

B.Sc. Botany

SEMESTER –I		
Code	Title of Course	Credits
BBO001B	CELL BIOLOGY AND THALLOPHYTES	4
BBO002B	Practical Lab of Algae, Fungi and Basics of Cell Biology	1
	Total Credits	5
SEMESTER –II		
BBO 003B	BRYOPHYTA, PTERIDOPHYTA AND LICHENS	4
BBO004B	Practical Lab of Cryptogams and Lichens	1
	Total Credits	5
SEMESTER –III		
BBO005B	GENETICS AND PLANT BREEDING	4
BBO006B	Practical Lab on basics of Plant Breeding and Genetics	1
	Total Credits	5
SEMESTER –IV		
BBO007B	MORPHOLOGY, ANATOMY AND PLANT PHYSIOLOGY	4
BBO008B	Practical Lab on Fundamentals of Anatomy ,Morphology and Plant Physiology	1
	Total Credits	5
SEMESTER -V		
BBO009B	GYMNOSPERM, ANGIOSPERM AND PALEOBOTANY	4
BBO010B	Practical Lab on Spermatophytes and PaleoBotany	1
	Total Credits	5
SEMESTER -VI		
BBO012B	ENVIRONMENTAL MANAGEMENT AND ECONOMIC BOTANY	4
BBO013B	Practical Exercises based on Plant Ecology and Economic Botany	1
BBO014A	Project (optional)	6
	Total Credits	36

B SC (CHEMISTRY MAJOR) PROGRAM EDUCATIONAL OBJECTIVE (PEO'S):

A Graduate of the Chemistry Major with Botany Minor should:

PEO-I Students Will Develop Themselves As Effective Professionals By The Knowledge Gained With Attention To Team Work, Effective Communication, Critical Thinking And Problem Solving Skills.

PEO-II Students Will Develop Professional Skills That Prepare Them For Self Employment As Well As To Qualify Competitive Examination And Life-Long Learning In Advanced Areas Of Botany And Related Fields.

PEO-III Students Will Demonstrate Their Ability To Adapt To A Rapidly Changing Environment By Having Learned And Applied New Skills And New Technologies.

PEO-IV Students Will Be Provided With An Educational Foundation That Prepares Them For Excellence, Leadership Roles Along Diverse Career Paths With Encouragement To Professional Ethics And Active Participation Needed For A Successful Career.

Program Outcome (PO's)

A Graduate of the B.Sc. Chemistry Major with Botany Minor Will Demonstrate:

The Student Outcomes Are:

1. An Ability To Apply Profound Understanding Of Chemistry, Botany And Zoology (Knowledge Of Science)
2. An Ability To Design And Perform Experiments, As Well As To Analyze And Interpret Data(Problem Analysis)
3. An Ability To Communicate Effectively With Reference To Speaking, Reading, Writing And Listening Clearly In Person Through Electronic Media In English And Hindi And Able To Get Acquainted With The People, Ideas Books Media And Technology(Communication Skills)
4. A Recognition Of The Need For, And An Ability To Engage In Life-Long Learning(Design/Development Of Solutions)
5. A Knowledge Of Contemporary And Burning Issues Related To Science(Individual And Team Work)
6. An Ability To Use The Techniques, Skills, And Modern Scientific Tools Necessary For Botany Practices

I Semester

L	T	P	C
4	-	1	5

BBO001B: 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, Peroxysome 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*.

BBO002B: Cell Biology and Thallophyta Practical Lab

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, IInd 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., New York 1988.
10. Singh V., Pande P.C. and Jain D.K. A Text Book of Botany Rastogi and Co. Merrut, 2001.
11. Alexopoulos, 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

L	T	P	C
4	-	1	5

BBO 003B: 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, Stear 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

BBO 004B: Bryophyta, Pteridophyta and Lichen Practical Lab

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
4	-	1	5

BBO005B: 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.

BBO006B: Genetics and Plant Breeding Practical Lab

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 Breeding 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

L	T	P	C
4	-	1	5

BBO007B: 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, Gibberellins, Cytokinins, ABA, And 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.

BBO008B: Morphology, Anatomy and Plant Physiology Practical Lab 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 2nd 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, 5th Edition

V Semester

L	T	P	C
4	-	1	5

BBO009B: 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*

BBO010B: Gymnosperm, Angiosperm and PaleoBotany Practical Lab

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*

Solavaceae – *Datura*, *Withania*

Apocyneceae – *Vinca rosea*, *Thevetia*

Asclepeideaceae – *Calotropis*

Euphorbiaceae – *Euphorbia*, *Ricinus*

Liliaceae – *Onion*, *Asphodelus*

Poaceae – *Triticum*

Esteraceae – *Heliathus*, *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. IInd 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

L	T	P	C
4	-	1	5

BBO012B: 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.

