

## B.Sc Botany

<b>SEMESTER –I</b>		
Code	Title of Course	Credits
<b>BSB001A</b>	<b>CELL BIOLOGY AND THALLOPHYTES</b>	<b>4</b>
<b>BSB002A</b>	Practical Lab of Algae, Fungi and Basics of Cell Biology	<b>1</b>
	<b>Total Credits</b>	<b>5</b>
<b>SEMESTER –II</b>		
<b>BSB 003A</b>	<b>BRYOPHYTA, PTERIDOPHYTA AND LICHENS</b>	<b>4</b>
<b>BSB004A</b>	Practical Lab of Cryptogams and Lichens	<b>1</b>
	<b>Total Credits</b>	<b>5</b>
<b>SEMESTER –III</b>		
<b>BSB005A</b>	<b>GENETICS AND PLANT BREEDING</b>	<b>4</b>
<b>BSB006A</b>	Practical Lab on basics of Plant Breeding and Genetics	<b>1</b>
	<b>Total Credits</b>	<b>5</b>
<b>SEMESTER –IV</b>		
<b>BSB007A</b>	<b>MORPHOLOGY, ANATOMY AND PLANT PHYSIOLOGY</b>	<b>4</b>
<b>BSB008A</b>	Practical Lab on Fundamentals of Anatomy ,Morphology and Plant Physiology	<b>1</b>
	<b>Total Credits</b>	<b>5</b>
<b>SEMESTER -V</b>		
<b>BSB009A</b>	<b>GYMNOSPERM, ANGIOSPERM AND PALEOBOTANY</b>	<b>4</b>
<b>BSB010A</b>	Practical Lab on Spermatophytes and PaleoBotany	<b>1</b>
<b>BSB011A</b>	Project (optional)	<b>6</b>
	<b>Total Credits</b>	
<b>SEMESTER -VI</b>		
<b>BSB012A</b>	<b>ENVIRONMENTAL MANAGEMENT AND ECONOMIC BOTANY</b>	<b>4</b>
<b>BSB013A</b>	Practical Exercises based on Plant Ecology and Economic Botany	<b>1</b>
	<b>Total Credits</b>	<b>36</b>

### I Semester

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### **BSB001A: Cell Biology and Thallophytes**

**Credit(s): 4**

#### **Unit-I**

Cell theory, cell size and shape, eukaryotic cell components. Cell membrane and cell wall: the function of membrane, models of membrane structure, membrane protein and their function, cell wall, structure, origin & function.

#### **Unit-II**

Nucleus- nuclear envelop, structure of nuclear pore complex, chromatin structure, DNA packaging in eukaryotes, euchromatin, heterochromatin, nucleolus and ribosome structure, mitosis, meiosis.

#### **Unit-III**

Cell organelles: Mitochondria structure, composition, semiautonomous nature, symbiont hypothesis mitochondrial nature.

Chloroplast- structure, composition, semiautonomous nature and chloroplast DNA. ER, Golgi body, lysosome, Peroxisome and glyoxisome structure and role.

#### **Unit -IV**

Algae- General characteristics; Ecology and distribution, Range of thallus organization and reproduction; Basic criteria used in classification (Fritsch, and Smith), *Spirullina* cultivation (SCP)

Important classes in relation to applied Phycology listed below

Cyanophyceae- *Nostoc*

Chlorophyceae- *Volvox, Chara*

Xanthophyceae – *Vaucheria*

Phaeophyceae- *Ectocarpus*

Rhodophyceae – *Polysiphonia*

#### **Unit -V**

**Fungi-** General characteristics; Ecology and distribution; Range of thallus organization; Cell structure; Wall composition; Nutrition; Growth; Reproduction and spores; Heterokaryosis and parasexuality; Basic criteria used in classification. Mushroom cultivation.

Life cycle of *Sclerospora, Aspergillus, Claviceps, Ustilago* and *Alternaria*.

