Maharaja Surajmal Brij University
Bharatpur (Rajasthan)

Syllabus of Botany

Three/Four Year Bachelor of Science

(III & IV Semester)

Academic Session 2024-25

Dr. Farbat Singh
Asstt. Registrar
Acad.I

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

PO10. Developing the potential for vertical career growth in plant sciences, academic and service sectors and related fields.

PO11. 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.

PO12. Proficient knowledge in the major domains of plant sciences including plant identification, plant diseases, microbiology, Plant biotechnology etc.

PO13. Students can successfully learn tools and techniques related to plant research.

PO14. After completion of course students would be able to execute their professional roles in society as botanist, plant taxonomist, plant pathologist, etc.

PO15.Students will be able to learn skills to work as a team with the people from multidisciplinary environment.

PO16. To design and develop sustainable solutions to major biological problems by applying appropriate tools.

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

PO18. Acquire knowledge and understanding of norms and ethics in the field of botany.

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Examination Scheme

1. 1credit = 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 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-20T-301 Microbiology and plant pathology	CA	01 Hr	CA	20 Marks	CA	08 Marks
		EoSE	03 Hrs	EoSE	80 Marks	EoSE	32 Marks
Practical	BOT-20P-302 Practical-III	CA	01 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	Minimum Marks
Theory	BOT-20T-301 Microbiology and plant pathology	03 Hrs	100 Marks	40 Marks
Practical	BOT-20P-302 Practical-III	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
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

Three/Four Year Bachelor of Science (Bio Group) III-Semester- Botany

BOT-20T-301-Microbiology and Plant Pathology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
III	BOT-20T-301	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							
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					

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COURSEOUTCOMES

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

Understanding	• 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.
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.

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Detailed Syllabus
BOT-20T-301 - [Microbiology and Plant Pathology]

Unit–I

Introduction to Microbial Word

History and Development in the field of Microbiology, General Introduction of R.H. whittaker's five kingdom concept. Origin of Life, Contribution of Louis Pasteur and Robert Koch, Germ theory of disease.

(7 Lectures)

Applied Microbiology

Economic importance of viruses, Economic importance of Bacteria with reference to their role in agriculture , food Industry and medicine. **(5 Lectures)**

Mycoplasma:

General characteristics, morphology and Reproduction. **(3 Lectures)**

Unit-II

Bacteria And Virus

Bacteria: General Characteristics, Classification, Cell structure, endospore formation, Reproduction- asexual and recombination (Conjugation, Transformation and Transduction).

(10 Lectures)

Virus: Discovery, General account, structure with special reference to TMV, Bacteriophage; Replication of T4 phage (Lytic and Lysogenic).

(5 Lectures)

Unit-III

Introduction to Phyto-pathology

Terminology and basic concepts (Primary and Secondary inoculum; infection, Pathogenicity, Pathogenesis, Disease Cycle); General symptoms caused by Viruses, Bacteria, Fungi, Mycoplasma, Nematodes, Insects. Diseases caused by deficiency of Nutrients.

(8 Lectures)

Bacterial, Viral and Mycoplasmal 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 Dieseases

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)

Disease caused by insect 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)

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Suggested Books and References–

1. Pelczar,M.J.(2001)Microbiology,5thedition.NewDelhi,Delhi:TataMc-Graw-HillCo.
2. Prescott, L.M., Harley J.P., Klein D.A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
3. Agrios G.N.(2004)PlantPathology,5th Edition,AcademicPress
4. PandeyB.P.(2001)PlantPathology(PathogenandPlantDisease),S.ChandPublishing
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.

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

B.Sc. Semester– III (2024-25)
BOT-20P-302 Botany Practical-III

Exercised based on Microbiology and Plant Pathology

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 Mycorrhiza (Photographs/3D Models)

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

III Study of symptoms of plant diseases (specimen/permanent slide/Photographs/Pictures) 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 (allstages). Study of histopathology using temporary slide prepration of infected part of root knot of Vegetable, Leaf gall of *Pongamia*.

