S.S. Jain Subodh P.G. College Jaipur

(Autonomous)

Affiliated to University of Rajasthan Jaipur

(Three/Four Year Bachelor of Science)

(Bio Group)

Subject: Botany

Syllabus

Session 2025-26

(From the Academic Year 2025-26onwards)

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 completionofcoursestudentswouldbeabletoexecutetheirprofessionalrolesin 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 designanddevelopsustainablesolutionstomajorbiologicalproblemsbyapplying appropriate tools.

PO17. Develop skills, attitude and values required for self-directed, lifelong learning and professional development.

PO8. Acquire knowledge and understanding of norms and ethics in the field of botany.

B.Sc. Biology Botany

Course Structure under C.B.C.S. And NEP-2020

Examination Scheme for EoSE for Semester I

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	BOT-T-101 – Cell Biology and Diversity of Plant Kingdom	CIA	1Hrs	CIA	30Marks	CIA	12 Marks
		EoSE	3Hrs	EoSE	70Marks	EoSE	28 Marks
Practical	BOT-P-101–Practical I	CIA	1Hrs	CIA	20Marks	CIA	8 Marks
		EoSE	3Hrs	EoSE	30Marks	EoSE	12 Marks

B.Sc. Biology Botany

Course Structure Under C.B.C.S. And NEP-2020

Examination Scheme for EoSE for Semester I &II

Course code		Course Title	Credit	Marks	External	Internal
SEM.I	BOT-101	Paper-I Cell Biology and Diversity of Plant Kingdom	4	100	EoSE 70	CIA 30
	BOT-501 P	PRACTICAL	2	50	30	20
SEM.II						
	BOT-102	Paper- II Molecular	4	100	EoSE 70	CIA 30

		Biology, Genetics and Diversity of Plant Kingdom II				
	BOT-502 P	PRACTICAL	**2**	**50**	**30**	**20**

Examination Scheme

1. 1credit = 25marks 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 (30% weightage) and (End of end-semester examination) EoSE (70% 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.

B.Sc. Sem. I

Cell Biology and Diversity of Plant Kingdom I

BOT--101

1 Credit -25 marks

4 Credit-100 Marks

Max.Marks -70, Internal Marks-30 Marks

Objectives:

- To impart knowledge cell types their structure and functions of cell organells.
- To understand structure of Nucelic acids
- To understand basic of plant diversity.
- To understand structure and reproduction in the Algae.
- To understand structure and reproduction in the Bryophytes.
- To have a basic idea of Lichen.

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 here ditary 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 the irendeavours.
7. Promote shared learning through practical classes, presentations and assignments.

The question Paper will consist of two parts A&B

Part A: 14 Marks

Part A will be compulsory having 10 very short answer type questions (with a limit of 20 words) of two marks each and candidate have to attempt only seven out of it.

Part B: 56 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. Candidate has to attempt one question from each unit of their choice. Each Carry 14 Marks.

Unit – I 15 Hrs.

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.

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 . .

Unit – II

15 Hrs.

Nucleic acids: DNA as genetic material (Griffith's transformation experiment and Hersheyand Chase blender experiment); Structure and function of DNA (Watson and Crick Model); Structure and function of different types of RNA (rRNA, mRNA, tRNA, snRNA).

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. **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.

Unit – III 15 Hrs.

Plant Kingdom : Introduction to plant kingdom-Basic idea of hierarchy in all groups of plants

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*.

Lichen: General characteristics; Habitat; Structure; Reproduction; Ecological and Economic Importance.

Unit – IV 15 Hrs

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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: Agaricus.

Bryophytes: General characteristics ;affinities with algae and pteridophytes; Distribution; Rangeof 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*

Suggested Books and References–

1. Alberts,B.,Johnson,A.,Lewis,J.,Raff,M.,Roberts,K.,&Walter,P.(2014). **Molecular Biology of the Cell**(6thEd.).NewYork: 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. VeerBalaRastogi.**Genetics.**Medtech
5. VeerBala Rastogi.**AText book of Cell Biology and Genetics.** Kedarnath Ramnath
6. Alexopoulos, C.J.andMims,C.W.:**Introductory Mycology**,John Wiley and Sons, New York, 2000
7. Singh,Pande and Jain**.AText book 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 (2ndEd.)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)

Botany Practical-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 meiosisin root-tipcells and flowerbuds 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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B.Sc. Semester- I (Bio Group)
Botany Practical-I Scheme of Practical
Examination and Distribution of marks

Duration-3hrs

Max.Marks:30

S.No.	**Exercise**	**Regular**
1.	Exercise based on cell structure and types.	**3**
2.	Make a suitable acetocarmine preparation of the given material. Draw a well-labelled diagram of any one stage of nuclear division.	**3**
3.	Make a suitable stained preparation of the given material **A**. Draw a labelled diagram and identify giving reasons.**(Algae)**	**3**
4.	Make a suitable stained preparation of the given material **B**. Draw a labelled diagram and identify giving reasons.(**Fungi)**	**3**
5.	Make a suitable stained preparation of the given material **C**(vegetative/Reproductive part). Draw a labelled diagram and identify giving reasons. (**Bryophyte)**	**3**
6.	Comment up on the spots-identify giving reasons.(1to5)	**10**
7.	Viva-voce	**5**
	Total	**30**

Signature of BoS Member	**Signature of BoS Convenor**

B.Sc. Sem. II

Molecular Biology, Genetics and Diversity of Plant Kingdom-II

BOT--201

1 Credit -25 marks

4 Credit-100 Marks

Max.Marks -70, Internal Marks-30 Marks

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.