### **BSB002A: Practical Lab of Algae Fungi and Basics of Cell Biology** **Credit(s): 1**

1. To identify various parts of Dissecting and Compound microscope and to understand its functioning
2. To identify the different morphological forms of bacteria viz. Cocci, Bacilli under the compound microscope.
3. To prepare epidermal peel preparation of onion leaf and study internal structure of cell.
4. To draw electron microphotographs of eukaryotic cell with its various internal cell organelles.
5. To prepare and identify different stages of mitosis in root tips of onion.
6. To prepare and identify different stages of Meiosis in Onion flower bud .
7. To prepare and identify suitable temporary slides of the algal cyanobacteria and chlorophyceae viz. *Nostoc and Volvox*.
8. To prepare and identify suitable temporary slides of the algal member *Vaucheria, Ectocarpus* and *Polysiphonia*.
9. To prepare and identify suitable temporary slides of the fungal member *Sclerospora and Aspergillus*.
10. To prepare and identify suitable temporary slides of vegetative, asexual and sexual stages of *Ustilago* and *Alternaria*.

11. Demonstration of Mushroom cultivation.
12. Demonstration of SCP Cultivation.

**Suggested Books**

1. Kaushik P. Microbiology, Emkay Publication, 2001.
2. Pelczer, Chan and Krug. Microbiology. McGraw Hill Co., London, 1995.
3. De Robertis & De Robertis Cell and Molecular Biology. Lippincott Williams and Wilkins.
4. P.K. Gupta, Cell and Molecular Biology. Rastogi Publication.
5. C.B. Powar – Cell Biology, Himalaya Publishing House.
6. V.B. Rastogi – Cell Biology. Rastogi Publications.
7. Gilbert, M. Smith Cryptogamic Botany Vol I and II, II<sup>nd</sup> Ed. Tata McGraw Hill Publishing Company Ltd. N.Delhi. 1985.
8. Ghemawat M.S., Kapoor, J.N. and Narayan H.S. : A text Book of Algae. Ramesh Book Depot. Jaipur 1976.
9. Kumar. H.D. Introductory Phycology. Affiliated East-West Press Ltd., Newyork 1988.
10. Singh V., Pande P.C. and Jain D.K. A Text BBook of Botany Rastogi and Co. Merrut, 2001.
11. Alexopolous, C.J. and Mims : Introductory Mycology, John Wiley and Sons, New York, 2000.
12. Dube, H.C. Fungi, Rastogi Publication, Merrut, 1989.
13. Sharma O.P. Fungi Today and Tomorrow Publication, 2000.

## II Semester

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**BSB 003A: Bryophyta, Pteridophyta and Lichens**

**Credit(s): 4**

**Unit-I**

Bryophyta: general characters, origin, affinities and classification & Economic Importance of Bryophyta.. Life cycle of *Marchantia*., *Anthoceros*, *Sphagnum* & *Funaria*

**Unit-II**

General character of pteridophyta, classification by Smith and Sporne, Stellar system in pteridophyta, Alteration of generation. Distribution, Structure and life history of *Rhynia* and *Psilotum*.

**Unit -III**

Distribution, Structure and life history of *Lycopodium* and *Equisetum*

**Unit-IV**

Distribution, Structure and life history of *Selaginella* and *Marsilea*.

**Unit-V**

Lichens- distribution, nature of association of phycobiont and mycobiont, classification of lichens, structure reproduction & economic importance. Mycorrhiza – General account and its significance

**BSB 004A: Practical Lab Cryptogams and Lichens**

**Credit(s): 1**

1. To examine external morphology of vegetative and reproductive parts of *Marchantia* .
2. To prepare hand cut sections of vegetative and reproductive parts of *Marchantia*.
3. To observe external morphology under dissecting microscope of *Anthoceros* and *Sphagnum*.
4. To prepare hand cut sections of vegetative and reproductive parts of *Anthoceros* and *Sphagnum*.
5. To study and prepare hand cut sections of vegetative and reproductive parts of *Funaria*.

