

## Microbial Diversity and Technology

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
4	56	2	56
Content of Theory Course 1			56 Hrs
Unit –1			15
<p><b>Chapter No. 1: Microbial diversity</b>-Introduction to microbial diversity; Methods of estimation; Hierarchical organization and positions of microbes in the living world. Whittaker’s five-kingdom system and Carl Richard Woese’s three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature</p>			5
<p><b>Chapter No. 2 History and developments of microbiology</b>-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and M W Beijerinck and Paul Ehrlich)</p>			5
<p><b>Chapter No. 3 Microscopy</b>-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram’s and differential staining.</p>			5

<b>Unit – 2</b>	15
<b>Chapter No. 4. Culture media for Microbes-</b> Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.	5
<b>Chapter No. 5. Sterilization methods</b> -Principle of disinfection, antiseptic, tyndallisation and Pasteurization, <b>Sterilization</b> -Sterilization by dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods of sterilization- phenolic compounds, anionic and cationic detergents.	5
<b>Chapter No. 6. Microbial Growth</b> -Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.	5
<b>Unit – 3</b>	11
<b>Chapter No. 7 Microbial cultures and preservation</b> -Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.	5
<b>Chapter No. 8. Viruses-</b> General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.	4
<b>Chapter No. 9. Viroids-</b> general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses.	2

<b>Unit – 4</b>	15
<p><b>Chapter No. 10. Bacteria-</b> General characteristics and classification. Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of <i>Rhizobium</i> and its applications. A brief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas- General characteristics and diseases. Economic importance of Bacteria.</p>	5
<p><b>Chapter No. 11. Fungi-</b>General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Neurospora</i>, <i>Puccinia</i>, <i>Penicillium</i> and <i>Trichoderma</i>. Economic importance of Fungi.</p>	6
<p><b>Chapter No. 12. Lichens</b> – Structure and reproduction. <b>VAM Fungi</b> and their significance. <b>Plant diseases-</b>Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker, Root Knot Disease of Mulberry.</p>	4

#### **Text Books**

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.

## References

1. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., NewDelhi.
2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4<sup>th</sup> ed. Eaglewood Cliffts. N.J.Prentice- Hall. New Delhi.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge UniversityPress. Cambridge.
5. Jayaraman J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
6. Ketchum PA. 1988. Microbiology, concepts and applications. John Wiley and Sons. New York.
7. Michel J, Pelczar Jr.EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, NewDelhi.
8. Powar CB and Daginawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house,Bombay.
9. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
10. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co.Pvt.Ltd. New Delhi.
11. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
12. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5<sup>th</sup> edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
13. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, NewDelhi.

**FSA483**

**I B.Sc., I- Semester**

**MICROBIAL DIVERSITY AND TECHNOLOGY**

**PRACTICALS**

**Lectures: 56 Hours**

**(4 Hours/week)**

**Practical 1:** Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, LAF, Colony counter, Haemo cytometer, Micrometer etc.).

**Practical 2:** Enumeration of soil/food /seed microorganisms by serial dilution technique.

**Practical 3:** Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of *E coli* / *B. subtilis*/ Fungi and study of cultural characteristics.

**Practical 4:** Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.

**Practical 5:** Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

**Practical 6:** Isolation and study of morphology of *Rhizobium* from root nodules of legumes

**Practical 7:** Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

**Practical 8:** Study of vegetative structures and reproductive structures - *Albugo*, *Phytophthora*, *Rhizopus*, *Saccharomyces*, *Puccinia*, *Agaricus*, *Lycoperdon*, *Penicillium*, (Depending on local availability)

**Practical 9:** Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

**Practical 10:** Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

**Practical 11:** Study of well-known microbiologists and their contributions through charts and photographs (As mentioned in theory).

