSE)
Theory	BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I	03 Hrs	100 Marks	40 Marks
Practical	BOT-51P-102 – Practical-I Cell Biology and Diversity of Plant Kingdom-I	04 Hrs	50 Marks	20 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: 80 Marks

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	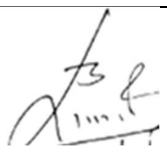	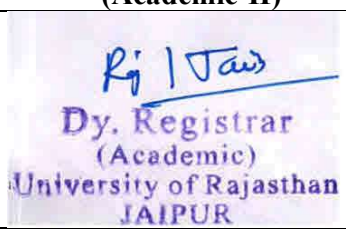

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 20 marks.

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	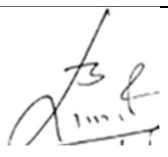	

Syllabus

UG0802 – Three/Four Year Bachelor of Science (Bio Group)
I-Semester - Botany
BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
I	BOT-51T-101	Cell Biology and Diversity of Plant Kingdom-I				5	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	Major/Minor	4	2	6	Yes	60 lectures with diagrammatic and informative assessments during lecture hours	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Biology Courses of Senior Secondary level					
Objectives of the Course:		➢ To understand the structural organization and functions of organelles in the cell. ➢ To differentiate between prokaryotic and eukaryotic cells and plant and animal cells. ➢ To gain understanding on Nucleic acids and chromosome organization. ➢ To understand cell cycle and analyze different stages of mitosis and meiosis. ➢ To understand microscopic to macroscopic view of the Algae and Fungi. ➢ To be able to differentiate algal and fungal members. ➢ To understand difference between Hepaticopsida, Anthocerotopsida and Bryopsida. ➢ To be able to identify and know about Lichens.					

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Course Outcomes:

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

Cognitive level	Course outcomes
1. Understanding	• To know the structural and functions properties of prokaryotic and eukaryotic cells. • To learn, understand and develop skill and hands on training in basics of cell biology. • To make students know of all the kind of plant groups and understand relationships between them. • To aware students about diversity of lower plant presents on various habitats. • To understand microscopic to macroscopic view of the plants. • To interpret amphibious to symbiotic relationship of the plants.
2. Memorizing	• Composition of cell. • Human chromosomes and organization of chromosomes. • Names of all plant groups and relationships between them. • Diagrammatic representation of the algae, bryophytes and lichens. • Typical type of Life cycles found in algae, Fungi and bryophytes.
3. Applying	• Variations in functions of cell organelles. • Concept of cell cycle, abnormalities, cell membrane, cell-cell interactions. • Economic importance of algae, fungi and lichens. • Microscopic identification of algae, bryophytes, fungi and lichens.

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	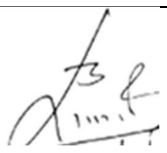	

Detailed Syllabus

BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I

Unit – I

Cell and Cytoskeleton	Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Plant and animal cells; Chemistry, structure and function of Plant cell wall. Overview of plasma membrane: fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis. Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton**:** Role and structure of microtubules, microfilaments and intermediary filaments.	**(8 lectures)**
Cell Organelles	Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semi-autonomous nature of mitochondria and chloroplast. Lysosomes and Vacuoles. Endomembrane system: Endoplasmic Reticulum – Types and Structure. Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus.	**(7Lectures)**

Unit –II

Nucleic acids	DNA as genetic material (Griffith's transformation experiment and Hershey and Chase blender experiment); Structure and function of DNA (Watson and Crick Model); Structure and function of different types of RNA (rRNA, mRNA, tRNA, snRNA).	**6 lectures**
Chromosomes	Chromosome number, structure and function, types of chromosomes (metacentric, sub-metacentric, acrocentric, telocentric); Chromosome organization according to Nucleosome model; Special types of chromosomes: Lamp brush and Polytene chromosomes.	**5 lectures**
Cell Division	Phases of eukaryotic cell cycle; Different stages of mitosis; Different stages of Meiosis I and Meiosis II, synaptonemal complex, chiasmata formation and crossing over.	**4 lectures**

Unit –III

Plant Kingdom	Introduction to Plant kingdom-Basic idea of hierarchy in all groups of plants	**2 lectures**
Algae	General characteristics; Diverse Habitats; Range of thallus organization; methods of reproduction (Vegetative, Asexual, Sexual); Economic importance. Criteria and classification system of Fritsch (1935) (distinguishing features upto classes). Morphology and life history of: Cyanophyceae: *Nostoc*; Chlorophyceae: *Volvox*; Xanthophyceae: *Vaucheria*; Phaeophyceae: *Ectocarpus*; Rhodophyceae: *Polysiphonia*.	**10 lectures**

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Lichen	General characteristics; Habitat; Structure; Reproduction; Ecological and Economic importance.	**3 lectures**

Unit-IV

Fungi	General characteristics; Thallus organization; Different hyphal forms; Heterokaryosis and Para sexuality; Nutrition and Reproduction in fungi; Economic importance.Classification (A*lexopoulos & Mims, 1996*); Morphology and life history of: Zygomycota: *Rhizopus*, Ascomycota: *Peziza*, Basidiomycota: *Puccinia*.	**7 Lectures**
Bryophytes	General characteristics; affinities with algae and pteridophytes; Distribution; Range of thallus structure; Reproduction (Vegetative and Sexual); Alternation of generations and evolution of sporophytes.Classification (Proskauer, 1957); Structures of gametophyte & sporophyte and life history (Development details not included) of: Hepaticopsida: *Marchantia*, Anthocerotopsida: *Anthoceros* and Bryopsida: *Funaria*.	**8 lectures**

Suggested Books and References –

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6thEd.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: A Molecular Approach** (6th Ed.). Washington: ASM; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments**. John Harris, D., Wiley & sons, New York
4. Veer Bala Rastogi. **Genetics.** Medtech
5. Veer Bala Rastogi. **A Textbook of Cell Biology and Genetics.** Kedarnath Ramnath
6. Alexopoulos, C.J. and Mims, C.W.: **Introductory Mycology**, John Wiley and Sons, New York, 2000
7. Singh, Pande and Jain**. A Textbook of Botany,** Rastogi publications
8. Dube, H.C.: Fungi, Rastogi Publication, Meerut, 1989.
9. Vashishtha, **B.R. Botany for Degree Students -Fungi**, S. Chand & Co., New Delhi, 2001.
10. Gilbart, M. Smith: **Cryptogamic Botany**, Vol. I & II (2nd Ed.) Tata McGraw Hill. Publishing Co., Ltd., New Delhi, 1985.
11. Puri. P.: **Bryophytes**, Atmaram& Sons. Delhi, Lucknow, 1985.
12. Aneja, K.R.: **Experiments in Microbiology, Plant Pathology and Biotechnology**. New Age International (P) Ltd., Publishers, New Delhi 2003.
13. Pandey B. P.(2022) **Algae, Bryophytes and Lichens**. S Chand Publication

Suggested E-resources:

1. **https://youtu.be/K2teJ6-DBLw**
2. https://archive.nptel.ac.in/courses/102/108/102108086/
3. https://archive.org/details/cellmolecularapp6edcoop

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	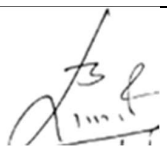	

B.Sc. Semester- I (Bio Group)
BOT-51P-102 Botany Practical-I
Cell Biology and Diversity of Plant Kingdom-I
Syllabus

Cell and Cell Organelles

- Study of electron microphotographs of prokaryotic and eukaryotic cell.
- Study of electron microphotographs of virus, bacteria and eukaryotic cells for comparative study of cellular organization.
- Study of cell structure in Onion, *Hydrilla* and *Spirogyra*.
- Study of plastid for pigment distribution in *Lycopersicon*, *Cassia* and *Capsicum*.