6. To identify various morphological forms (Crustose, Foliose and Fruticose) of lichens and comment upon their economic importance to mankind.
7. To examine external morphology of vegetative and reproductive parts of *Psilotum*.
8. To examine external morphology of vegetative and reproductive parts of *Lycopodium* and *Equisetum*.
9. To prepare hand cut and double stained sections of vegetative and reproductive parts of *Lycopodium* and *Equisetum*.
10. To examine & prepare hand cut double stained sections of vegetative and reproductive parts of *Selaginella*
11. To examine & prepare hand cut double stained sections of vegetative and reproductive parts of *Marsilea*.
12. Isolation & Identification of Ectomycorrhiza from the plant roots.

### Suggested Books

1. Puri P. Bryophytes Atma Ram and Sons, Delhi, Lucknow 1985.
2. Sarabhai R.C. and Saxena R.C. Text Book of Botany Vol. I and II, Ratan Prakashan Mandir, Merrut, 1980.
3. Singh, Pandey and Jain. A text Book of Botany, Rastogi and Co. Merrut 2001.
4. Vashishta B.R. : Botany for degree students (Bryophyta.) S. Chand & Co. New Delhi 2002.
5. Sarabhai & Saxena, Text Book of Botany, Rastogi Publications. Merrut 1990.
6. Sporne, K.R. Morphology of Pteridophytes B.I. Publication Pvt. Mumbai (2002).
7. Vashishta P.C. Pteridophyta. S. Chand and Co. New Delhi

## III Semester

L	T	P	C
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### BSB005A: Genetics and Plant Breeding

Credit(s): 4

#### Unit-I

Mendel work, (Terminologies, Laws of inheritance, Modified Mendelian Ratios, Cytoplasmic Inheritance & Multiple allelism.

#### Unit-II

Sex determination in human, Drosophila and plants, Sex linked inheritance.

Linkage: concept & history, complete & incomplete linkage, Bridges experiment, Crossing over: concept and significance.

#### Unit-III

Numerical chromosomal changes, euploidy, polyploidy and aneuploidy.

#### Unit-IV

Structural chromosomal changes : deletions, duplications, inversions and translocations.

Types of mutations, effects of physical and chemical mutagens.

#### Unit-V

Introduction and objectives of plant breeding, general methods of plant breeding, Conventional and non conventional methods of plant breeding, hybrid vigour, inbreeding depression.

Introduction to the concept of Recombinant DNA Technology & Plant Tissue culture.

### BSB006A: Practical Lab on basics of Genetics and Plant Breeding

Credit(s): 1

- 1.To prepare note and understand the terminologies proposed by Mendel.
2. To solve numerical problems based on Mendel's Law of Inheritance (Monohybrid and Dihybrid Crosses).
- 3.To analyse numerical problems based upon modified Mendelian Laws through Punnett square method.
- 4.To perform the numericals based on sex determination in Drosophila & Humans
5. To comment upon the types of cloning vectors used in genetic engineering.
6. To comment upon the types of enzymes used in rDNA technology.
- 7 To prepare temporary slide and comment upon Bar Body .
- 8 . To perform emasculation of anther in a bisexual cross pollinated flower.
9. To perform various methods of vegetative propagation found in plants.
10. Familiarization of basic equipment in tissue culture, composition of MS media.
11. Demonstration of *in vitro* sterilization and inoculation methods using leaf & nodal explants of dicot plant.