BBO 013B: Environment Management and Economic Botany Practical Lab 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 centre 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 emphasize 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.

Semester-I

BBO 001B	Cell Biology and Thallophytes	4-0-1 [5]
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Objective

- To learn about the basic concept of cell theory and cell types
- To understand fundamental concepts of Cell Biology.
- To understand the Classification, evolution, Life cycle and economic importance of Fungal members.
- To understand the Classification, evolution, Life cycle and economic importance of Algal members.

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, role and function.
Unit -IV	Algae- General characteristics; Ecology and distribution, Range of thallus organization and reproduction; Basic criteria used in classification (Fritsch, and Smith), <i>Spirulina</i> cultivation (SCP) Important classes in relation to applied Phycology listed below Cyanophyceae- <i>Nostoc</i> Chlorophyceae- <i>Volvox</i> , <i>Chara</i> Xanthophyceae – <i>Vaucheria</i> Phaeophyceae- <i>Ectocarpus</i> Rhodophyceae – <i>Polysiphonia</i>
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 <i>Sclerospora</i> , <i>Aspergillus</i> , <i>Claviceps</i> , <i>Ustilago</i> and <i>Alternaria</i> .

Course Outcome (CO):

At the end of this course students will have:

CO1: An Understanding of cell theory, cell type's prokaryotes & eukaryotes.

CO2: To understand the structure, function and models of cell membrane and cell wall.

CO3: An ability, structure, function and importance of Nucleus, DNA structure function and its replication and Role of mitosis and meiosis in living organisms.

CO4: An ability to understand the origin, structure and development of double membrane and single membraned cell organelles.

CO5: An ability to understand the basic criteria used in classification, General Characteristics, Ecology, distribution, Range of thallus organization and reproduction in different classes of algal members.

CO6: An ability to understand the basic criteria used in classification, General Characteristics, thallus organization and reproduction in different classes of Fungal members

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Programme Outcome						Programme Specific Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	
CO1	H	L	M	M	M	M	L				M			
CO2	H	L	M	M	M	M	M				M			
CO3	H	M	M	M	M	M	M				M			
CO4	H	M	M	M	M	M	M							
CO5	H	H	M	H	H	H	M			M	H			
CO6	H	H	M	H	H	H	M			M	H			

H = Highly Related; M = Medium L = Low

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, 2nd 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., New York 1988.
10. Singh V., Pande P.C. and Jain D.K. A Text Book 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.

BBO002B: Cell Biology and Thallophyta Practical Lab

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.

Semester-II

BBO 003B	Bryophyta, Pteridophyta and Lichens	4-0-1 [5]
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Objective

- To learn about general characteristic features, origin, life cycle and classification of Bryophyta.
- To understand fundamental concepts of Pteridophyta, classification, life cycle and evolutionary details with the help of representative members of Pteridophytes.
- To understand the distribution, classification and reproduction of lichens and Mycorrhiza.

Unit-I	Bryophyta: general characters, origin, affinities and classification & Economic Importance of Bryophyta. Life cycle of <i>Marchantia</i> ., <i>Anthoceros</i> , <i>Sphagnum</i> & <i>Funaria</i>
Unit-II	General character of pteridophyta, classification by Smith and Sporne, Stelar system in pteridophyta, Alteration of generation. Distribution, Structure and life history of <i>Rhynia</i> and <i>Psilotum</i> .
Unit -III	Distribution, Structure and life history of <i>Lycopodium</i> and <i>Equisetum</i>

Unit-IV	Distribution, Structure and life history of <i>Selaginella</i> and <i>Marsilea</i> .
Unit-V	Lichens- distribution, nature of association of phycobiont and mycobiont, classification of lichens, structure reproduction & economic importance. Mycorrhiza – General account and its significance

Course Outcome (CO):

At the end of this course students will have:

CO1: An Understanding of general characters, origin and classification of Bryophytes.

CO2: Ability to understand the life cycle of some primitive and advanced members of bryophyte.

CO3: An Understanding of general characters, origin, classification and stelar system of pteridophytes.

CO4: Ability to understand the distribution, structure life history of some primitive and advanced members of pteridophyte.

