SYLLABUS

Under Graduate Course (UG) CBCS

(As per National Education Policy-2020)

B.Sc. PART I (2023-24)

(SEMESTER I and II)

Department of Botany

JAI NARAIN VYAS UNIVERSITY JODHPUR

Preamble

The bachelor's degree program in Botany aims to provide a comprehensive learning environment that fosters cognitive development and critical thinking skills of students. The program intends to equip students with the latest subject matter, both theoretical and practical, to enhance their core competency and facilitate discovery learning. The curriculum also aims to mould responsible citizens who are aware of domain-independent knowledge, including communication and critical thinking, and enable graduates to prepare for national and international competitive examinations.

Upon graduation, students would acquire core competencies in Botany and related areas, including the ability to identify major plant groups and compare their characteristics, understand the genetic diversity of organisms, explain various plant processes, and demonstrate experimental techniques in their specialization. Additionally, the program intends to develop analytical abilities and critical thinking skills in students to address practical problems effectively. Graduates would also possess digital skills, ethical and moral values, and psychological strengths to become team players and independent learners.

The program aims to critically evaluate ideas and arguments, identify problems, and propose solutions using creative approaches acquired through interdisciplinary experiences. Graduates would accurately interpret collected information and use taxonomical information to evaluate and formulate a plant's position in taxonomy. They would also apply the scientific method to questions in botany, present scientific hypotheses and data, and access primary literature to evaluate scientific content. Graduates would be able to apply mathematical tools and physical principles to analyze biological situations, identify major groups of organisms, and explain ecological interconnectedness. Finally, graduates would demonstrate proficiency in experimental techniques and methods of analysis in their specialization within biology.

The University Grant Commission (UGC) has recommended the implementation of the Choice Based Credit System (CBCS) to standardize teaching practices among universities and facilitate students' mobility across institutions by considering credits. The credit-based semester system provides flexibility in designing curricula and assigning credits based on course content and teaching hours. Under this system, students can choose courses, learn at their own pace, take additional courses, and earn more credits than required, promoting interdisciplinary learning. The syllabus includes a semester-wise course distribution, detailed course outlines, and suggested reading materials.

Aims of the Program

1. To foster a dialogue about plants and their significance in a holistic environment, rather than focusing solely on theoretical aspects through didactic monologues.
2. To equip students with the latest theoretical and practical subject matter in order to foster core competency and discovery learning, allowing graduates to pursue further discipline-specific studies or begin domain-related employment.
3. To develop responsible citizens who possess domain-independent knowledge, including critical thinking and communication skills.
4. To prepare graduates for national and international competitive examinations, including UGC-CSIR NET and Civil Services Examination.

Program Outcomes (PO)

Core Competency:

1. Students will be able to identify major groups of plants and compare the characteristics of lower (e.g., algae and fungi) and higher (angiosperms and gymnosperms) plants.
2. Students will be able to explain the evolution of organisms using the evidence-based comparative botany approach and understand genetic diversity on earth. They will also be able to explain various plant processes and functions, metabolism, concepts of gene and genome, and how an organism's function is influenced at the cell, tissue, and organ level.
3. Students will be able to understand the adaptation, development, and behaviour of different life forms and trace the energy pyramids through nutrient flow on earth.
4. Students will be able to demonstrate experimental techniques and methods in their area of specialization in botany.

Analytical Ability:

Students will be able to apply scientific methods to address different questions by formulating hypotheses, collecting data, and critically analyzing the data to decipher the degree to which their scientific work supports their hypothesis.

1. Critical Thinking and Problem-Solving Ability:
   Students will increase their understanding of fundamental concepts and their applications of scientific principles. They will become critical thinkers and acquire problem-solving capabilities.
2. Digital Skills:
   Students will acquire digital skills and integrate fundamental concepts with modern tools.
3. Ethical and Psychological Strengthening:
   Students will strengthen their ethical and moral values and be able to deal with psychological weaknesses.
4. Teamwork:
   Students will learn teamwork skills in order to efficiently serve institutions, industry, and society.
5. Independent Learning:
   The program outcome will lead to students gaining knowledge and skills for further higher studies, competitive examinations, and employment, in addition to generic skills, especially in botany. Learning outcomes-based curriculum would ensure equal academic standards across the country and a broader picture of their competencies.

Program Specific Outcomes (PSOs)

The program aims to provide a comprehensive education in plant biology that encompasses both traditional and modern approaches. It seeks to equip learners with an in-depth understanding of plants and their diversity, as well as their importance for human welfare and economic value. This program is primarily aimed to introduce students to the richness of plant diversity found in surrounding areas. The curriculum comprises practical sessions and interactions that will aid learners in acquiring practical experience and enhancing their

analytical abilities.