Cell Division and Chromosomes

Study of permanent slides/photographs of different stages of mitosis and meiosis, sex chromosomes, polytene chromosome and salivary gland chromosomes.

- Study of different stages of mitosis and meiosis in root-tip cells and flower buds respectively of onion.
- Calculate the mitotic index of onion root tip cells.
- Study of induced aberrations in onion root tips employing chemicals and plant extracts.

Algae and Lichen

- **Algae-** Study of morphology and anatomy of *Nostoc*, *Volvox, Chara, Vaucheria, Ectocarpus* and *Polysiphonia* (vegetative and reproductive structures) by preparing temporary slides and studying permanent slides.
- **Lichens:** Study of growth forms of lichens (crustose, foliose and fruticose)

Fungi and Bryophyta

- **Fungi-** Microscopic observation of vegetative and reproductive structures of *Rhizopus*, *Peziza* and *Agaricus* through preparation of temporary slides and permanent slides.
- **Bryophytes**- Study of morphology, anatomy, vegetative and reproductive organs of *Marchantia*, *Anthoceros* and *Funaria* by preparing temporary slides and studying permanent slides.
- Study of renowned Indian scientists in the fields of phycology (M.O.P Iyengar), mycology (K. C. Mehta), bryology (S.R.Kashyap) and lichens (D.D.Awasthi).
- Make a list of national and international institutes of repute in the fields of cytology, phycology, mycology, bryology and lichens.

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	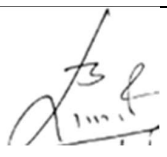	

UNIVERSITY OF RAJASTHAN

B.Sc. Semester- I (Bio Group) Botany Practical-I

Cell Biology and Diversity of Plant Kingdom-I

Scheme of Practical Examination and Distribution of marks

BOT-51P-102 **Duration- 4 hrs**

Max. Marks: 10*+40 **Min. Marks: 4*+16**

S.No.	**Exercise**	**Regular**	**NC/Ex students**
1.	Exercise based on cell structure and types.	**4**	**6**
2.	Make a suitable acetocarmine preparation of the given material. Draw a well-labelled diagram of any one stage of nuclear division.	**4**	**6**
3.	Make a suitable stained preparation of the given material **A**. Draw a labelled diagram and identify giving reasons.**(Algae)**	**4**	**6**
4.	Make a suitable stained preparation of the given material **B**. Draw a labelled diagram and identify giving reasons. (**Fungi)**	**4**	**6**
5.	Make a suitable stained preparation of the given material **C**(vegetative/Reproductive part). Draw a labelled diagram and identify giving reasons. (**Bryophyte)**	**4**	**6**
6.	Comment upon the spots- identify giving reasons. (1 to 5)	**10**	**15**
7.	Viva-voce	**5**	**5**
8.	Record	**5**	**-**
	Total	**10*+40=50**	**50**
***Internal marks for regular students only**			
Regular 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. Learn, understand and develop skill and hands on training in basics of cell biology.
2. Acquire basic knowledge of hereditary material and chromosomes.
3. Know all the kind of plant groups and understand relationships between them.
4. Understand diversity of lower plant presents on various habitats.
5. Identify microscopic to macroscopic view of the plants.
6. Apply the economic importance of lower plants in their endeavours.
7. Promote shared learning through practical classes, presentations and assignments.

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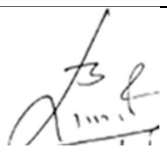
		

Examination Scheme for EoSE for Semester II

CA – Continuous Assessment EoSE – End of Semester Examination

Regular Students –

Type of Examination	CourseCode and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II	CA	01 Hr	CA	20 Marks	CA	08 Marks
		EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	BOT-52P-104 – Practical-II Molecular Biology, Genetics and Diversity of Plant Kingdom-II	CA	1 Hr	CA	10 Marks	CA	04 Marks
		EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 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.

Non-Collegiate Students –

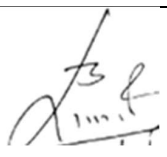
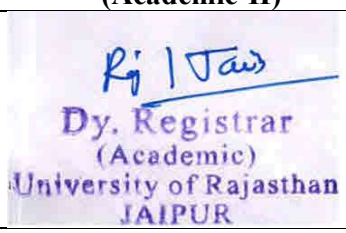
Type	Course Code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II	03 Hrs	100 Marks	40 Marks
Practical	BOT-52P-104– Practical-II Molecular Biology, Genetics and Diversity of Plant Kingdom-II	04 Hrs	50 Marks	20 Marks

The 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: 80 Marks

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

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 20 marks.

Syllabus

UG0802 – Three/Four Year Bachelor of Science (Bio Group)

II-Semester - Botany

BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II

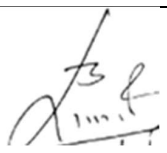
Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
II	BOT-52T- 103	Molecular Biology, Genetics and Diversity of Plant Kingdom-II				5	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Introductory	Major/Minor	4	2	6	Yes	60 lectures with diagrammatic and informative assessments during lecture hours	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Biology Courses of Senior Secondary level					
Objectives of the Course:		➢ To understand the Mendel's laws and its deviations. ➢ To impart knowledge on DNA replication, Mendel's laws of inheritance, mutations. ➢ To understand functions of genes, linkage and crossing over. ➢ To understand morphology and anatomy of the Pteridophytes and Gymnosperms. ➢ To understand reproduction in the Pteridophytes and Gymnosperms. ➢ To have a basic idea of Fossil plants.					

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		Dy. Registrar (Academic) University of Rajasthan JAIPUR

Course Outcomes:

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

Cognitive level	Course outcomes
Understanding	• To learn, understand and develop skill and hands on training in basics of genetics. • To understand functions of genes, linkage and crossing over. • To interpret genetics of a large group of population. • To understand characteristic feature and life cycle pattern of pteridophytes and gymnosperms. • To understand adaptation of pteridophytes to land habit.
Memorizing	• Differentiation between linkage, crossing over, allelic interactions. • Mendel's laws of genetics. • Classification of pteridophytes and gymnosperms. • Evolutionary concepts in pteridophytes and gymnosperms. • Habit, habitat, morphology and anatomy of various members.
Applying	• Allelic and non-allelic interactions • Possibilities of mutations and mutagens and ploidy in plants. • Ecology and economic importance of pteridophytes and gymnosperms.