CO5: An understanding of distribution nature of association and classification of lichens and understanding of General characteristics of Mycorrhizae.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Programme Outcome						Programme Specific Outcome						
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	H	M	M	H	M	H	HR	H R			M		
CO2	H	M	M	H	M	H	HR				HR		M
CO3	H	M	M	H	M	H	HR			M	HR		
CO4	H	M	M	H	M	H	HR				M		M
CO5	M	M	M	M		H	M		M				L

H = Highly Related; M = Medium L = Low

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

BBO 004B: Bryophyta, Pteridophyta and Lichen Practical Lab

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.

Semester-III

BBO 005B	Genetics and Plant Breeding	4-0-1 [5]
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Objective

- To understand the general terminologies and laws of Genetics.
- To understand Cytoplasmic Inheritance & Multiple Allelism, Sex determination and Sex Linked inheritance in human, Drosophila and plants.
- To learn mechanism and role of Linkage and Crossing over, polyploidy.
- An understanding of Conventional and Non conventional mode of Plant Breeding, concept of rDNA Technology and Plant tissue culture

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

Course Outcome (CO):

At the end of this course students will have:

CO1: An Understanding of general terminologies and laws of Genetics.

CO2: Ability to understand Cytoplasmic Inheritance & Multiple Allelism.

CO3: Ability to understand the Sex determination and Sex Linked inheritance in human, Drosophila and plants.

CO4: An understanding of Linkage and Crossing over, polyploidy.

CO5: An understanding of Numerical and Structural changes in chromosome and their role in plant breeding.

CO6: An understanding of Conventional and Non conventional mode of Plant Breeding.

CO7: An understanding of concept of rDNA Technology and Plant tissue culture

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Programme Outcome						Programme Specific Outcome						
	PO 1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	HR	HR	HR	HR	M		HR	M	M		HR	M	M
CO2	HR	HR	HR	HR	M	M	HR	HR		HR		M	
CO3	HR	HR	HR	HR	HR	L	HR	HR			HR	M	

CO4	M		HR	HR	HR	L	HR	HR		HR	HR	HR	
CO5		HR	HR		HR	L	HR	M					
CO6	M	HR		HR	M	M	HR	M					
CO7	HR	M	HR		M	HR	HR						

H = Highly Related; M = Medium L = Low

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 Breeding 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

BBO006B: Genetics and Plant Breeding Practical Lab

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.

Semester-IV

BBO 007B	Morphology, Anatomy and Plant Physiology	4-0-1 [5]
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Objective

- To learn about types of tissues and their organization in stem root and leaf.
- To understand the concept of stelar evolution and basic body plan, modular type of growth in Seed bearing plants.
- To understand fundamental concepts of shoot and root system and theories related to them.
- To understand the morphology, anatomy & embryology of seeds and vegetative propagation methods in seed bearing plants.
- To learn about and understanding the physiology of plant water relationship.
- Understanding the physiology of Mineral Nutrition in plants.
- Understanding the role of growth regulators and light in plants.
- Understanding the physiology of Photosynthesis in plants.

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 update. 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.

Course Outcome (CO):

At the end of this course students will have:

CO1: An Understanding of Plant tissue system and their organization in plants.

CO2: Ability to understand the modular and basic body plan of plants.

CO3: An Understanding of morphology, anatomy and embryology of root, shoot and seeds of mono and dicot plants.

CO4: Ability to understand the mechanism and physiology of water relations and mineral nutrition in higher plants.

CO5: An understanding of role of physical factors and light in plant growth.

CO6: An understanding of mode of action of growth regulators in plants.

CO7: Able to understand the mechanism of Photosynthesis in plants.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Programme Outcome						Programme Specific Outcome						
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	M	HR		HR	HR	HR		M	M				M
CO2	HR	HR	HR	HR	HR	HR		M					
CO3	HR	HR	HR	HR	HR	HR		M			M		
CO4	HR	HR	HR	HR	HR	HR				M			
CO5	HR	HR	HR	HR	HR	HR			M				

CO6	HR	HR	HR	HR	HR	HR				M	M		
CO7	HR	HR	HR	HR	HR	HR			M		M	HR	HR

H = Highly Related; M = Medium L = Low

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 2nd 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, 5th Edition

BBO008B: Morphology, Anatomy and Plant Physiology Practical Lab

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.