### **Suggested Books**

1. Rastogi V.B. Genetics. Rastogi Publications.
2. Gupta P.K. Classical to Modern Genetics. Rastogi Publications.
3. Sandu and Arora, Genetics.Himalaya Publishing House
4. Miglani G.S. Advanced Genetics, Narosa Publishing House, New Delhi (2000).
5. Gardner, Principles of Genetics. Wiley India
6. Choudhary H.K. Elementary Principles of Plant Breeding, Oxford and IBH Publishing Co. N.D. 1989.
7. Shukla R.S. and Chandel P.S. Cytogenetics, Evolution and Plant Breedings S Chand and Co. Ltd. New Delhi (2000).
8. Singh R.B. Text Book of Plant Breeding Kalyani Publishers. Ludhiana.
9. Plant tissue culture by H.S Chawla
10. Bhojwani, S.S & Razdan, M.K (1996) Plant Tissue Culture , Theory & Practice, Elsevier Science Amsterdam, The Netherlands
11. Bhojwani, S.S & Bhatnagar S.P.(2011) The Embryology of Angiosperms Vikas Publication House Pvt. Ltd, New Delhi, 5th Edition

## **IV Semester**

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### **BSB007A: Morphology, Anatomy and Plant Physiology**

**Credit(s): 4**

#### **Unit-I**

Different types of tissues, their organization into root, stem and leaf (monocot & dicot), Concept of stele and its evolution, meristematic, simple and complex secretory tissue.

Basic Body plan of flowering plants, modular type of growth, diversity of plant forms: annual, biennials and perennials.

#### **Unit-II**

Shoot and root system: shoot and root apical meristem and its histological organization, vascularisation of primary shoot and root in monocot and dicots, monopodial and sympodial growth.

Morphology and anatomy of seed (monocot and dicot), significance of seed. Microsporogenesis, Megasporogenesis, Double fertilization & triple fusion.

#### **Unit-III**

Plant water relationship: Significance of water, water potential, water absorption and transport, transpiration, mechanism of opening and closing to stomata.

Mineral Nutrition: Essential elements, micro and macro nutrients, soil factors affecting their availability, Physiological basis of deficiency, symptoms, ion uptake. Transport of inorganic and organic component, transport pathway Xylem and Phloem.

#### **Unit-IV**

Role of physical factors in growth of plants: Response to light, photomorphogenesis, Role of growth regulators: Auxin, Gibberelins, Cytokinins, ABA, Ethylene

#### **Unit-V**

Photosynthesis: Brief history, pigments, mechanism of light, absorption and energy transfer PSI and PSII e-transport, ATP synthesis C3, C4 and CAM photorespiration.

### **BSB008A: Practical Lab on Fundamentals of Anatomy, Morphology and Plant Physiology Credit(s): 1**

1. To use any commonly occurring dicotyledonous plant as a model to understand the basic body plan and modular type of growth.
2. To prepare hand cut section and stained preparation of L.S. of shoot tip.
3. To understand the difference between Monopodial and Sympodial types of branching.
4. To prepare transverse hand cut sections of monocot and dicot stem and root of sunflower, nerium, and maize for anatomical study.
5. To perform hand cut sections of monocot and dicot stem and roots having secondary growth in sunflower, nerium and maize.
6. To Examine structure of monocot and dicot seed.
7. Specimen study for modifications of plant parts for vegetative reproduction.
8. To study the permeability of plasma membrane using different concentration of solvent.
9. To separate chlorophyll pigment by solvent method.
10. To study the apical growth of plant by Arc Auxanometer.
11. To study photosynthesis by inverted funnel method and Moll's half leaf method.
12. To study the demonstration of stomatal transpiration by four leaf method.
13. To demonstrate the phenomenon of osmosis by potato osmometer.
14. To calculate % germinated pollen in given medium
15. Demonstration of Hydroponics System.