PSO1: Students will have an in-depth understanding of the fundamental principles of botany, including plant morphology, anatomy, physiology, ecology, cytology, and genetics; as well as advanced aspects, including plant biotechnology and molecular biology.

PSO2: Student will be able to understand diversity of plants and microbes, their morphology, architecture, reproduction, and habitat.

PSO3: Students will gain hands-on experience on plant identification, species distribution, and ecological surveys, and develop an appreciation for the diversity and complexity of natural systems.

PSO4: Students will develop a scientific aptitude and critical thinking skills, including the ability to analyze, evaluate, and synthesize scientific information, and to apply scientific knowledge to solve real-world problems.

PSO5: Students will develop effective oral and written communication skills, including the ability to present scientific data, write scientific reports, and communicate scientific concepts to both scientific and non-scientific audiences.

PSO6: Students will be prepared for lifelong learning, including continuing education, professional development, and the pursuit of advanced degrees in botany or related fields.

Discipline Course Outcome (COs)

Introduction: The program aims to provide a comprehensive education in plant biology that encompasses both traditional and modern approaches. It seeks to equip learners with an in-depth understanding of plants and their diversity, as well as their importance for human welfare and economic value. This course is primarily aimed to introduce students to the richness of plant diversity found in surrounding areas. The curriculum comprises practical sessions and interactions that will aid learners in acquiring practical experience and enhancing their analytical abilities. The subject-specific outcomes will be the following-

1. Students will be able to understand the diversity of plants and microbes, their morphology, architecture, reproduction, and habitat.
2. Students will be able to comprehend the various types of plants and their characteristics, as well as their interactions with other organisms in their environment.
3. In addition, the program also focuses on the study of microbes that cause plant diseases, their symptoms, and methods of control. This will assist students in recognizing how diseases can harm plants and how to prevent or manage them.
4. Finally, the course also addresses the economic value of plants and their role in human welfare. Students will gain knowledge about how plants can be utilized for food, medicine, fuel, and other purposes, and how these applications contribute to sustainable development.

Jai Narain Vyas University, Jodhpur
Department of Botany
(NEP -2020)
B.Sc. Three Year Degree

Discipline wise Minimum Credit Required for three-degree program						
Course	**Credit**					
	Year I		**Year II**		**Year III**	
	I	**II**	**III**	**IV**	**V**	**VI**
Discipline Centric Core Course (DCC)	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**	**-**	**-**
Discipline Specific Elective Course (DSE) interdisciplinary	**-**	**-**	**-**	**-**	**6 (4T+2P)**	**6 (4T+2P)**
Discipline Specific Elective Course (DSE) interdisciplinary					**6 (4T+2P)**	**6 (4T+2P)**
Discipline Specific Elective Course (DSE) interdisciplinary					**6 (4T+2P)**	**6 (4T+2P)**
Discipline Centric Core Course (DCC) (Other than Botany)	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**		
Discipline Centric Core Course (DCC) (Other than Botany)	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**	**6 (4T+2P)**		
Ability Enhancement Course EC Eng/ Hin	**2**					
Ability Enhancement Course EC Env		**2**				
Skill Enhancement Course SEC			**2**	**2**	**2**	**2**
Total Credit	**20**	**20**	**20**	**20**	**20**	**20**
additional summer training course /vocational course						

Discipline Centric Core Course (Botany):

Year 1	Eligibility: 10+2 from any recognized Board with Biology Prerequisite: Subject in 10+2 Class						
Course	**SEM**	**Level**	**Code**	**Course Nomenclature**	**Credit**		
					T	**P**	**Total**
DCC	**I**	**5**	**DCC-BOT5001T**	**Algae, Fungi, Microbes and Plant Pathology**	**4**		**6**
		5	**DCC-BOT5001P**	**Practical for Algae, Fungi, Microbes and Plant Pathology**		**2**	
DCC	**II**	**5**	**DCC-BOT5002T**	**Bryophytes, Pteridophytes Gymnosperms and Palaeobotany**	**4**		**6**
		5	**DCC-BOT5002P**	**Practical for Bryophytes, Pteridophytes Gymnosperms and Palaeobotany**		**2**	

SEM I

DCC-BOT5001T/P Algae, Fungi, Microbes and Plant Pathology

Course Objective:

1. To teach students the basic characteristics of algae, fungi, and microbes, including their morphology, classification, and life cycle.
2. To provide hands-on experience in the identification and study of algae, fungi, and microbes, as well as in the diagnosis and management of plant diseases.

Course outcome:

After the completion of the course the students will be able to:

1. describe the diversity of algae, fungi, and microbes and their ecological roles in various environments.
2. understand the principles and methods of plant pathology, including the causes, symptoms, and control of plant diseases.
3. identify the algae, fungi, and microbes on the basis of their morphological characteristics.

