

**Annexure 2A**



**Parishkar College of Global Excellence, Jaipur**

**B.Sc. Botany Pass Course  
Choice Base Credit System (CBCS)**

**Faculty Members**

Dr. Ramesh Chand Swami  
(**HOD, Department of Botany**)

Dr. Preeti Sharma

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## **Details of Course- Botany**

### **Core Courses –Botany**

1. Biodiversity (Microbes, Algae, Fungi and Archegoniate)
2. Plant Ecology and Taxonomy
3. Plant Anatomy and Embryology
4. Plant Physiology and Metabolism

### **Discipline Specific Electives -Botany (Any two)**

1. Cell and Molecular Biology
2. Economic Botany and Biotechnology
3. Analytical Techniques in Plant Sciences
4. Research Methodology

### **Skill Enhancement Courses - Botany (Any four)**

1. Bio fertilizers
2. Herbal Technology
3. Nursery and Gardening
4. Mushroom Culture Technology
5. Intellectual Property Rights

### **Ability enhancement Compulsory Course- 1.**

Environmental Science

2. English Communication / Hindi

**B.Sc. Pass course**  
**Core Course: Botany**  
**Paper I**  
**Biodiversity (Microbes, Algae, Fungi and Archegoniate)**  
**(Credit: Theory 4; Practical 2)**  
**Lectures: 60**

**Objectives**

- To impart knowledge of basic concept of bacteriology & virology.
- To study various types of algae, fungi, bryophytes, pteridophytes and gymnosperm.
- To acquire knowledge about the economic value of important algae, fungi, bryophytes, pteridophytes, & gymnosperm.
- To teach about basics of lichen and mycorrhizae. **Course Learning Outcomes**
  
- Students will learn general structure, reproduction & economic importance of virus and bacteria.
- Identifying bacteria, fungi and understand their impact on human being and plants.
- Understanding characteristics, distribution, and economic importance of algae.
- Differentiate various algae, bryophytes, pteridophytes & gymnosperm.

**Unit 1**

**(15 Lectures)**

S.No..	Syllabus
1.	<b>Microbes</b> <b>Viruses: Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV);, TSEs Viral like agents viroids, prions Economic importance</b>
2.	<b>Bacteria: Early earth/ Microbial Evolution, General characteristics and cell structure; bacteria culture; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance, Mycoplasma.</b>

## Unit 2

(15 Lectures)

S.No..	Syllabus
1.	<b>Algae: General characteristics;</b> Ecology and distribution; Range of thallus organization and reproduction, <b>Classification of algae: Cyanophyceae: <i>Nostoc</i>; Chlorophyceae – <i>Chlamydomonas</i>, <i>Chara</i>, Xanthophyceae – <i>Vaucheria</i>; Phaeophyceae – <i>Ectocarpus</i>; Rhodophyceae – <i>Polysiphonia</i>.</b> Economic importance
2.	<b>Fungi: Introduction – General characteristics ,ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction, and classification of fungi: Zygomycota: <i>Rhizopus</i>; Ascomycota: <i>Penicillium</i>, Basidiomycota: <i>Puccinia</i>, <i>Agaricus</i>; Deuteromycetes : <i>Alternaria</i>.</b> Economic Importance of fungus. Symbiotic Associations-Lichens: General account, reproduction, and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

## Unit 3

(15 Lectures)

S.No..	Syllabus
1.	<b>Introduction to Archegoniate: Unifying features of archegoniates, Transition to land habit, Alternation of generations.</b>
2	Bryophytes: General characteristics, adaptations to land habit, Classification , <b>Range of thallus organization. Classification: morphology, anatomy, and reproduction of <i>Riccia</i>, <i>Marchantia</i>, <i>Anthoceros</i> and <i>Funaria</i>.</b> Ecology and economic importance of bryophytes.

## Unit 4

(15 Lectures)

S.No..	Syllabus
1.	<b>Pteridophytes : General characteristics, classification: Early land plants (<i>Lepidodendron</i> and <i>Rhynia</i>). Morphology, anatomy, and reproduction of <i>Selaginella</i>, <i>Equisetum</i> and <i>Pteris</i>. Heterospory and seed habit, Stelar evolution. Economic importance of Pteridophytes.</b>
2.	<b>Gymnosperms: General characteristics, Classification: Morphology, anatomy and reproduction of <i>Cycas</i>, <i>Pinus</i> and <i>Ephedra</i>.</b> Economic importance of gymnosperm.