**Practical-12:** Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

(**Note:** Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

**FSA483**

**SCHEME OF PRACTICAL QUESTION PAPER  
I SEMESTER  
MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time: 3 Hours**

**Max Marks- 25**

**I. Write critical notes on A, B & C**

**3X2=6 Marks**

A and B- Microbial Instruments (As mentioned in the syllabus)

C- Microbiologists (As mentioned in the Syllabus)

(Identification- 1 mark, Application/Contribution- 1Mark)

**II. Bacterial staining D -Simple / Gram's staining**

**5 Marks**

(Preparation- 3 Marks Flow chart- 2 Marks)

**III. Prepare a temporary stained slide ' E ' of the given material and leave the preparation for evaluation.**

**5 Marks**

(*Rhizobium, Rhizopus, Saccharomyces, Penicillium*)

(Identification- 1 Mark, Mounting- 2 Marks, Diagram with reasons- 2 Marks)

**IV. Identify the Specimens F & G**

**2X3=6 Marks**

(F- Albugo, Phytophthora, Agaricus, Lycoperdon)

(G - Plant Diseases (As Mentioned in the Syllabus)

( Identification with Diagram - 2 Marks, Reason – 1Mark)

**V. Identify the Permanent Slide H**

**3 Marks**

(Fungi/Pathology)

(Identification & Diagram- 2 Marks, reasons- 1 Marks)

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**FSA483**

**I SEMESTER  
PRACTICAL QUESTION PAPER  
MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time:** 3 Hours

**Max Marks-** 25

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|-------------|--|--------------------|
| <b>I.</b>   | Write critical notes on <b>A, B &amp; C</b>  | <b>6 Marks</b>     |
| <b>II.</b>  | Bacterial staining <b>D</b> -Simple / Gram's staining  | <b>5 Marks</b>     |
| <b>III.</b> | Prepare a temporary stained slide <b>E</b> of the given material and leave the preparation for evaluation. | <b>5 Marks</b>     |
| <b>IV.</b>  | Identify the Specimens <b>F &amp; G</b>  | <b>2X3=6 Marks</b> |
| <b>V.</b>   | Identify the Permanent Slide <b>H</b>  | <b>3 Marks</b>     |

**NOTE:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

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**FSA480**

**SCHEME OF BOTANY THEORY EXAMINATION  
I SEMESTER  
MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSA480**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**I SEMESTER**

**MICROBIAL DIVERSITY AND TECHNOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X1=05	8X2=16	23
III	2X2=4	5X1=05	8X1=08	17
IV	2X1=2	5X2=10	8X2=16	28
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**Semester I**  
**PLANTS AND HUMAN WELFARE**

**Course Outcome:**

On completion of this course, the students will be able to

1. To make the students familiar with economic importance of diverse plants that offer resources to human life.
2. To make the students known about the plants used as-food, medicinal value and also plant source of different economic value.
3. To generate interest amongst the students on plants importance in day today life, conservation, ecosystem and sustainability.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	0
<b>Content of Theory Course</b>			
<b>Unit I</b>			13
<p>Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation.</p> <p><b>Cereals:</b> Wheat and Rice (origin, evolution, morphology, post-harvest processing &amp; uses). Green revolution. Brief account of millets and their nutritional importance.</p> <p><b>Legumes:</b> General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem.</p>			
<b>Unit II</b>			13
<p><b>Cash crops:</b> Morphology, new varieties and processing of sugarcane, products and by- products of sugarcane industry. Natural Rubber –cultivation, tapping and processing.</p> <p><b>Spices:</b> Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom.</p> <p><b>Fruits:</b> Mango, grapes and Citrus (Origin, morphology, cultivation ,processing and uses)</p> <p><b>Beverages:</b> Tea, Coffee (morphology, processing&amp;uses)</p>			
<b>Unit III</b>			13
<p><b>Oils and fats:</b> General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family &amp; uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications.</p>			

<p><b>Essential Oils:</b> General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents.</p> <p><b>Drug-yielding plants:</b> Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera and Cannabis.</p> <p><b>Fibers:</b> Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).</p>	
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### **Text Books and References**