DCC- BOT5001T: Algae, Fungi, Microbes and Plant Pathology

Unit I **(12 hours)**

General characters and classification of algae. Important features of Chlorophyceace, Charophyceae, Xanthophyceae, Phaeophyaceae, and Rhodophyceae. Structure and life history of *Volvox, Chara, Vaucheria, Ectocarpus and Polysiphonia*.

Unit II **(12 hours)**

General characters and classification of Fungi. Important features of Mastigomycotina Zygomycotina, Ascomycotina, Basidiomycotina, and Deuteromycotina. Structure and life history of *Albugo, Rhizopus, Aspergillus, Agaricus, Puccinia* and *Alternaria.*

Unit III **(12 hours)**

Morphology, anatomy and reproduction of Lichens. Brief account on *Parmelia* and *Usnea*. Mycorrhiza: ectomycorrhiza, endomycorrhiza and their significance. Economic and Ecological importance of Algae, Fungi and Lichen

Unit IV **(12 hours)**

General characters, structure and multiplication of viruses. Structure of Tobacco mosaic virus (TMV) and Yellow Vein Mosaic Virus (YVMV). Transmission of plant viruses. Structure and replication of Bacteriophages. General account of Viroids and Prions. Bacteria: General characters, structure, nutrition, reproduction and economic importance of Bacteria. Cyanobacteria–Important features and Life history of Nostoc and Oscillatoria. Nitrogen fixation–by Cyanobacteria (Blue green algae).

Unit V **(12 hours)**

Brief account of Mycoplasma and Phytoplasma. Symptoms, causal organism and disease cycle of plant diseases with special reference to green ear disease of Bajra, loose smut of wheat, citrus canker, little leaf of brinjal and root knot nematode disease of vegetables. Non-parasitic disease, i.e. Black heart disease of potato. General account of plant disease management.

DCC- BOT5001P: Practical for Algae, Fungi, Microbiology and Plant Pathology
(60 hours)

Suggested Laboratory Exercises:

1. Algae: Microscopic preparation and study of following algal materials: *Volvox, Vaucheria, Chara, Ectocarpus* and *Polysiphonia.*
2. Fungi: Microscopic preparation and study of following fungal materials: Albugo, *Rhizopus*, *Aspergillus*, *Puccinia*, *Agaricus* and *Alternaria*.
3. Lichens: Study of *Parmelia* and *Usnea*
4. Viruses: Tobacco mosaic virus (TMV) and YVMV.
5. Bacteria: Gram staining of bacteria, Root nodules-Rhizobia (specimen), Cyanobaceria: Microscopic preparation and study of *Nostoc* and *Oscillatoria*.
6. Pathology: Study of symptoms of following diseases (specimen or photographs): Green ear disease of bajra, Loose smut of wheat, Black rust of wheat, Citrus canker, Little leaf of brinjal, Root knot nematode disease, Black heart disease of potato

Suggested Reading

Bold, H.C., Alexopoulous,C.J. and Delevoryas, T. Morphology of Plant and Fungi (4thEd.) Harper &Foul Co., New York, 1980.

Pandey, S.N. and Trivedi, P.S. A Text Book of Botany 2000 Volume I, Vikas Pub. House Pvt. Ltd., New Delhi.

Singh, V., Pande, P.C. and Jain, D.K. A Text Book of Botany, Rastogi & Co., Meerut, 2001.

Vashista, B. R. Botany for Degree Students (Algae, Fungi, Bryophyta), S. Chand & Co. Ltd., New Delhi,2002.

Alexopoulos, C.J., and Mims. Introductory Mycology, John Wiley and Sons, New York, 2000.

Bilgrami, K.S. and Dube, H.C. A Text Book of Modern Plant Pathology, Vikas Publ. House, New Delhi, 1976.

Biswas, S.B. and Biswas, A. An Introduction to Viruses, Vikas Publ. House, New Delhi, 2000.

Clifton, A. Introduction to Bacteria, McGraw Hill Co., New York, 1985.

Dube, H.C. Fungi, Rastogi Publication, Meerut, 1989.

Kaushik, P. Microbiology, Emkay Publication,2001.

Palezer, Chanand King. Microbiology, McGraw Hill Book Co., London,1995.

Amrita Rohilla, Handbook of Bacteriology. Oxford Book Company. 2013

P. C. Trivedi. Bacteriology Structure, Reproduction, Plant Diseases and Management. Nova Science Publishers. 2021

Pathak, V.N. Fundamentals of Plant Pathology, Agro Botanica. 2000.

Purohit, S.S. Microbiology, Agro. Bot. Publication, Jodhpur, 2002.

Sharma, O.P. Fungi, Today and Tomorrow, Publication,2000.

Sharma, P.D. Microbiology and Plant Pathology, Rastogi Publ. Meerut, 2003.