➤ **Suggested Practicals**

1. Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; *Citrus canker*, *little leaf of brinjal*, *yellow vein mosaic of bhindi*
3. Bacterial Gram staining
4. Culture media preparation (Nutrient Agar, Potato Dextrose Agar)
5. Isolation of microbes by streak plate method.
6. Study of vegetative and reproductive structures of *Oscillatoria*, *Nostoc*, *Anabaena*, *Chara* (electron micrographs), *Vaucheria*, *Ectocarpus* and *Polysiphonia* through temporary preparations and permanent slides.
7. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
8. *Alternaria*: Specimens/photographs and tease mounts.
9. *Puccinia* and *Agaricus*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
10. Lichens: Specimen Study of growth forms of lichens (crustose, foliose and fruticose)
11. Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs)
12. Study of vegetative and reproductive structures *Riccia*, *Marchantia*, *Anthoceros* and *Funaria*
13. Study of vegetative and reproductive structures in *Selaginella*, *Equisetum* and *Pteris*
14. Study of vegetative and reproductive structures in *Cycas*, *Pinus* and *Ephedra*

➤ **Innovative and research oriented applied botany- □ Algae as biofuel/food supplements**

- Algae as biofertilizers
- Future aspects of Fungi in Pharmaceuticals
- Mass production of Algae and Cyanobacteria
- Extraction of ephedrine
- Investigation and Pathology of Non cereal crops (eg. cotton) of economic value.
- Study of wild flora research

➤ **Suggested Readings**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 12; 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Singh V. Jain D. K., Pande P. C. (2010). A Text Book of Botany - textbook of botany. Rastogi publication, Meerut, India.
7. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.

8. **Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.**
9. Vashishta, P.C., Sinha, A.K., Kumar (2010). A text book of Botany for degree students, Gymnosperm. S. Chand. Delhi, India.
10. **Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad**
11. **Gilbert M. Smith,(1938). Cryptogamic Botany. Tata Mc-Graw Hill Book company. Vol. I & Vol. II.**

**B.Sc. Pass Course**  
**Core Course: Botany**  
**Paper II**  
**Plant Ecology and Taxonomy**  
**(Credit: Theory 4; Practical 2)**  
**Lectures: 60**

**Objectives**

- To acquire knowledge of plant population, community and plant succession.
- To study ecosystem and biogeochemical cycling of carbon, nitrogen and phosphorus.
- To provide understanding of phytogeography & learn about endangered plant of Rajasthan.
- To disseminate the knowledge of classification & IUCN and Taxonomic evidences.
- To learn about Angiospermic families.

**Course Learning Outcomes**

- Learn about the inter relationship between living world and environment.
- Acquire knowledge about the effect of different abiotic and biotic factor in the environment.
- Understand about the fundamental aspect of ecosystem, plant community.
- Learn about taxonomic rules and evidences in plant taxonomy.
- Identify plants on the basis of characteristic feature of different families of angiosperm.

**Unit 1**

**(15 Lectures)**

S.No.	Syllabus
1.	<b>Introduction: Introduction, scientist and its scope</b> Atmosphere and its layer; plants adaptation of Hydrophytes Mesophytes & Xerophytes
2.	<b>Environment and climate: Abiotic factor</b> water, light, temperature, soil (development, profile, physical -chemical characteristics of soil) <b>Biotic factors: Interaction between animal &amp; plants</b>
3.	<b>Ecosystem-Structure, energy flow trophic organization, food chains &amp; food web, ecological pyramid, production and productivity, Biogeochemical cycling: cycling of carbon, nitrogen and phosphorus. Plant Sucession: Plant sucession ,types and its process</b>

**Unit 2**

**(15 Lectures)**

S.No.	Syllabus
1.	Plant Communities <b>Plant population, plant community characteristics, frequency, density, abundance and cover; ecotype, ecad</b>
2	<b>Phytogeography</b> <b>Principle biogeographical zones</b> , vegetation of India & Rajasthan. Plant conservation strategies in situ & ex -situ conservation Red data book. Endangered plants of Rajasthan.

**Unit 3****(15 Lectures)**

S.No.	Syllabus
1	<b>Introduction to plant Taxonomy</b> <b>Introduction principles and rules of IUCN (International code of Nomenclature);</b>
2	<b>Classification types: <i>Carolus linnaeus</i>, artificial, natural, phylogenetic, <i>Bentham &amp; Hooker</i> and <i>Engler and Prantl</i>.</b>
3	<b>Taxonomic evidences from anatomy, embryology, palynology and phylogeny</b>

**Unit 4****(15 Lectures)**

S.No.	Syllabus
1.	Study of Angiospermic families – Ranunculaceae, Brassicaceae, Rosaceae, Fabaceae (Papilionoideae, Caesalpinioideae, Mimosoideae), Euphorbiaceae, Malvaceae, Apiaceae, Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae, Poaceae, Liliaceae

➤ ***Suggested Practicals***

1. Study of instruments used to measure microclimatic variables: Soil thermometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and water holding capacity of soil.
4. Dissolved oxygen content, BOD and pH of water.
5. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (*Nerium*, *Calotropis*, *Capparis*, *Casuarina*, *Nelumbo*, *Hydrilla*, *Nymphaea*, *Eichhornia*)  
(b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*, *Tinospora*).
6. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
7. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
8. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):

Brassicaceae -*Brassica*, *Iberis*;Asteraceae –*Sonchus*, *Ageratum*, *Helianthus*, *Tridax*Solanaceae –*Datura stramonium*, *Withania*Lamiaceae -*Salvia*, *Ocimum*



Liliaceae - *Asphodelus / Lilium / Allium*.