#### **Suggested Books**

1. Cutter E.G. 1969. Part I Cells and Tissues ,Edward Arnold, London.
2. Cutter E.G. 1971. Plant Anatomy: Experiment and Interpretation Part-II, Organs, Educated Arnold. London.
3. Esau. K. 1977. Anatomy of seed Plants 2<sup>nd</sup> Eds. John Wiley & Sons, New York.
4. Fahn A. 1985. Plant Anatomy, Pergamon Press, Oxford.
5. Salisbury and Ross. Plant Physiology.
6. Teiz and Zeiger Plant Physiology.
7. V. Verma. Plant Physiology.
8. Bhojwani, S.S & Bhatnagar S.P(2011) The Embryology of Angiosperms Vikas Publication House Pvt. Ltd, New Delhi, 5<sup>th</sup> Edition

### **V Semester**

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### **BSB009A: Gymnosperm, Angiosperm and Paleobotany**

**Credit(s): 4**

#### **Unit-I**

Classification and characteristic features of different groups of Gymnosperm. Distribution, morphology, vegetative and reproductive parts, anatomy and life cycle of *Cycas*.

## Unit-II

Distribution, Morphology of vegetative and reproductive parts, anatomy, reproduction and life cycle of *Pinus* and *Ephedra*, Economic Importance of Gymnosperm.

## Unit-III

Angiosperm – origin and evolution. Some examples of primitive angiosperm.

Introduction, Principles of taxonomy, units of classification, Concept of Genus and species, Binomial nomenclature, ICBN, Botanical gardens and Herbaria.

## Unit-IV

Classification of angiosperm Linnaeus, Bentham and Hooker's system, Engler and Prantle system of classification.

Diversity of flowering plants as illustrated by members of the families, Brassicaceae, Malvaceae, Fabaceae, Solanaceae, Apocynaceae, Asclepiadaceae, Euphorbiaceae, Liliaceae and Poaceae, Asteraceae.

## Unit-V

Fossilization, types of fossils, technique to study fossils, geological time scale, Applied aspect of PaleoBotany (use in coal and petroleum exploration).

Fossil Pteridophyta – *Lepidodendron*, *Calamites*

Fossil Gymnosperms – *Williamsonia*

### **BSB010A: Practical Lab on Spermatophytes and PaleoBotany** **Credit(s): 1**

1. To understand terminology used for the plant description and their identification.

2. To study Key for the identification of angiospermic plant families.

3. To perform description of some important angiospermic plant families:

Brassicaceae – *Brassica campestris*

Malvaceae – *Hibiscus rosasinensis*, *Abutilon*

Fabaceae – *Pisum sativum*, *Cassia*, *Acaccia*

Solanaceae – *Datura*, *Withania*

Apocynaceae – *Vinca rosea*, *Thevetia*

Asclepeideaceae – *Calotropis*

Euphorbiaceae – *Euphorbia*, *Ricinus*

Liliaceae – *Onion*, *Asphodelus*

Poaceae – *Triticum*

Esteraceae – *Helianthus*, *Tridax*

4. To study the external morphology of vegetative and reproductive parts of *Cycas*.

5. To prepare suitable double stained preparation of T.S of root, stem, rachis, leaflet and microsporophyll of *Cycas* and assign them to their respective systematic position.

6. To study the external morphology of vegetative and reproductive parts of *Pinus*.

7. To prepare suitable double stained preparation of T.S of root, stem and foliage leaf of *Pinus*.

8. To study reproductive structure (Male cone and Female cone ) of *Pinus* and identify and assign them to their respective systematic position.

9. To study the external morphology of vegetative and reproductive parts of *Ephedra*.

10. To prepare suitable double stained preparation of T.S of stem (node and internode) of *Ephedra*.

11. To study reproductive structure (Male Strobilus and Female strobilus ) of *Ephedra* and identify and assign them to their respective systematic position.