Signature of Dean	**Signature of BoS Convenor**	**Signature Of DR (Academic-II)**
		

Detailed Syllabus

BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II

Unit – I

DNA replication	Enzymes and mechanisms of prokaryotic DNA replication: Initiation, Elongation and Termination; Leading and lagging strands, Okazaki fragments.	**7 lectures**
Expression of Gene in Prokaryotes	Transcription, Initiation, elongation and termination. **Genetic code:** Meaning, types of codons, properties. **Translation**: Initiation, Elongation and Termination in Prokaryotes	**8 lectures**

Unit –II

Genetic inheritance	Mendel's laws of inheritance and their exceptions; allelic (incomplete dominance, co-dominance, lethality) and non-allelic interactions (complementary genes, epistasis and duplicate genes); Multiple allelism (ABO blood groups in men); Quantitative inheritance (Grain color in wheat). **Cytoplasmic inheritance:** Plastid inheritance (different types of leaves in *Mirabilis jalapa*); Mitochondrial inheritance (Cytoplasmic male sterility in plants).	**8 lectures**
Structural and numerical aberrations	Deletion, Duplication, Translocation, Inversion, Aneuploidy and Polyploidy. **Mutations**: Types of Mutations, Spontaneous and induced Mutations, Physical and Chemical mutagens.	**7 lectures**

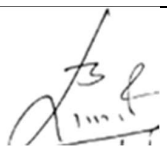
Unit –III

Pteridophytes	General characteristics; Affinities with bryophytes & gymnosperm; Heterospory and seed habit; Evolution of stele in Pteridophytes; Economic importance. Classification (Riemers, 1954); Study of life history of fossil Pteridophyte – *Rhynia*. Life history of Psiloptopsida: *Psilotum;* Lycopsida: *Selaginella*; Sphenopsida: *Equisetum*; Pteropsida: *Marsilea*.	**15 lectures**

Unit-IV

Gymnosperms	General characteristics; Affinities with Pteridophytes and Angiosperms, Distribution; Economic importance. Classification (Sporne, 1965); Life history of Cycadopsia: *Cycas*; Coniferopsida: *Pinus*; Gnetopsida: *Ephedra*.	**12 lectures**
Paleobotany	Introduction, Basic concept and significance, Geological time scale; Types of Fossils.	**3 lectures**

Suggested Books and References –

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2014). **Molecular Biology of the Cell** (6thEd.). New York: Garland Science
2. Cooper, G. M., and Hausman, R. E. (2013). **The Cell: A Molecular Approach** (6th Ed.). Washington: ASM; Sunderland.
3. Karp, G. **Cell and Molecular Biology. Concepts and experiments**. John Harris, D., Wiley & sons, New York
4. Lodish, HF. Berk, A. Kaiser, CA, Krieger, M. Bretscher, A. Ploegh, H. Aman, A. Martin, K. (2016). **Molecular Cell Biology** (8th Ed.). New York: W.H. Freeman
5. Gupta P.K. **Cell and Molecular Biology** 2018. 5th edition Rastogi Publication India.
6. Veer Bala Rastogi. **Genetics.** Medtech
7. Veer Bala Rastogi. **A Textbook of Cell Biology and Genetics.** Kedarnath Ramnath
8. Singh, Pande and Jain**. A Textbook of Botany,** Rastogi publications
9. B.R. Vashishta and P.C. Vashishta. **Botany for Degree Students: Pteridophyta - Vascular Cryptogams),** S.Chand (G/L) & Company Ltd
10. B.R. Vashishta and P.C. Vashishta. **Gymnsperms (Botany for Degree Students),** S.Chand (G/L) & Company Ltd

Suggested E-resources:

1. **https://youtu.be/K2teJ6-DBLw**
2. https://archive.org/details/cellmolecularapp6edcoop
3. https://assets.cambridge.org/97805217/07725/excerpt/9780521707725_excerpt.pdf
4. https://books.google.co.in/books?id=Xz1RCgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

B.Sc. Semester- II (Bio Group)

BOT-52P-104-Botany Practical-II

Molecular Biology, Genetics and Diversity of Plant Kingdom-II

Practicals related to DNA

- Isolation of Genomic DNA from Onion/Banana/Pineapple/etc.
- Demonstration of Gel-electrophoresis

Practicals related to Genetics

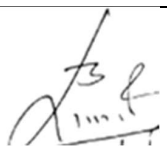
- To solve genetic problems based upon Mendel's laws of inheritance: Monohybrid cross, Dihybrid cross, Back cross and test cross.
- Induction of polyploidy using colchicines
- Emasculation, Bagging and Tagging

Pteridophytes-

- **S**tudy ofvegetative and reproductive stages of *Selaginella*, *Equisetum* and *Marsilea* by preparing temporary slides and studying permanent slides.
- Study of fossil plant: *Rhynia*

Gymnosperms

- Study of Vegetative and reproductive stages of *Cycas*, *Pinus* and *Ephedra* by preparing temporary slides and studying permanent slides.

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

UNIVERSITY OF RAJASTHAN

B.Sc. Semester- II (Bio Group) Botany Practical-II

Molecular Biology, Genetics and Diversity of Plant Kingdom-II

Scheme of Practical Examination and Distribution of marks

BOT-52P-104 **Duration- 4 hrs**

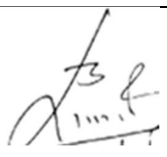
Max. Marks: 10*+40 **Min. Marks: 4*+16**

S.No.	Exercise	Regular	NC/Ex students
1.	Exercise-based on Nucleic acids	**5**	**7**
2.	Exercise-based on Genetics	**5**	**7**
3.	Make a suitable stained preparation of the given material **A**(vegetative/Reproductive part). Draw a labelled diagram and identify giving reasons. (**Pteridophyte)**	**5**	**8**
4.	Make a suitable stained preparation of the given material **B** (vegetative/Reproductive part). Draw a labelled diagram and identify giving reasons. (**Gymnosperm**)	**5**	**8**
5.	Comment upon the spots- identify giving reasons. (1 to 5)	**10**	**15**
6.	Viva-voce	**5**	**5**
7.	Record	**5**	**-**
	Total	**10*+40= 50**	**50**
	***Internal marks for regular students only**		
	Regular 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. Learn, understand and develop skill and hands on training in basics of genetics.
2. Acquire basic knowledge of Mendel's laws of genetics.
3. Develop possibilities of mutations and mutagens and ploidy in plants.
4. Understandcharacteristic feature and life cycle pattern of pteridophytes and gymnosperms.
5. Apply the economic importance and evolutionary concepts of pteridophytes and gymnosperms.
6. Comprehend information about fossil plants.
7. Promote shared learning through practical classes, presentations and assignments.

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

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	
Theory	BOT-63T-201 Microbiology and Plant Pathology	CA	1 Hrs	CA	20 Marks	CA	8 Marks
		EoSE	3 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	BOT-63P-202 Practical-III Microbiology and Plant Pathology	CA	1 Hrs	CA	10 Marks	CA	4 Marks
		EoSE	4 Hrs	EoSE	40 Marks	EoSE	16 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.

Non-Collegiate Students –

Type	Course Code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	BOT-63T-201 Microbiology and Plant Pathology	3 Hrs	100 Marks	40 Marks
Practical	BOT-63P-202 Practical-III Microbiology and Plant Pathology	4 Hrs	50 Marks	20 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.

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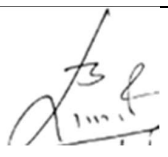
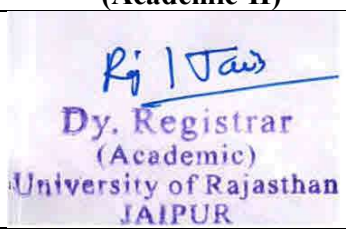
		

PART-B: 80 Marks

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 20 marks.