1. Kochhar, S.L. (2012). Economic Botany in Tropics. MacMillan & Co. New Delhi.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers. Netherland.
3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers. Lincoln, United Kingdom

## B.Sc. BOTANY: Open Elective Course (OE-1.2)

### Semester I BOTANY FOR THE BEGINNERS

#### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with importance of Botany: plants as natural resources.
2. To make the students known about the plants used as-food, medicinal value and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of plants in day today life, ecosystem restoration.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory</b>			
<b>UNIT I: Living World</b>			<b>13 hrs.</b>
Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio- diversity and conservation.  Concept of Living and Non Living: Viruses, Bacteria, Fungi, Plants and Animals; Five kingdom Classification- Classification of plants- Eichler's system – general characters of groups- An introduction to the Life cycle of plants. Cell Structure-Prokaryote and eukaryote			
<b>UNIT II: Morphology of Angiosperms, Origin and Evolution of Life</b>			<b>13 hrs</b>
Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non essential whorls.  Definition, Ancient Concepts and Modern Concepts. Origin of Life – Geological Time scale – Variation in Hydrosphere, Lithosphere, Atmosphere and Biosphere from Pre Cambrian to Coenozoic era. Darwin's Natural Selection theory and Modern evidences at molecular and organismic level in support of Darwin's theory			
<b>UNIT III: Interaction between plants and animals</b>			<b>13 hrs</b>
General concept on Interaction between plants, microbes and animals. Ecological Significance of Plants – Solar energy fixing Producers, Nitrogen fixation, biofertilisers, biopesticides, Symbiotic relationships-Mutualism, Commensalism, Proto-operation, Parasitism.			

Plants and Animals for pollination and seed/fruit dispersal- Pollination- Entomophily, Chiropterophily, Myrmecophily Seed Dispersal: Zoochory, Specific case studies on examples for co evolution- Dodo and Calvaria, Butterflies and plants; Wasps and Ficus, mimicking for pollinators. Medicinal uses of plants – traditional knowledge and scientific knowledge – a brief account	
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### **Text Books and References**

1. Agarwal, S. K. (2009), Foundation Course in Biology, Ane Books Pvt. Ltd., New Delhi.
2. Datta, A C Class Book of Botany. New Delhi.
3. Mamatha Rao, Microbes and Non flowering plants-impacts and applications, Ane Books, Pvt Ltd, New Delhi.
4. Pandey, B. P. 2001.College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.
5. Prithipal Singh (2007), An introduction to Biodiversity. Ane Books India, New Delhi
6. Raven, P.H; Johnson, G.B; Losos, J.B; Singer, S.R (2005), Biology, seventh edition, Tata McGraw Hill, New Delhi
7. Robert A Wallace. Biology: The world of life. Harper Collins Publishers

## B.Sc. BOTANY: Open Elective Course (OE-1.3)

### Semester I

#### MUSHROOM CULTIVATION

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with mushroom cultivation for commercial exploitation.
2. To make the students known about the *Agaricus* (mushroom) used as-food, medicine and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of mushroom in day today life.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory Course OE 1.3: MUSHROOM CULTIVATION</b>			<b>39 hrs</b>
<b>UNIT-I . Mycology and Mushroom Biology</b>			<b>13 hrs.</b>
Five kingdom classification of organisms. Kingdom fungi. General characters of form, function, reproduction and relationship with other organisms. Importance of fungi in human welfare. Morphology (range of form, macro-morphology, micro-morphology), life cycle of a typical mushroom and biological function. Edible, non-edible and poisonous species. Domestication of mushroom. Importance of mushroom in human nutrition, sustainable livelihood, ecosystem function and quality of the environment.			
<b>UNIT II. Applied Mushroom Biology</b>			<b>13 hrs</b>
Mushroom cultivation and production. Lab scale, pilot plant and large scale cultivation of commercial species. Crop cycle- spawn, substrate, substrate processing, spawning, spawn run, cropping, harvesting, environment requirement, post harvest practices, shelf life, preservation, storage, transport and marketing. Value-added products of mushroom. Constraints and environment management. Economics of mushroom cultivation. Designs of mushroom facility. Economics of mushroom cultivation and marketing.			
<b>UNIT IV. Mushroom Biotechnology.</b>			<b>13 hrs</b>
Concept. Preparation of flavours, appetizers, nutraceuticals, dietary supplements and cosmetics. Mushroom bioremediation. Cleaning of polluted sites. Utilization of mushroom mycelium or enzymes in recycling biological materials. Mycofiltration and applications of the process. Mycorrhiza applications. Biopulping, biobleaching and biotransformations. Biodetergents.			