12. To Study types of fossils. Fossil Pteridophyta – *Lepidodendron*, *Calamites*, Fossil Gymnosperms – *Williamsonia*.

13. To prepare a properly dried and pressed specimen of any wild plants with herbarium label( Submitted in record book)

### **Suggested Books**

1. Vashishtha P.C. Gymnosperm, S. Chand Company.

2. Singh Pandey Jain, A text Book of Botany, Rastogi Publication.

3. Biswas C and Johari B M .The Gymnosperm.Narosa Publishing house.
4. Wilson N.S., Rothwell G.W. PaleoBotany and Evolution of Plants. II<sup>nd</sup> Ed. Cambridge. Univ. Press, U.K. (1990).
5. Willis K.J and McElwain J.C. The Evolution of Land Plants.Oxford University Press.
6. V.V. Shivrajan, Introduction to Principles to the Plant Taxonomy, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
7. Angiosperm Taxonomy, Singh, Pandey, Jain Rastogi Publishers, Meerut.
8. Gurucharan Singh, Plant Systematics (2001). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

## VI Semester

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### **BSB012A: Environmental Management and Economic Botany**

**Credit(s): 4**

#### **Unit-I**

Introduction to Ecology, Community and Ecosystem Inter-relationships between living world and environment, Biosphere, biomes, ecosystem and its components (abiotic and biotic) Bioenergetics.

#### **Unit-II**

Biogeochemical cycles, Hydrologic cycle. Concept of habitat and niche.

Population and Community Ecology (Part Population attributes, density, natality, mortality, age ratio, sex ratio, dispersal and dispersion of population, exponential and logistic growth, life history strategies, population interactions).

#### **Unit-III**

Biodiversity and regional conservation strategies success stories with reference to India and sustainable utilization. Principles of wildlife management, wildlife sanctuaries, parks and biosphere reserves in India, endangered and threatened species of plants and animals in India, germplasm banks.

#### **Unit-IV**

Basic concept of center of origin of cultivated plants . Food plants – rice, wheat , maize , potato and sugarcane . Vegetable oils: coconut , groundnut and mustard . Spices: General account with an

emphasize on those plants cultivated in Rajasthan (cumin, capsicum, coriander) Beverages: tea and coffee. Fibers: cotton and jute.

#### **Unit-V**

Medicinal plants: General account with an emphasize on those cultivated in Rajasthan (senna, isabgol, safed musli). Wood: General account of sources of firewood, timber and bamboos; Rubber. Legumes or pulses, starch or sugar yielding plants. EthnoBotany: a general account.

### **BSB 013A: Practical Exercises based on Plant Ecology and Economic Botany**

**Credit(s):**

**1**

1. To study plant communities by quadrat methods so as to determine percentage frequency and density of plant species.
2. To determine chloride, carbonate, organic matter in given sample.
3. To find out the porosity of grassland and wood land soil sample.
4. To determine the moisture content of grassland soil.
5. To study morphological adaptation of hydrophytes & Xerophytes.
6. To measure water holding capacity of soil.
7. To study the basic concept of center of origin of cultivated plants proposed by Vavilov.



8. To study the common name, botanical name, family, part used and economic importance of plants used as cereals (rice, wheat, maize).
9. To study the common name, botanical name, family, part used and economic importance of sugar yielding plants (potato and sugarcane).
10. To study the common name, botanical name, family, part used and economic importance of Vegetable oils yielding plants (coconut, groundnut and mustard).
11. To study the common name, botanical name, family, part used and economic importance of fiber yielding plants (cotton and jute) and types of wood.
12. To study the common name, botanical name, family, part used and economic importance of plants used as spices and beverages (tea and coffee).
13. To study general account with an emphasis on medicinal plants cultivated in Rajasthan (senna, isabgol, safed musli).
14. Visit to any herbal garden in near vicinity.

**Suggested Books:**

1. P.D. Sharma, Ecology and utilization of plants. Rastogi publication.
2. Odum E P., and Barrett G.W., Fundamentals of Ecology. Thomson Asia Pvt. Ltd.
3. Rajagopalan R, Environmental Studies Oxford University Press.
4. P.D. Sharma. Ecology and utilization of plants. Rastogi Publication.
5. S.L. Kochar., Economic Botany in Tropics. McMillan Publishing House.
6. B.P. Pandey Economic Botany in Tropics.
7. Sambhamurthy. Economy Botany.