Semester-V

BBO 009B	Gymnosperm, Angiosperm and Paleobotany	4-0-1 [5]
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Objective

- To learn about classification and characteristic features of gymnosperms.
- To understand the distribution, morphology, reproduction and life cycle of important representative members of Gymnosperm.
- To understand the origin, evolution and examples of primitive Angiosperm.
- To learn about the principles of taxonomy, classification and binomial system of nomenclature.
- Understanding the identification criteria of important angiospermic families in the surroundings.
- Understanding the detail of paleobotany including fossil types, formation of fossils, and applied aspect of paleobotany and important members of fossil plants.

Unit-I	Classification and characteristic features of different groups of Gymnosperm. Distribution, morphology, vegetative and reproductive parts, anatomy and life cycle of <i>Cycas</i> .
Unit-II	Distribution, Morphology of vegetative and reproductive parts, anatomy, reproduction and life cycle of <i>Pinus</i> and <i>Ephedra</i> , 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 – <i>Lepidodendron</i> , <i>Calamites</i> Fossil Gymnosperms – <i>Williamsonia</i>

Course Outcome (CO):

At the end of this course students will have:

CO1: An Understanding of general characters and classification of Gymnosperms.

CO2: To understand the distribution, morphology, reproduction and life cycle of important representative members of Gymnosperm.

CO3: Ability to understand the evolution of Angiosperm.

CO4: An understanding of principles of taxonomy, classification and binomial system of nomenclature

CO5: Able to identify and recognize the **important** angiospermic families in the surroundings

CO6: Able to understand the branch of paleobotany and important representative members of Paleobotany.

Course Outcome	Programme Outcome						Programme Specific Outcome						
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	M	HR	HR	HR	HR	HR		HR	HR	HR			HR
CO2	HR	HR	HR	HR	HR	HR				HR	HR		
CO3	HR	HR	HR	HR		HR		HR	HR	HR		HR	HR
CO4	HR		HR		M								
CO5	HR	HR		HR		HR	HR	HR	HR	HR	HR	HR	
CO6	HR	HR	HR	M		M	HR	HR	HR	HR	HR		

H = Highly Related; M = Medium L = Low

Text Books:

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

BBO010B: Gymnosperm, Angiosperm and PaleoBotany Practical Lab

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*
 - Solavaceae – *Datura, Withania*
 - Apocynaceae – *Vinca rosea, Thevetia*
 - Asclepeideaceae – *Calotropis*
 - Euphorbiaceae – *Euphorbia, Ricinus*
 - Liliaceae – *Onion, Asphodelus*
 - Poaceae – *Triticum*
 - Esteraceae – *Heliahthus, 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)

Semester-VI

BBO 012A	Environmental Management and Economic Botany	4-0-1 [5]
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Objective

- To learn about basic concept of ecology and interrelationship of living and nonliving components of the environment.
- To understand the concept of ecosystem, Biosphere and biomes of the world.
- To understand fundamental concepts of biogeochemical cycles, population and community ecology.
- To understand the Biodiversity and conservation strategies for wild life management. Plants.
- To learn about and understanding of economic importance of cultivated plants for food, oils, beverages and fibres.
- Understanding the importance of Medicinal plants of Rajasthan.
- Understanding the wood, rubber and sugar yielding plants for the human welfare.

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.

Course Outcome (CO):

At the end of this course students will have:

CO1: Able to understand the meaning of Ecology, Community and Ecosystem as well and their **role** for the existence of living world.

CO2: Ability to understand the concept of ecosystem, Biosphere and biomes of the world.

CO3: An Understanding of biogeochemical cycle and their significance.

CO4: Ability to understand the factors affecting population and community ecology and their interrelationship to the society.

CO5: An understanding of strategies and importance of wild life protection by humans and their need for the survival of living beings.

CO6: An understanding of economically important plants for food, oils, fibres, medicines and beverages etc.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Programme Outcome						Programme Specific Outcome						
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	HR	HR	HR	HR	HR	HR	HR		HR			HR	HR
CO2	HR	HR	HR	HR	HR	HR	HR		HR				M
CO3	HR	HR	HR	HR	HR	HR	HR			HR	M	M	
CO4	HR	HR	HR	M	HR	HR	HR	HR	HR	HR	HR	HR	
CO5	HR	HR	HR	HR	HR	HR	HR		HR	HR			
CO6	HR	HR	HR	HR	HR	M	H		HR	HR			

H = Highly Related; M = Medium L = Low

Text 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.

BBO 013B: Environment Management and Economic Botany Practical Lab

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 centre of origin of cultivated plants proposed by Pavlov.
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 fibre 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 emphasize on medicinal plants cultivated in Rajasthan (senna, isabgol, safed musli).
14. Visit to any herbal garden in near vicinity.