**References.**

1. Harandar Singh 1991. Mushrooms: the art of Cultivation. Sterling Publishers.
2. Kaul, T.N.2001. Biology and conservation of Mushrooms. Oxford and IBH Publishing Company. New Delhi.
3. Tripathi, M. Mushroom Cultivation. Oxford and IBH Publishing Company. New Delhi.
4. Suman B.C. and Sharma V P.2007. Mushroom Cultivation in India. Eastern Book Corporation. New Delhi.
5. Singh R. and U.C.Singh 2005. Modern Mushroom Cultivation. Agrobios. New Delhi.

**Pedagogy:**

**Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission etc**



**FSA940**

**OPEN ELECTIVE  
SCHEME OF BOTANY THEORY EXAMINATION  
I SEMESTER  
PLANTS AND HUMAN WELFARE  
MODEL QUESTION PAPER**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSA940**

**OPEN ELECTIVE  
BLUE PRINT OF BOTANY THEORY EXAMINATION  
I SEMESTER  
PLANTS AND HUMAN WELFARE**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
<b>I</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>II</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>III</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## DSC-2 Diversity of Non- Flowering Plants

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours/semester
4	56	2	56
Content of Theory Course 2			56Hrs
Unit –1			15
<p><b>Chapter No. 1</b> Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae.</p>			5
<p><b>Chapter No. 2</b> Morphology and reproduction and life-cycles of <i>Nostoc</i>, <i>Oedogonium</i>, <i>Chara</i>, <i>Sargassum</i> and <i>Batrachospermum</i>. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins.</p>			5
<p><b>Chapter No. 3</b> Algal cultivation- Cultivation of microalgae-<i>Spirulina</i> and <i>Dunaliella</i>; Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses.</p>			5

<b>Unit – 2</b>	15
<b>Chapter No. 4.</b> Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes.	5
<b>Chapter No. 5</b> Distribution, morphology, anatomy, reproduction and life-cycles of <i>Riccia</i> , <i>Anthoceros</i> , and <i>Funaria</i> . Ecological and economic importance of Bryophytes. Fossil Bryophytes.	5
<b>Chapter No. 6. . Pteridophytes-</b> General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in <i>Selaginella</i> , <i>Equisetum</i> , <i>Pteris</i> and <i>Salvinia</i> .	5
<b>Unit – 3</b>	15
<b>Chapter No. 7</b> A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.	5
<b>Chapter No. 8. Gymnosperms-</b> General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> .	5
<b>Chapter No. 9.</b> Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines.	5

<b>Unit – 4</b>	11
<b>Chapter No. 10. Origin and evolution of Plants:</b> Origin and evolution of plants through Geological Time scale.	2
<b>Chapter No. 11. Paleobotany-</b> Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating.	5
<b>Chapter No. 12.</b> Fossil taxa- <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Lyginopteris</i> and <i>Cycadeoidea</i> . Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences.	4

### **Text Books**

- 1) Chopra, G.L. A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
- 2) Johri, Lata and Tyagi, 2012, A Text Book of, Vedam e Books, New Delhi.
- 3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
- 4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
- 5) Sharma, O.P., 2017, Algae Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut.

### **References**

1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsevier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.