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

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 linkages, 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.

The question Paper wills consist of two parts A&B

Part A: 14 Marks

Part A will be compulsory having 10 very short answer type questions (with a limit of 20 words) of two marks each and candidate have to attempt only seven out of it.

Part B: 56 Marks

Part B of the question paper shall be divided into four units comprising question number 2-5. Candidate have to attempt one question from each unit of their choice. Each Carry 14 Marks.

Unit-1

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

15 hrs

Unit-II

Genetic inheritance: 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). **Structural and numerical aberrations:** Deletion, Duplication, Translocation, Inversion, Aneuploidy and Polyploidy. Mutations: Types of Mutations, Spontaneous and induced Mutations, Physical and Chemical mutagens.

15 Hrs

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 hrs

Unit-IV

Gymnosperms : Gymnosperms General characteristics; Affinities with Pteridophytes and Angiosperms, Distribution; Economic importance. Classification (Sporne, 1965); Life history of Cycadopsia: *Cycas*; Coniferopsida: *Pinus*; Gnetopsida: *Ephedra*. **Paleobotany: Paleobotany** Introduction, Basic concept and significance, Geological time scale; Types of Fossils 15 Hrs

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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. 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 2018.5thedition Rastogi Publication India.

6. Veer BalaRastogi. Genetics.Medtech

7. Veer BalaRastogi. A Textbook of Cell Biology and Genetics.KedarnathRamnath

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

Practical Syllabus

Practicals related to DNA -

- Isolation of Genomic DNA from OnionBanana/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-

- Study of vegetative 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.

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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**. JohnHarris,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**(8thEd.).New York:W.H.Freeman
5. GuptaP.K.**Cell and Molecular Biology**2018.5theditionRastogiPublicationIndia.
6. VeerBalaRastogi.**Genetics.**Medtech
7. VeerBalaRastogi.**AText book of Cell Biology and Genetics.** KedarnathRamnath
8. Singh, Pande and Jain**.A Text book of Botany,**Rastogipublications
9. B.R.Vashishta and P.C.Vashishta. **Botany for Degree Students: Pteridophyta-Vascular Cryptogams),** S.Chand (G/L) & Company Ltd
10. B.R.VashishtaandP.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

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B.Sc. Semester- II (Bio Group) BOT- 202P

Botany Practical-II Syllabus

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**tudyof vegetative 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.

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B.Sc. Semester- II (Bio Group) Botany Practical-II Scheme of Practical Examination and Distribution of marks

Duration-3hrs

Max.Marks:30

S.No.	Exercise	Regular
1.	Exercise-based on Nucleic acids	**3**
2.	Exercise-based on Genetics	**4**
3.	Make a suitable stained preparation of the given material **A**(vegetative/Reproductive part). Draw a labelled diagram and identify giving reasons. (**Pteridophyte)**	**4**
4.	Make a suitable stained preparation of the given material **B** (vegetative/Reproductive part).Draw a labeled diagram and identify giving reasons.(**Gymnosperm**)	**4**
5.	Comment upon the spots- identify giving reasons.(1to5)	**10**
6.	Viva-voce	**5**
	Total	**30**

Signature of BoS Member	Signature of BoS Convenor

SYLLABUS

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

Subject: Botany

B.Sc. Semester III &IV

Examination 2026-27

(From the Academic Year 2024-25 onwards)

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

Examination Scheme for EoSE for Semester III & IV

Course code		Course Title	Credit	Marks	External	Internal
SEM.I	**BOT-301**	Paper **Microbiology and Plant Pathology**	**4**	**100**	**EoSE 70**	**CIA 30**
	BOT-501 P	PRACTICAL	**2**	**50**	**30**	**20**
SEM.II						
	BOT-401	Paper **Plant Taxonomy and Economic Botany**	**4**	**100**	**EoSE 70**	**CIA 30**
	BOT-502 P	PRACTICAL	**2**	**50**	**30**	**20**

Examination Scheme for EoSE for Semester III

CIA-Continuous Assessment EoSE -End of Semester Examination

Type of Examination	CourseCodeandNomenclature	Duration of Examination		MaximumMarks		MinimumMarks	
Theory	**BOT--301 Microbiology and Plant Pathology**	**CIA**	**2Hrs**	**CIA**	**30 Marks**	**CIA**	**Marks**
		EoSE	**3Hrs**	**EoSE**	**70 Marks**	**EoSE**	**Marks**
Practical	**BOTP Practical-III**	**Internal**	**1Hrs**	**Internal**	**20 Marks**	**CIA**	**Marks**
		EoSE	**3Hrs**	**External**	**30 Marks**	**EoSE**	**Marks**

Semester	Code of the Course		Credits		
III	**BOT-301**	**6**	**4**		
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**
		Theory	**Practical**	**Total**	

Intermediate	**Major**	**4**	**2**	**6**	**60 lectures with diagrammatic presentations and informative assessments during lecture hours**

B.Sc. Sem. III

BOT--301-Microbiology and Plant Pathology

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 in further 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.