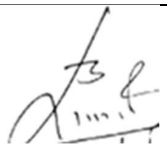
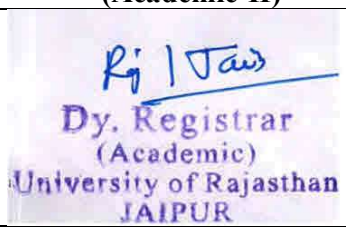
Syllabus

UG0802 – Three/Four Year Bachelor of Science (Bio Group)

III-Semester- Botany

BOT-63T-201-Microbiology and Plant Pathology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
III	BOT-63T-201	Microbiology and Plant Pathology				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	Major/Minor	4	2	6	Yes	60 lectures with diagrammatic presentations and informative assessments during lecture hours	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Botany course of Foundation/Introductory level					
Objectives of the Course:		➢ To gain in-depth knowledge about bacteria, viruses and other microorganisms, including their structure, function, genetics, and role in ecosystems, ➢ To learn about the interactions between plants and microorganisms, ➢ To understand the beneficial relationships (e.g., symbiosis) and harmful interactions (e.g., plant diseases) between plants and microorganisms					

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

COURSE OUTCOMES

On completion of the course the student would be able to develop the following

Understanding	• To gain in-depth knowledge about bacteria, virusesand other microorganisms, including their structure, function, genetics, and role in ecosystems. • To learn about the interactions between plants and microorganisms, • To understand the beneficial relationships (e.g., symbiosis) and harmful interactions (e.g., plant diseases) between plants and microorganisms.
Memorizing	• Different types of microbes with structure , function and their economic importance. • Host pathogen interaction and its effects on plants. • Symptomology, disease cycle and control of different pathogens causing diseases.
Applying	• Acquire proficiency in various laboratory techniques, such as culturing microorganisms, gram staining, microscopy, and biochemical assays. • Will be helpful for students infurther developing interest in agricultural research, crop protection, and pest management to improve crop yield and quality. • Work in disease prevention and control, focusing on plant diseases that impact food safety and public health.

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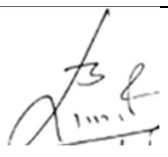
		

Detailed Syllabus
BOT-63T-201 - [Microbiology and Plant Pathology]

Unit – I

Microbiology	Introduction to microbial word: History and Development in the field of microbiology, Systemic position of Micro-organism (R.H. Whittaker's five kingdom concept, Carl Woese's Domain System), Origin of Life, contribution of Louis Pasteur and Robert Koch, Germ theory of disease.	**(7 Lectures)**
Virus	Discovery, General account, structure with special reference to TMV, Pox virus, Bacteriophage; Replication of T4 phage (Lytic and Lysogenic).	**(6 Lectures)**
Mycoplasma	General Characteristics, Morphology and Reproduction.	**(2 Lectures)**

Unit –II

Bacteria	General Characteristics, Classification, Cell structure, endospore formation, Reproduction- asexual and recombination (Conjugation, Transformation and Transduction).	**(10 Lectures)**
Applied Microbiology	Economic importance of viruses, Economic importance of Bacteria with reference to their role in agriculture and food industry, Biofilms	**(5 Lectures)**

Unit –III

Phyto-pathology	Terminology and basic concepts (Primary and Secondary inoculum; infection, Pathogenicity, Pathogenesis, Disease Cycle); Biotic and abiotic diseases, General symptoms caused by Viruses, Bacteria, Fungi, Mycoplasma, Nematodes, Insects (smut, rust, mildews, canker, mosaic, vein clearing, spots, lesion, knot, galls).	**(8 Lectures)**
Diseases	Viral, Mycoplasmal and Bacterial diseases: Brief account, Symptomology and control of the following plant diseases:- Tobacco Mosaic, Little leaf of Brinjal, Citrus canker and Angular leaf spot of Cotton.	**(7 Lectures)**

Unit-IV

Fungal Diseases	Symptomology, disease cycle and 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, Early blight of Potato	**(10 Lectures)**
Diseases	**Disease caused by insects and nematodes:** General account of diseases caused by insects and nematodes, Brief account and histopathology of root knot of vegetables, leaf gall of *Pongamia*.	**(5 Lectures)**

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		Dy. Registrar (Academic) University of Rajasthan JAIPUR

Suggested Books and References –

1. Pelczar, M.J. (2001) Microbiology, 5th edition. New Delhi, Delhi: Tata Mc-Graw- Hill Co.
2. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
3. Agrios G.N. (2004) Plant Pathology, 5th Edition, Academic Press
4. Pandey B.P. (2001) Plant Pathology (Pathogen and Plant Disease), S. Chand Publishing
5. Mehrotra RS and Aggarwal A. (2003) Plant Pathology, 2nd Edition. Delhi: Tata Mc-Graw-Hill Co.
6. Sharma P.D. (2013). *Plant pathology*. Deep and Deep Publications.

Suggested E-resources:

1. **https://archive.nptel.ac.in/courses/102/103/102103015/**
2. **https://onlinecourses.swayam2.ac.in/cec21_bt16/preview**
3. **https://www.pdfdrive.com/plant-pathology-concepts-and-laboratory-exercises-e179105354.html**

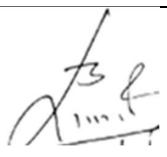
University of Rajasthan
B.Sc. Semester – III (Microbiology and Plant Pathology)
BOT-63P-202 Botany Practical-III

I Microscopic techniques- handling of light microscope, general idea of SEM and TEM.
Write major contribution of leading scientists of Microbiology
Study of TMV, Bacteriophage and Pox virus, Mycorrhiza (Photographs/3D Models)

II Study of Bacteria by Gram Staining and Negative staining
Preparation of Liquid and solid media for culturing microbes
Pure culture techniques- pour plate, spread plate, streaking

III Study of symptoms of plant diseases (specimen/permanent slide)-
Downy mildew/green ear disease of Bajra,
Tobacco Mosaic, Citrus canker, Little leaf of Brinjal,
Study of spores of *Alternaria* from Early blight of Potato

IV Study and identification of spores from temporary slide preparation from infected plant material:- white rust of crucifers (conidia stage), Black/ stem rust of Wheat (all stages).
Study of histopathology using temporary slide prepration of infected part of root knot of tomato, Leaf gall of *Pongamia*

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

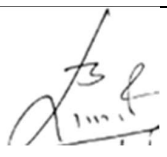
UNIVERSITY OF RAJASTHAN
B.Sc. Semester- III (Bio Group) Botany Practical-III
Microbiology and Plant Pathology
Scheme of Practical Examination and Distribution of marks

BOT-63P-202 **Duration: 4 Hrs**
Maximum Marks 10*+40 Marks Minimum marks 4*+16 Marks

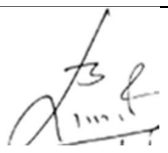
S.No.	Exercise	Regular	Ex./N.C. Students
1.	Perform exercise of Microbiology Gram'/negative staining of bacteria or Identification of virus/mycoplasma	**4**	**5**
2.	Perform the exercise based on the microbiology – media preparation/any pure culture technique	**6**	**10**
3.	Study the material "A" carefully, prepare a suitable stained preparation, and identify the casual organism associated with the disease giving reasons (Fungal disease)	**6**	**10**
4.	Identify the material "B" carefully, prepare a suitable stained preparation, and identify the casual organism associated with the disease giving reasons (Insect/Nematode disease)	**4**	**5**
5.	Spotting (5 spots)	**10**	**15**
6.	Viva voce	**5**	**5**
7.	Record	**5**	**-**
	TOTAL	**10*+40=50**	**50**
	***Internal marks for regular students only**		
	Regular 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: Upon completion of course, students will be able to

1. Understand about morphology and function diverse microbes.
2. Understand about diagnosing plant diseases, understanding their causes, and implementing management strategies to control or prevent them.
3. Understand and perform different laboratory exercise to further understand about microorganisms.
4. Acquire knowledge about different types of microbes with structure, function and their economic importance, Host pathogen interaction and its effects on plants.