Fabaceae- *Pisum sativum, Cassia fistula, Senna tora, Acacia nilotica, Prosopis cineraria*

Rubiaceae- *Hamelia*

Euphorbiaceae- *Riccinus communis, Euphorbia pulcherima, Jatropha*

9. **Mounting of any ten properly dried and pressed specimen of any wild plants with herbarium label (to be submitted in the record book).**

10. **Any one Forest/Agriculture/Conservatory/Herbal garden field visit and report submission.**

11. **Listing of recognised herbariums of Rajasthan.**

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➤ *Plant resistance in high temperature and their productivity*

➤ *Different seasonal impacts on plant growth*

➤ *Cultivation of commercial crops in Rajasthan*

➤ *Endangered plant species discovery and their conservation*

➤ *Reduction of noise pollution by roadside flora study*

➤ *Eco-club/Photography club should be formed*

➤ *Production of Whole plant based food materials*

➤ **Suggested Readings**

1. **Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.**

2. **Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8<sup>th</sup> edition.**

3. Odum E., Barrick M., and Barrett G.W. ( 2017) Fundamentals of Ecology. Cengage; India

4. **Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.**

5. **Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.**

6. Sharma O. (2017) **Plant Taxonomy. Mc Graw Hill Education, India. Practical**

7. Plant taxonomy by Rendel

**B.Sc. Pass course**  
**Skill Enhancement Course**  
**Biofertilizers**  
**(Credits 2)**  
**Lectures: 30**

**Objectives**

- To gain the knowledge of eco-friendly bio fertilizer.
- To learn about mycorrhizal association with crop plants.
- To educate about organic farming and recycling of organic waste.

**Course learning Outcomes**

- Students will be aware about business opportunity in the field of plant sciences.
- Students can utilize biofertilizer, vermicompost for increasing yield of crop plants.

**Unit 1**

**(8 Lectures)**

S.No.	Syllabus
1	<b>General account about the microbes used as biofertilizer – Trichoderma, Rhizobium, PGPR. Biopesticides – Calotropis and Neem decoction. Biological control</b>
2	<b>Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication.</b>

**Unit 2**

**(7 Lectures)**

S.No.	Syllabus
1	<b>Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.</b>

**Unit 3**

**(8 Lectures)**

S.No.	Syllabus
1	<b>Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.</b>

**Unit 4****(7 Lectures)**

S.No.	Syllabus
1	<b>Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.</b>

**➤ Suggested Readings****1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.****2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.****3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.****4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.****5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.****6. Vyas,S.C, Vyas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad****➤ *Innovative and research oriented applied botany-***

- Futuristic approach to biofertilizers**
- Biofertilizers in enhancement of useful secondary metabolites**
- Development of Green Plastic and it's scope**

**B.Sc. Pass course**  
**Skill Enhancement Course**  
**Mushroom Culture Technology**

(Credits 2)

Lectures: 30

**Objectives**

- To make aware students about the mushroom growing techniques.
- To teach nutritional and medicinal value of mushroom.
- Students will learn about cultivation and storage techniques of mushroom.

**Course learning Outcomes**

- Students will learn the cultivation techniques of mushroom
- Students can learn the techniques and small or large scale industries can be established by students.
- This course enables them to export and marketing of mushroom

**Unit 1**

**(7 Lectures)**

S.No.	Syllabus
1	Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - <i>Calocybe indica</i> , <i>Lentinus edodes</i> (Shiitake), <i>Ganoderma lucidum</i> ( <i>Rishi</i> ), <i>Hericium erinaceus</i> (Lion's Mane), <i>Pleurotus eryngii</i> (King Oyster), <i>CORDYCEPS SINENSIS</i> , <i>Flammulina filiformis</i> (Enoki), <i>Flammulina filiformis</i> (Oyster) <i>Volvariella volvacea</i> , <i>Agaricus bisporus</i> (Button). Natural condition for mushroom cultivation.

**Unit 2**

**(8 Lectures)**

S.No.	Syllabus
1	<b>Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation- Low cost technology, Composting technology in mushroom production.</b>

**Unit 3****(7 Lectures)**

<b>S.No.</b>	<b>Syllabus</b>
1	Pure culture-spawn preparation: Pure culture - preparation of medium (PDA and Oatmeal agar medium), Sterilization, Preparation of test tube slants to store mother culture, Culturing of <i>Pleurotus</i> mycelium on Petri plates, Preparation of mother spawn in saline bottle and polypropylene bag and their multiplication

**Unit 4****(8 Lectures)**

<b>S.No.</b>	<b>Syllabus</b>
1	<b>Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins.</b>
2	<b>Food Preparation: Types of foods prepared from mushroom. Research Centres -National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.</b>

➤ **Suggested Readings**

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

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- **Mushroom cultivation for high nutritive value as substitute of non vegetarian products**
- **Growth of economically important varieties of mushrooms in high temperature conditions**