5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co. New Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge. Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar ( 1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge University Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allahabad.
14. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad. Press, Cambridge.
15. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. Cryptogamic Botny. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.
18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
20. Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
21. Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge University Press, Cambridge.
22. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

**FSB483**

**I B.Sc., II- Semester**

**DSC-2 Diversity of Non- Flowering Plants**

**PRACTICALS**

**Lectures: 56 Hours**

**(4 Hours/week)**

**Practical-1:** Study of morphology, classification, reproduction and lifecycle of

*Nostoc.*

**Practical-2:** Study of morphology, classification, reproduction and life-cycle of

*Oedogonium & Chara, Sargassum, Batrachospermum/ Polysiphonia.*

**Practical-3:** Study of morphology, classification, reproduction and life-cycle of

*Riccia/Marchantia & Anthoceros.*

**Practical-4:** Study of morphology, classification, anatomy, reproduction and life-cycle of

*Selaginella and Equisetum.*

**Practical -5:** Study of morphology, classification, anatomy, reproduction and life-cycle of

*Pteris, Azolla..*

**Practical -6:** Study of morphology, classification, anatomy and reproduction

in *Cycas.*

**Practical -7:** Study of morphology, classification & anatomy, reproduction in

*Pinus.*

**Practical -8:** Study of morphology, classification & anatomy, reproduction in

*Gnetum.*

**Practical -9:** Study of important blue green algae causing water blooms in

the lakes.

**Practical -10:** Study of different methods of cultivation of ferns in a nursery.

**Practical -11:** Preparation of natural media and cultivation of *Azolla* in artificial ponds.

**Practical -12:** Media preparation and cultivation of *Spirulina*.

**Practical -13:** Study different algal products and fossils impressions and slides/Photographs.

**Practical-14:** Visit to algal cultivation units/lakes with algal blooms/Fern house/  
Nurseries/Geology museum/lab to study plant fossils.

(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)



**FSB483**

**II SEMESTER**

**SCHEME OF PRACTICAL QUESTION PAPER  
DIVERSITY OF NON- FLOWERING PLANTS**

**Time:** 3 Hours

**Max Marks-** 25

**I. Prepare a temporary stained slide of the given material A and leave the preparation for evaluation** **5 Marks**

Algae (Nostoc, Oedogonium, Chara, Batrachospermum / Polysiphonia )

(Preparation - 2 Mark, Diagram-1 Marks, Identification with Reasons- 2 Marks)

**II. Identify the given specimens B & C** **2X3=6 Marks**

**B-** Bryophytes (Marchantia and Anthoceros)

**C-** Pteridophytes (Selaginella, Equisetum, Pteris , Azolla,)

(Identification- 1 Mark, Diagram with reasons- 2 Marks)

**III. Identify the Permanent Slides D, E, F & G** **4X2=8 Marks**

(One each from Algae, Bryophyte, Pteridophyte and Gymnosperms)

(Identification- 1 Mark, Diagram with Reasons-1 Marks)

**IV. Comment on H & I** **2X3=6 Marks**

H- Gymnosperm

I – Fossils

(Identification- 1 Mark, Diagram with Reasons- 2 Marks)

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**FSB483**

**II SEMESTER**

**PRACTICAL QUESTION PAPER  
DIVERSITY OF NON- FLOWERING PLANTS**

**Time:** 3 Hours

**Max Marks-** 25

**I.** Prepare a temporary stained slide of the given material **A** and leave the preparation for evaluation

**5 Marks**

**II.** Identify the given specimens **B & C**

**2X3=6 Marks**

**III.** Identify the Permanent Slides **D, E, F & G**

**4X2=8 Marks**

**IV.** Comment on **H & I**

**2X3=6 Marks**

**NOTE: Duly valued, certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.**

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**FSB480**

**SCHEME OF BOTANY THEORY EXAMINATION**

**II SEMESTER  
MODEL QUESTION PAPER  
DIVERSITY OF NON FLOWERING PLANTS**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSB480**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**II SEMESTER**