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

5. Apply control and management strategies for plant diseases caused by fungi, bacteria, nematodes, insects etc.
6. Acquire proficiency in various laboratory techniques, such as culturing microorganisms, gram staining, microscopy, and biochemical assays.
7. Develop interest among students in agricultural research, crop protection, and pest management to improve crop yield and quality.
8. Work in disease prevention and control, focusing on plant diseases that impact food safety and public health

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

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	
Theory	**BOT-64T-203 – Plant Taxonomy and Economic Botany**	**CA**	**1 Hrs**	**CA**	**20 Marks**	**CA**	**8 Marks**
		EoSE	**3 Hrs**	**EoSE**	**80 Marks**	**EoSE**	**32 Marks**
Practical	**BOT-64P-204 – Practical IV Plant Taxonomy and Economic Botany**	**CA**	**1 Hrs**	**CA**	**10 Marks**	**CA**	**4 Marks**
		EoSE	**4 Hrs**	**EoSE**	**40 Marks**	**EoSE**	**16 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.

Non-Collegiate Students –

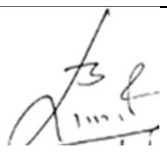
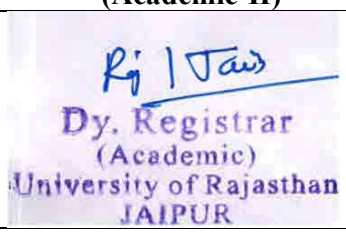
Type	Course Code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	**BOT-63T-201 Microbiology and Plant Pathology**	**3 Hrs**	**100 Marks**	**40 Marks**
Practical	**BOT-64P-204 – Practical IV Plant Taxonomy and Economic Botany**	**4 Hrs**	**50 Marks**	**20 Marks**

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: 80 Marks

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

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 20 marks.

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	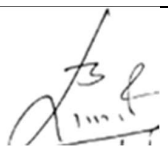	

Syllabus
UG0802 -BOT-64T-203
Plant Taxonomy and Economic Botany
IV-Semester- B.Sc. (Bio Group)
Botany

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
IV	BOT-64T-203	Plant Taxonomy and Economic Botany				6	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	Major/Minor	4	2	6	Yes	60 lectures with diagrammatic presentations and informative assessments during lecture hours	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Botany course of Foundation/Introductory level					
Objectives of the Course:		➢ To gain in-depth knowledge about plant taxonomy and economic botany. ➢ To learn about the various aspects of taxonomy like nomenclature, classification and identification ➢ To understand the benefits of plants with their products in various field. ➢ To learn about plant collection and preservation of plants in lab (herbarium).					

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		Dy. Registrar (Academic) University of Rajasthan JAIPUR

COURSE OUTCOMES

On completion of the course the student would be able to develop the following

Understanding	• To Understand the historical development and modern approaches to plant classification systems, including the principles and criteria used for categorizing plants • Understand the evolutionary relationships among different plant groups and how phylogenetic trees represent these relationships. • Understand the key morphological features that are used to identify and classify plants at various taxonomic levels (family, genus, species).
Memorizing	• Memorize the hierarchical classification of plants, including ranks such as domain, kingdom, phylum, class, order, family, genus, and species. • Memorize the characteristics and representative species of major plant families, including their economic and ecological significance.
Applying	• Apply knowledge to identify plant species in the field using keys, guides, and floras, demonstrating proficiency in using diagnostic features. • Apply techniques for collecting, preserving, and preparing plant specimens for herbarium collections, ensuring accurate labeling and documentation. • Conduct independent or group research projects involving the collection, identification, and classification of local plant species, integrating field and laboratory work.

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	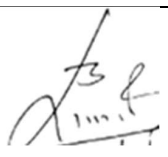	

Detailed Syllabus

BOT-64T-203 - Plant Taxonomy and Economic Botany

UNIT-I

Classification	Artificial (Linneaus), Natural (Bentham&Hooker) and Phylogenetic (Engler and Prantle's) System.	**5 lectures**
Nomenclature	Angiosperm Phylogeny Group (APG). International Code of Botanical Nomenclature. Introduction, principles, rules (Name of Taxon, Priority & publication) and Recommendations. Introduction to International code of Nomenclature for algae, fungi and plants (ICNafp),	**5 lectures**
Herbarium	Equipments, herbarium sheet preparation & preservation and significances. Introduction to Botanical Survey of India (BSI).	**5 lectures**

UNIT-II

Taxonomic literature	Floras, Monographs, Icons.	**3 lectures**
Modern Trends	Cytotaxonomy, Chemotaxonomy, Palynology, Embryology Anatomy and Numerical taxonomy.	**5 lectures**
Study of Families	Diagnostic characters and economic importance ofRanunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae and Asteraceae.	**7 lectures**

UNIT-III

Study of Families	Diagnostic characters and economic importance of Apocynaceae, Asclepieadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae and Poaceae.	**8 lectures**
Economic Botany	Vavilov concept of centre of origin. Primary and secondary centres. **Cereals** (General account): Rice, Wheat, Maize. **Millets** (General account)**:** Ragi (finger millet), Jowar (Sorghum), Sama (Little millet), Bajra (pearl millet), Variga (Porso millet).	**7 lectures**

UNIT-IV

Economic Botany of	**Vegetable oil** : Ground nut and Mustard**Spices:** General account of turmeric, asafoetida, Cumin, Coriander & RedChilli. **Beverages:** Tea and Coffee. **Medicinal plants:** General account (Tulsi, Isabgol, Ashwgandha, Neem and Ephedra). **Fibres:** Cotton&Jute.Processing of Rubber &Sugarcane	**15 lectures**

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Suggested Books and References –

- Principles of Angiosperm Taxonomy by Davis & Heywood. Publisher: Oliver & Boyd
- Taxonomy of Vascular Plants by Lawrence H M George. Publisher : Scientific Publishers
- Plant Systematics: An Integrated Approach. by Gurcharan Singh. Publisher : CRC Press
- Plant Taxonomy by O. P. Sharma. Publisher : McGraw Hill Education
- Taxonomy of Angiosperms by A.V.S.S. Sambamurty. Publisher :Dreamtech Press
- Modern Plant Taxonomy by N.S. Subrahmanyam. Publisher : S Chand
- Economic Botany by B.P. Pandey. Publisher : S Chand & Company
- Economic botany: a comprehensive study by S.L.Kochhar. Publisher : Cambridge University Press
- Economic Botany by Singh, Pandey & Jain. Publisher -S. Chand Publishing

Suggested E-resources:

1. https://www.google.co.in/books/edition/The_Flowering_Plants_Handbook/yoLaBAAAQBAJ?hl=en&gbpv=1&dq=james+byng+taxonomy&printsec=frontcover
2. **https://www.pdfdrive.com**

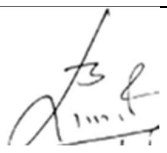
University of Rajasthan
B.Sc. Semester – IV (2024-25)
BOT-64P-204 Botany Practical-IV
Plant Taxonomy and Economic Botany

Exercises based on Plant Taxonomy: -

- Plant description and identification of following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae Apocynaceae, Asclepieadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae and Poaceae
- Exercise based on using taxonomic modern tools
- Preparation of Herbarium sheets
- Campus Flora writing/ Excursion/Field study
- Herbarium tools

Exercises based on Plant Taxonomy

- Biochemical test for Starch, Protein, Oil, Cellulose, ligninand tannin
- Medicinal plant-identification and collection
- Study of specimens with reference to economic use of Cereals, millets, Pulses, Oil, Fibres, Spices, and Beverages (common name, Botanical name, Family, Parts used, Economic uses)
- Collection of specimens of locally available medicinal/ wild plants
- Any other exercise based on theory syllabus

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		

UNIVERSITY OF RAJASTHAN

B.Sc. Semester- IV (Bio Group) Botany Practical-IV
Plant Taxonomy and Economic Botany
Scheme of Practical Examination and Distribution of marks