The theory question paper will consist of **two** parts **A** & **B**.
PART-A: 14 Marks

Part A will be compulsory having 10 very short answer-type questions (with a limit of 20 words) of 2 marks each. Candidate have to attempt seven questions.

PART-B: 56 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 14 marks.

Unit–I

Microbiology: Introduction to microbial lword :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.
Virus: Discovery, General account, structure with special reference to TMV, Pox virus, Bacteriophage; Replication of T4 phage (Lytic and Lysogenic).
Mycoplasma: General Characteristics, Morphology and Reproduction 15 Hrs.

Unit–II

Bacteria: General Characteristics, Classification, Cell structure, endospore formation, Reproduction-asexual and recombination (Conjugation, Transformation and Transduction).
Applied Microbiology Economic importance of viruses, Economic importance of Bacteria with reference to their role in agriculture and food industry, Bio-films . 15 Hrs

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).

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. 15 Hrs

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 **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* 15 Hrs

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,5thEdition,AcademicPress
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).*Plantpathology*.Deep and Deep Publications.
7. 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**

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University of Rajasthan B.Sc. Semester– III (2026.-27)
BOT-P-301 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 Poxvirus, 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.*

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.
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

B.Sc. Semester- III (Bio Group)
Botany Practical-III Scheme of Practical

Examination

Distribution of marks

Duration: 3Hrs

Maximum Marks-30

S.No.	Exercise	Regular
1.	Perform exercise of Microbiology Gram'/ negative staining of bacteria or Identification of virus/ mycoplasma	**3**
2.	Perform the exercise based on the microbiology– Media preparation/ any pure culture technique	**3**
3.	Study the material "A" carefully, prepare a suitable stained preparation, and identify the casual organism associated with the disease giving reasons (Fungal disease)	**5**
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.	Spotting(5spots)	**10**
6.	Viva-voce	**5**
	TOTAL	**30**

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Examination Scheme for EoSE for Semester IV

CIA– Continuous Internal Assessment
EoSE – End of Semester Examination

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	BOT-T-401 – Plant Taxonomy and Economic Botany	CIA	1Hrs	CIA	30Marks	CIA	Marks
		EoSE	3Hrs	EoSE	70Marks	EoSE	Marks
Practical	BOT –Practical IV	CIA	1Hrs	CIA	20Marks	CIA	Marks
		EoSE	3Hrs	EoSE	30Marks	EoSE	Marks

Semester	Code of the Course	Title of the Course/ Paper	NHEQF Level	Credits
IV	BOT-401	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

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).

Syllabus

BOT-401

Plant Taxonomy and Economic Botany
IV Semester- B.Sc. (Bio Group)

Botany

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.

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

PART-A: 14 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: 56Marks

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 14marks

BOT-401: *Plant Taxonomy and Economic Botany*

Unit-I

Artificial (Linneaus), Natural (Bentham& Hooker)and Phylogenetic (Engler and Prantle's) System**. 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), **Classification Herbarium** Equipments, herbarium sheet preparation & preservation and Significances. Introduction to Botanical Survey of India (BSI). 15 Hrs

Unit-II

Taxonomic literature Floras, Monographs, Icons **Modern Trends** Cytotaxonomy, Chemotaxonomy, Palynology, Embryology, Anatomy and Numerical taxonomy Study of Families Diagnostic characters and economic importance of Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae and Asteraceae. 15 hrs

Unit-III

Study of Families: Diagnostic characters and economic importance of Apocynaceae, Asclepieadaceae, Convolvulaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae and Poaceae **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). 15 Hrs.

Unit-IV

Economic Botany ofVegetable 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

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Suggested Books and References–

- Principles of Angiosperm Taxonomy by Davis & Heywood. Publisher: Oliver & Boyd
- Taxonomy of Vascular Plants by Lawrence HM 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: Dream tech 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**

B.Sc. Semester – IV

BOT-P-401P Botany Practical-IV

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, lignin and 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 /wildplants
- Any other exercise based on theory syllabus.

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

Duration: 3Hrs

Maximum Marks-30

Exercises	**Regular**
Identify the family of the given flower and describe floral characters insemi-technical language, draw Floral diagram and write floral formula.	**5**
Identify and describe the given herbarium tool	**3**
Perform the biochemical test of given material.	**3**
Identify the given material (economic botany), write botanical characters and economic importance	**4**
Spotting(5)	**10**
Viva-voce	**5**
TOTAL	**30**

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
- 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.
- 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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