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

BOT-20P-302 **Duration:4Hrs**
Maximum Marks10*+40Marks Minimum marks4*+16Marks

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(5spots)	10	15
6.	Viva voce	5	5
7.	Record	5	-
	TOTAL	10*+40=50	50
	*Internal marks for regular students only		

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	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. Understandandperformdifferentlaboratoryexercisetofurtherunderstandabout microorganisms.
4. Acquireknowledgeaboutdifferenttypesofmicrobeswithstructure,function and their economic importance, Host pathogen interaction and its effects on plants.
5. Applycontrolandmanagementstrategiesforplantdiseasescausedbyfungi,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

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Examination Scheme for EoSE for Semester IV

CA – Continuous Assessment EoSE – End of Semester Examination

Regular Students–

Type of Examination	Course Code and Nomenclature	Duration of Examination		Maximum Marks		Minimum Marks	
Theory	BOT-20T-401 – Plant Taxonomy and Economic Botany	CA	1Hrs	CA	20Marks	CA	8Marks
		EoSE	3Hrs	EoSE	80Marks	EoSE	32Marks
Practical	BOT-20P-402–PracticalIV	CA	1Hrs	CA	10Marks	CA	4Marks
		EoSE	4Hrs	EoSE	40Marks	EoSE	16Marks

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-20T- 401Plant Taxonomy and Economic Botany	3Hrs	100Marks	40Marks
Practical	BOT-20P-402–PracticalIV	4Hrs	50Marks	20Marks

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

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

BOT-20T-401
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-20T-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
List of Programme Codes in which Offered as Minor Discipline						
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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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 suchas 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-20T-401-Plant Taxonomy and Economic Botany

UNIT-I

Classification	Artificial (Linneaus),Natural (Bentham & Hooker)	**5 lectures**
Nomenclature	Angiosperm Phylogeny Group(APG).International Code of Botanical Nomenclature. Introduction, principles, rules (Name of Taxon, Priority & publication) and Recommendations. Introduction to ICBN	**5 lectures**
Herbarium	Equipments, herbarium sheet preparation & preservation and significances. Introduction to Botanical Survey of India (BSI).	**5 lectures**

UNIT-II

Taxonomic literature	Floras, E-floras, Monographs, Basic Terminology to describe the Plants	**4 lectures**
Modern Trends	Cytotaxonomy, Chemotaxonomy, Palynology, And Numerical taxonomy.	**5 lectures**
Study of Families	Diagnostic characters and economic importance of Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae and Asteraceae.	**6 lectures**

UNIT-III

Study of Families	Diagnostic characters and economic importance of Apocynaceae, Asclepieadaceae, Solanaceae, Lamiaceae, Euphorbiaceae and Poaceae.	**6 lectures**
Economic Botany of Cereals & Millet	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),	**9 lectures**

UNIT-IV

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

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Suggested Books and References –

- A text book of plant taxonomy by Suresh Kumar, campus book International, Dehli.
- 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
- Economic Botony by Suresh Kumar, Campus Book International, Dehli.

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

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B.Sc. Semester – IV (2024-25)
BOT-20P-402 Botany Practical-IV
Exercises based on Plant Taxonomy and Economic Botany

- Plant description and identification of following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Asteraceae Apocynaceae, Asclepieadaceae, Solanaceae, Lamiaceae, Euphorbiaceae and Poaceae
- Campus Flora writing/Excursion/Field study
- Herbarium tools
- Preparation of Herbarium sheets **(5 sheets)**
- Biochemical test for Starch, Protein, Oil, Cellulose, lignin and tannin
- Medicinal plant-identification and collection **- 5 sheets / 5 specimens**
- Study of specimens with reference to economic use of Cereals, millets, Pulses, Oil, Fibers, Spices, and Beverages (common name, Botanical name, Family, Parts used, Economic uses)

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

BOT-20P-402 **Duration:4Hrs**

Maximum Marks10*+40Marks Minimum marks4*+16Marks

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.		

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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.
- 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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