BOT-64P-204 **Duration: 4Hrs**

Maximum Marks 10*+40 Marks Minimum marks 4*+16 Marks

S.No.	Exercises	Regular	Ex./N.C. Students
1.	Identify the family of the given flower and describe floral characters in semi-technical language, draw floral diagram and write floral formula.	**7**	**10**
2.	Identify and describe the given herbarium tool	**4**	**6**
3.	Perform the biochemical test of given material.	**3**	**4**
4.	Identify the given material (economic botany), write botanical characters and economic importance	**6**	**10**
5.	Spotting (5)	**10**	**15**
6.	Viva voce	**5**	**5**
7.	Record	**5**	**-**
	TOTAL	**10*+40=50**	**50**
	***Internal marks for regular students only**		
	Regular 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:

On completion of the course the student will be able to:

- Learn the types of classifications- artificial, Natural and phylogenetic.
- Gain knowledge about Botanical Survey of India (BSI).
- Briefly study herbarium techniques.
- Learn the taxonomic evidences from molecular, numerical and chemicals.
- Brief study the economic products with special reference to the Botanical name, family, morphology of useful part and the uses
- Acquire an increased awareness and recognition of economical important plants.
- Learn diverse human uses of plants and plant products.
- Apply the knowledge gained in seeking employment to reputed institutions and organizations known in the field of plant taxonomy, diversity, conservation, agro-industry, pharmaceuticals etc.
- Memorize the various classification with the botanical names, distinctions, distribution, habit, characteristics and affinities of various taxon.

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	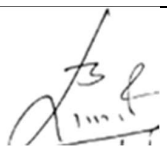	

- Learn the perspective of origin, history and role of important plants and plant products for the development of human culture.
- Acknowledge the economic uses of plants in modern society.
- Acquire an increased awareness and appreciation of plants & plant products encountered in everyday life.
- Develop scientific insights into the development of many plant products that have shaped our society.
- Appreciate the diversity of plants and the plant products in human use.

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	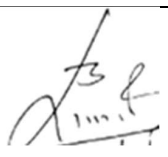	

University of Rajasthan

Jaipur-302004

SYLLABUS

(UG0802 – Three/Four Year Bachelor of Science)

(Bio Group)

Subject: Botany

For Semester V & VI
Examination 2025-26

(From the Academic Year 2025-26 onwards)

(Syllabus as per NEP-2020 and Choice Based Credit System)

Vision:

Signature of Dean	Signature of BoS Convenor	Signature Of DR (Academic-II)
		Dy. Registrar (Academic) University of Rajasthan JAIPUR

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. 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.

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

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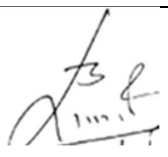
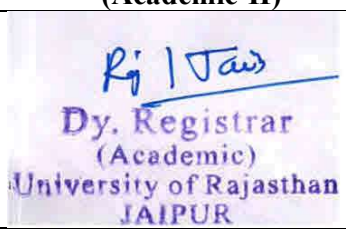
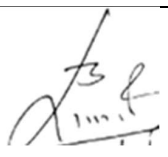
		

Name of University	**University of Rajasthan, Jaipur**
Name of Faculty	**Science**
Name of Discipline	**Botany**
Type of Discipline	**Major/Minor**
List of Programme where offered as Minor Discipline	**UG0806, UG0812**
Offered to Non-Collegiate Students	**Yes**

SEMESTER-WISE PAPER TITLES WITH DETAILS

UG0802–Three/Four Year Bachelor of Science (Bio Group)								
				Botany	**Credits**			
#	**Level**	**Semester**	**Type**	**Title**	**L**	**T**	**P**	**Total**
1.	5	I	MJR	**UG0802 - BOT-51T-101 -Cell Biology and Diversity of Plant Kingdom-I**	4	0	0	4
2.	5	I	MJR	**UG0802 - BOT-51P-102 – Practical-I**	0	0	2	2
3.	5	II	MJR	**UG0802 - BOT-52T- 103 - Molecular Biology, Genetics and Diversity of Plant Kingdom-II**	4	0	0	4
4.	5	II	MJR	**UG0802 - BOT-52P-104 – Practical-II**	0	0	2	2
5.	6	III	MJR	**UG0802- BOT-63T-201 – Microbiology and Plant Pathology**	4	0	0	4
6.	6	III	MJR	**UG0802- BOT-63P-202 – Practical –III**	0	0	2	2
7.	6	IV	MJR	**UG0802 - BOT-64T-203 Plant Taxonomy and Economic Botany**	4	0	0	4
8.	6	IV	MJR	**UG0802 BOT-64P-204 Practical-IV**	0	0	2	2
9.	7	V	MJR	**UG0802 BOT-75T-301 Plant Biochemistry and Physiology**	4	0	0	4
10.	7	V	MJR	**UG0802 BOT-75P-302 Practical-V**	0	0	2	2
11.	7	VI	MJR	**UG0802 BOT-76T-303 Plant Morphology, Anatomy and Embryology**	4	0	0	4
12.	7	VI	MJR	**UG0802 BOT-76P-304 Practical VI**	0	0	2	2
13.	8	VII	MJR	**UG0802**	4	0	0	4
14.	8	VII	MJR	**UG0802**	0	0	2	2
15.	8	VIII	MJR	**UG0802**	4	0	0	4
16.	8	VIII	MJR	**UG0802**	0	0	2	2

Signature of Dean	**Signature of BoS Convenor**	**Signature Of DR (Academic-II)**
		

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.
6. In the case of Non-Collegiate Students there will be no Continuous assessment and credit points in a course/subject will be assigned only if, the non-collegiate student obtains at least a C grade in the EoSE examination of a Course/Subject.

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 (Theory + Practical)	AEC	SEC	VAC	CORE (Theory +Practical)	SEC	VAC
	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

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Note:

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

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	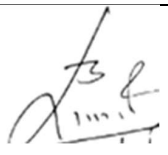	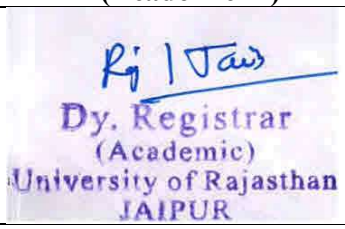

Examination Scheme for EoSE for Semester V

CA – Continuous Assessment EoSE – End of Semester Examination

For Regular Students –

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	**BOT-75T-301 - Plant Biochemistry and Physiology**	CA	01 Hr	CA	20 Marks	CA	08 Marks
		EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	**BOT-75P-302 – Practical-V (Based on Plant Biochemistry and Physiology)**	CA	1 Hr	CA	10 Marks	CA	04 Marks
		EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 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.

For Non-Collegiate Students –

Type	Course Code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	BOT-75T-301 - Plant Biochemistry and Physiology	03 Hrs	100 Marks	40 Marks
Practical	BOT-75P-302 – Practical-V (Based on Plant Biochemistry and Physiology)	04 Hrs	50 Marks	20 Marks

The 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: 80 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 20 marks.