Singh, V. and Srivastava, V. Introduction to Bacteria, Vikas Publication,1998.

Panday B.P. Botany- Microbiology and plant pathology. S. Chand. Publication 2022

SEM II

DCCBOT5002T/P Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany

Course Objective:

1. To teach students the basic characteristics of bryophytes, pteridophytes, and gymnosperms, and their economic importance.
2. To develop an understanding about the fossil plants, and their use in reconstructing plant evolutionary history.

Course outcome:

After the completion of the course the students will be able to:

1. describe and identify the morphology, anatomy, reproduction, and life cycles of bryophytes, pteridophytes, and gymnosperms.
2. classify bryophytes, pteridophytes, and gymnosperms, and explain their economic and ecological significance.
3. analyze and interpret plant evolutionary history, using fossil plants.

DCC- BOT5002T: Bryophytes, Pteridophytes Gymnosperms and Palaeobotany

Unit I **(12 hours)**

General characters, alternation of generations, and classification of Bryophyta. Characters and Classification of Hepaticopsida, Anthocerotopsida and Bryopsida. Structure and life history of *Riccia, Marchantia, Anthoceros* and *Sphagnum*.

Unit II **(12 hours)**

Geological time scale, Fossils: types and Fossilization. General characters and classification of Pteridophytes. Stelar systems in Pteridophyta. Brief account on fossil *Rhynia*. Important characters of Psilophyta; Structure and life cycle of *Psilotum*.

Unit III **(12 hours)**

Important characters of Lycophyta, Sphenophyta and Pterophyta. Structure and life cycle of *Lycopodium Selaginella, Equisetum, Adiantum* and *Marsilea*. Heterospory and seed habit in Pteridophyta.

Unit IV **(12 hours)**

General characteristics, classification and evolution of gymnosperms. Important characters of Cycadophyta, Coniferophyta. Morphology, anatomy, reproduction and life cycle of *Cycas* and *Pinus*.

Unit V **(12 hours)**

Important characters of Gnetphyta. Morphology, anatomy, reproduction and life cycle of *Ephedra*. Economic importance of Bryophyta, Pteridophyta and Gymnosperms.

DCC- BOT5002P: Practical for Bryophytes, Pteridophytes Gymnosperms and Palaeobotany (60 hours)

Suggested Laboratory Exercises:

Bryophytes: Study of external morphology and microscopic preparations of following Bryophytes: *Riccia, Marchantia, Anthoceros* and *Sphagnum*.

Pteridophytes: Study of external morphology of *Lycopodium, Selaginella, Equisetm, Adiantum* and *Marsilea*. Microscopic study of temporary double stained preparations of stem/rhizome of *Lycopodium, Selaginella, Equisetum* and *Marsilea*. Study of temporary single stained microscopic preparations of L.S. of cone of *Lycopodium, Selaginella* and *Equisetum*. L.S. of Sporophyll of *Adiantum* and H.L.S. of sporocarp of *Marsilea*.

Gymnosperms: Study of external morphology of plant parts of *Cycas*: young and old foliage leaf, scale leaf, male cone, microsporophyll, megasporophyll and mature seed (if available). Microscopic temporary double stained preparations of rachis and leaflet of *Cycas*. Study of T.S. of normal and Corolloid root by permanent slides. Study of external morphology of plant parts of *Pinus* habit, long and dwarf shoot, male and female cone. Microscopic temporary preparation of pollen grains (W.M.) of *Pinus*. Study through permanent slides T.S. stem: young and old; male/female cone of *Pinus*. Study of habit and structure of whole male and female cone of *Ephedra*. Microscopic preparation of parts of male and female flowers of *Ephedra*.

Palaeobotany: Image specimen of *Rhynia*.

Suggested Readings:

Bold, H.C., Alexopolous, C.J. and Delevoryas, T. Morphology of plant and fungi (4th ed.), Harper and Foul, Co., New York, 1980.

Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1988.

Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub. House Pvt. Ltd., New Delhi 2000.

Raven, P.H. Evert, R.F. and Eichhom, S.C. Biology of plants, (5th ed.), W.H. Reema and Co., Worth Publication, New York, U.S.A., 1999.

Sharma, O.P. Pteridophytes, Today and Tomorrow Publication, 2000.

Sporne, K.R. The Morphology of Gymnosperms, B.I. Publ. Pvt., Bombay, Calcutta, Delhi, 1991.

Vashista, P.C. Gymnosperm, S. Chand & Co. Ltd., New Delhi, 2002.

Vashista, P.C. Pteridophyta, S. Chand & Co. Ltd., New Delhi, 2002.

Wilson, N.S. and Rothewall, G.W. Palaeobotany and evolution of Plants, (2nd ed.), Cambridge University Press, U.K., 1993.