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	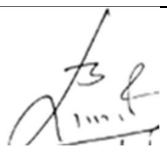	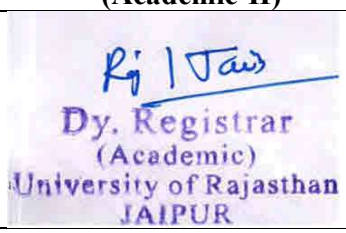

UG0802 – Three/Four Year Bachelor of Science (Bio Group)
V-Semester - Botany
BOT-75T-301 - Plant Biochemistry and Physiology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
V	BOT-75T-301	Plant Biochemistry and Physiology				7	4
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	Major/Minor	4	2	6	Yes	60 lectures with diagrammatic and informative assessments during lecture hours	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Botany course of Introductory/intermediate level					
Course Objectives:		✓ Understand the classification, structure, and function of major biomolecules (proteins, carbohydrates, lipids, nucleic acids). ✓ Explain the nature and types of biological bonds such as glycosidic, peptide, and phosphodiester bonds. ✓ Describe enzyme classification, structure, and factors affecting their activity. ✓ Illustrate mechanisms of water and nutrient transport in plants, including osmosis, transpiration, and pressure flow. ✓ Identify essential macro- and micronutrients in plants and symptoms of their deficiencies. ✓ Analyze key processes of photosynthesis and respiration, including electron transport and energy pathways. ✓ Interpret plant growth and development stages, hormonal regulation, and responses to environmental cues like photoperiodism and vernalisation.					

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Detailed Syllabus

BOT-75T-301 - Plant Biochemistry and Physiology

Unit – I

Biomolecules: Nomenclature, classification, importance, molecular structure and function of Proteins (primary, secondary, tertiary, conjugated), Carbohydrates (monosaccharides, disaccharides, polysaccharides), Lipids (saturated and unsaturated), General account of Secondary Metabolites in plants.

Nature of Bond: Glycosidic linkage, Peptide bond, Phosphodiester bonds, Alpha and Beta oxidation.
Enzymes: Nomenclature, classification, Structure, mechanism of action, factors affecting enzyme activity
(15 lectures)

Unit –II

Transport in Plants: Facilitated diffusion, active absorption, Passive and Active Transport (uniport, co-transport, symport, antiport), Concept and Mechanism of Water Potential, Osmosis, Plasmolysis, Ascent of Sap, Root Pressure, Guttation, Transpiration (Pressure Flow Hypothesis.

Mineral Nutrition and translocation: Macro- and Micro nutrients in Plants and deficiency symptoms, Translocation of Solutes, Phloem transport, Source-sink relationship, Factors affecting translocation of nutrients, Nitrogen Metabolism, Biological Nitrogen Fixation, Nodule formation. (15 lectures)

Unit –III

Photosynthesis: Pigments, Photosynthetic apparatus, Light reaction, PSI, PSII, Cyclic and Non-cyclic Photo-phosphorylation, Calvin cycle, C4 and CAM Pathway, Photorespiration, Factors affecting Photosynthesis.

Respiration: Aerobic and Anaerobic respiration, Glycolysis, Tricarboxylic Acid Cycle,Electron Transport System (ETS) and Oxidative Phosphorylation, Pentose Phosphate Pathway, Respiratory Quotient (RQ).
(15 lectures)

Unit-IV

Growth and Development: Phases of Growth, Differentiation, Dedifferentiation and Redifferentiation, Characteristics, discovery and Physiological effects of Plant Growth Regulators: Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic Acid. Concept, Physiology and mechanism of Photoperiodism and Vernalisation. Florigen concept, Seed Dormancy. (15 lectures)

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	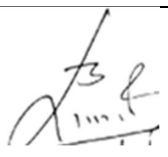	

Suggested Books and References –

1. Cox, M.M. and Nelson DL (2004) Lehniger Principle of Biochemistry (Third Edition) MacMillan Worth Publishers.
2. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons.U.S.A. 4th edition.
3. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
4. Harborne, J.B. (1973). Phytochemical Methods. John Wiley & Sons. New York.
5. Srivastava, L. M. 2002. Plant Growth and Development: Hormones and Environment (1st edition). Academic Press, USA.
6. Verma,S. K., Textbook of Plant Physiology, S.Chand & Company.

Suggested E-resources:

1. https://docs.google.com/file/d/0B_FBtJyzk2ZNLVNuZFp6S3E2YU0/edit?resourcekey=0-NxnSCZjwDIn3VDCh0rfgSQ
2. https://onlinecourses.swayam2.ac.in/cec19_bt09/preview
3. https://archive.org/details/plant-physiology-and-bio-chemistry/page/18/mode/2up

B.Sc. Semester- V (Bio Group)
BOT-75P-302 – Practical-V
(Based on Plant Biochemistry and Physiology)
Syllabus

1. To study the effect of temperature on permeability of Plasma Membrane
2. To determine osmotic potential of Vascular Sap using Plasmolytic method.
3. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
4. To separate chlorophyll pigments using paper chromatography.
5. To separate chlorophyll pigments using solvent method.
6. Separation of amino acids by paper chromatography.
7. To demonstrate enzyme activity- Catalase, amylase.
8. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
9. Mohl's Half Leaf experiment
10. To study the effect of light intensity and bicarbonate on O_2 evolution in photosynthesis.
11. Calculate Respiration Quotient (RQ) of different substrates by Ganong's Respirometer.
12. To study the phenomenon of seed germination (effect of light).
13. Demonstration of Potato osmoscope, Aerobic and Anaerobic respiration, Rate of Transpiration, Arc Auxanometer.

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UNIVERSITY OF RAJASTHAN

B.Sc. Semester- V (Bio Group) Botany Practical-V
(Based on Plant Biochemistry and Physiology)

Scheme of Practical Examination and Distribution of marks

BOT-75P-302 Duration- 4 hrs

Max. Marks: 10*+40 Min. Marks: 4*+16

S.No.	Exercise	Regular	NC/Ex students
1.	Exercise-based on Unit I	5	7
2.	Exercise-based on Unit II	5	7
3.	Exercise-based on Unit III	5	8
4.	Exercise-based on Unit IV	5	8
5.	Comment upon the spots- identify giving reasons. (1 to 5)	10	15
6.	Viva-voce	5	5
7.	Record	5	-
	Total	10*+40= 50	50
	*Internal marks for regular students only		
	Regular 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. Identify and classify major biomolecules such as carbohydrates, proteins, lipids, and nucleic acids, and explain their structure and function in biological systems.
2. Explain the nature and significance of biochemical bonds (glycosidic, peptide, phosphodiester) and key metabolic processes like alpha and beta oxidation.
3. Demonstrate an understanding of enzymes, including their classification, structure, mechanism of action, and the factors influencing their activity.
4. Describe the mechanisms of water and nutrient transport in plants and relate them to physiological processes like osmosis, transpiration, and root pressure.
5. Interpret the role of macro- and micronutrients in plant growth and diagnose common nutrient deficiency symptoms.
6. Explain the processes of nitrogen metabolism and biological nitrogen fixation, and evaluate their importance in plant productivity and sustainable agriculture.
7. Illustrate the light and dark reactions of photosynthesis and compare cyclic and non-cyclic photophosphorylation, including factors affecting the process.
8. Describe the pathways of respiration (aerobic and anaerobic), glycolysis, TCA cycle, ETS, and pentose phosphate pathway, and assess their role in energy production.
9. Apply the concepts of photoperiodism and vernalization in understanding flowering responses and seasonal adaptations in plants.

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	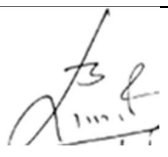	

Examination Scheme for EoSE for Semester VI

CA – Continuous Assessment EoSE – End of Semester Examination

Regular Students:

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	**BOT-76T-303 Plant Morphology, Anatomy and Embryology**	CA	01 Hr	CA	20 Marks	CA	08 Marks
		EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	**BOT-76P-304 Plant Morphology, Anatomy and Embryology- Practical**	CA	1 Hr	CA	10 Marks	CA	04 Marks
		EoSE	04 Hrs	EoSE	40 Marks	EoSE	16 Marks

The theory question paper (EoSE) 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.

Non-Collegiate Students:

Type	**Course Code and Nomenclature**	**Duration of Examination**	**Maximum Marks(EoSE)**	**Minimum Marks(EoSE)**
Theory	**BOT-76T-303 Plant Morphology, Anatomy and Embryology**	03 Hrs	100 Marks	40 Marks
Practical	**BOT-76P-304 (Based on Plant Morphology, Anatomy and Embryology) - Practical**	04 Hrs	50 Marks	20 Marks

The theory question paper (EoSE) will consist of two parts A&B.

PART-A: 20 Marks

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	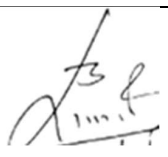	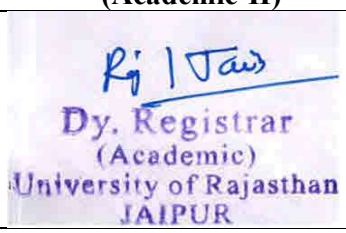

Part A will be compulsory having 10 very short answer-type questions (with a limit of 20 words) of two marks each.

PART-B: 80 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 20 marks.

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	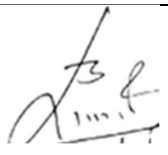	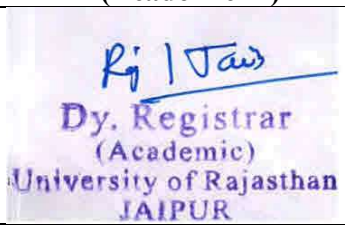

UG0802 – Three/Four Year Bachelor of Science (Bio Group)
Semester VI - Botany
UG0802 BOT-76T-303 Plant Morphology, Anatomy and Embryology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	**BOT-76T-303**	**Plant Morphology, Anatomy and Embryology**				**7**	**4**
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	**Major/Minor**	**4**	**2**	**6**	**Yes**	**60 lectures with diagrammatic and informative assessments during lecture hours**	
List of Programme Codes in which Offered as Minor Discipline		UG0806, UG0812					
Prerequisites		Botany course of Introductory/intermediate level					
Course Objectives:		This course will enable the students: To understand morphology and anatomy of flowering plants and its practical and experimental aspects. To understand the modifications of root, stem, leaves and their significance in plant life. To make the students learn about the concepts of secondary growth, abnormal secondary growth and wood formation. To provide knowledge of the internal structure and functional organization of higher plants To provide basic knowledge of male and female plant reproductive structures To provide detailed understanding of plant embryology and seed structure					

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	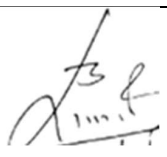	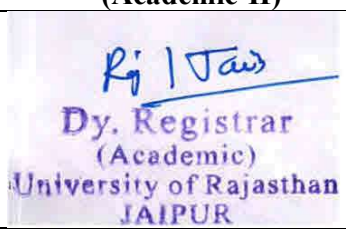

UG0802 BOT-76T-303
Detailed Syllabus
Plant Morphology, Anatomy and Embryology

Unit 1:Morphology and the Tissue System

Basic body plan of a typical dicot and a monocot plant; diversity of plants on the basis of habit, habitat, longevity, and body forms

Tissues: Structure and function- Meristematic Tissues, Permanent Tissues: Simple Tissues and Complex Tissues; Tissue systems: Epidermal Tissue System, Ground Tissue System and Vascular Tissue System

Organizational theories of Shoot apical meristem (SAM) and Root apical meristem (RAM)

(15 hours)

Unit 2: Growth in plants

Anatomy of primary structures of root, stem and leaf of dicot and monocot plants

Secondary Growth: Structure and function of vascular cambium, secondary growth in stem and roots; Annual Rings: Spring wood and autumn wood, Heartwood and sapwood, tyloses, Porous and non-porous wood

Structure and function of cork cambium, Periderm

Anomalous growth in *Nyctanthus*, *Boerhaavia*, *Bignonia,Salvadora, Dracaena* and *Leptadenia*

(15 hours)

Unit 3: Embryology I

Angiosperm flower, Structure of anther, microsporogenesis, development of male gametophyte, Structure of pistil, structure of ovule and its types, megasporogenesis, development and types of female gametophyte **(15 hours)**

Unit 4: Embryology II

Pollination and double fertilization. Endosperm: structure and types, embryo development in dicotyledons and monocotyledons,Seed structure (monocot and dicot), specialized structures related to seed, seed dispersal mechanisms.Polyembryony, apomixes **(15 hours)**

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Suggested Books and References –

1. Cutter E.G. 1971. Plant Anatomy: Experiment and Interpretation. Part II Organs. Edward Arnold, London.
2. Esau K. 1977. Anatomy of seed plants, 2nd edition, John Wiley and Sons New York.
3. Fahn, A. 1974. Plant anatomy 2nd edition. Pergamon press. Oxford.
4. Crang, R. et al, 2018. Plant anatomy: a concept-based approach to the structure of seed plants.
5. Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
6. Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.
7. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
8. Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
9. Raghavan, V. (2000). Developmental Biology of Flowering plants, Springer, Netherlands.
10. Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands

Suggested E-resources:

1. https://nptel.ac.in/courses/102107075

B.Sc. Semester- VI (Bio Group)

BOT-76P-304 – Practical-VI

(Based on Plant Morphology, Anatomy and Embryology)

Syllabus

1. Study of Tissue organization in root and shoot apices using permanent slides
2. Study of Anatomy of dicot and monocot root
3. Study of Anatomy of dicot and monocot stem
4. Study of Anatomy of dicot and monocot leaf
5. Study of Anomalous secondary growth in stems of *Nyctanthus*, *Boerhaavia*, *Bignonia, Salvadora, Dracaena*and *Leptadenia*
6. Study of ovule using temporary/ permanent slides/photographs
7. Study of T. S. of anther, to study the wall layers and pollen sac with pollen grains
8. Study of pollen germination and pollen viability
9. Measurement of pollen size using micrometry
10. Study of types of placentation in angiosperms
11. Study of structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
12. Study of developmental stages of dicot and monocot embryos using permanent slides / photographs
13. Study of seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens)
14. Any other exercise related to syllabus

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UNIVERSITY OF RAJASTHAN

B.Sc. Semester- VI (Bio Group) Botany
Plant Morphology, Anatomy and Embryology Practical

Scheme of Practical Examination and Distribution of Marks

BOT-76P-304 Duration- 4 hrs

Max. Marks: 10*+40 Min. Marks: 4*+16

S.No.	Exercise	Regular	NC/Ex students
1.	Anatomical exercise on plant stem/ root/ leaf. Draw a labelled diagram and comment.	5	8
2.	Anatomical exercise on anomalous secondary growth. Draw a labelled diagram and comment.	5	8
3.	Study of the given reproductive part of plant. Draw a labelled diagram and comment.	5	7
4.	Comment on the given embryological exercise.	5	7
5.	Comment upon the spots- identify giving reasons. (1 to 5)	10	15
6.	Viva-voce	5	5
7.	Record	5	-
	Total	**40 (10*+40=50)**	**50**
*Internal marks for regular students only			
Regular 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:

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

- Apply knowledge of plant anatomy to identify plant samples and interpret their adaptive significance
- Understand on the organization of tissues and tissue systems in plants.
- Analyze and compare vascular bundles and secondary growth in monocot and dicot plants
- Identify and analyze anomalous patterns of secondary growth in various plants.
- Understand, evaluate and analyze the wood anatomy and climate studies
- Identify and compare the different reproductive organs of angiosperms and analyze the diversity of their structures.
- Understand the process of double fertilization and its significance in flowering plants
- Illustrate and interpret various aspects of embryology.

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