**DIVERSITY OF NON FLOWERING PLANTS**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X2=10	8X2=16	28
III	2X1=2	5X1=05	8X2=16	23
IV	2X2=4	5X1=05	8X1=08	17
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**FSB940**

**Open Elective Cours (OE-2.1)**

**I B.Sc., Semester II**

**PLANT PROPAGATION, NURSERY MANAGEMENT AND GARDENING**

**Paper Outcome:**

On completion of this course, the students will be able to

1. To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
2. To get knowledge of new and modern techniques of plant propagation.
3. To develop interest in nature and plant life.

<b>Number of Theory Credits</b>	<b>Number of lecture hours/semester</b>	<b>Number of practical Credits</b>	<b>Number of practical hours / semester</b>
<b>3</b>	<b>39</b>	<b>0</b>	<b>00</b>
<b>Unit I :Nursery and Vegetative propagation</b>			<b>13</b>
Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery.  Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants .Green house, mist chamber, shed root, shade house and glass house.			
<b>Unit II :Gardening</b>			<b>13</b>
Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.			
<b>Unit III: Seed, Sowing/raising of seeds and seedlings</b>			<b>13</b>
Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification.  Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, ferns, petunia, orchids etc. Storage and marketing procedures. Developing and maintenance of different types of lawns. Bonsai technique.			

### **Text Books and References**

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. Dept. of Agriculture and Cooperation, National Seed Corporation Ltd. New Delhi.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. Oxford & IBH Publishing Co. New Delhi.
3. Jules, J. (1979). Horticultural Science, 3rd edition. W.H. Freeman and Co. San Francisco, California.
4. Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi Publications. Nagercoil, Tamil Nadu.
5. Musser E., Andres. (2005). Fundamentals of Horticulture. McGraw Hill Book Co. New Delhi
6. Sandhu, M.K. (1989). Plant Propagation. Walle Eastern Ltd. Bangalore.

## Open Elective Course (OE-2.2)

### I B.Sc., Semester II

#### BIO-FUELS

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with Bio-fuel plant species cultivation for commercial exploitation.
2. To make the students known about the Bio-fuel used in automobile industries and solving fuel problems in feature.
3. To generate interest amongst the students to know the importance of Bio-fuel in day today life and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>UNIT-I</b>			<b>10 hrs.</b>
Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels and present status.			
<b>UNIT II</b>			<b>16 hrs</b>
Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass-plant, animal and microbial based waste). Algal biofuel.  Biodiesel species: <i>Pongamia pinnata</i> , <i>Simarouba gluca</i> , <i>Jatropha curcas</i> , <i>Azardirachta india</i> , <i>Madhuca indica</i> and <i>Callophyllum innophyllum</i> . Seed harvesting, processing, oil extraction, and characterization.			
<b>UNIT III</b>			<b>13 hrs</b>
Introduction to biodiesel, bioethanol, biogas and bio hydrogen. Production technology of biofuels (Biodiesel, ehanol and biogas). Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in Karnataka and India. Biofuel production statistics. Fuel against food security concepts.			

### **Text Books and References**

- 1) The Biodiesel Handbook (2005). Jurgen Krahl, Jon Harlan Van Gerpen. AOCS Press.
- 2) Bioenergy and Biofuels (2017). Ozcan Konur. CRC Press, Taylor & Francis's group.
- 3) <https://mnre.gov.in/biofuels>



## Open Elective Course (OE-2.3)

### I B.Sc., Semester II

#### BIOFERTILISERS

##### Course Outcome:

On completion of this course, the students will be able to

1. To make the students familiar with bio-fertilizer plant species cultivation for commercial exploitation.
2. To make the students known about the bio-fertilizer used in agriculture forming and industries and solving problems erupted by synthetic fertilizer.
3. To generate interest amongst the students to know the importance of bio-fertilizer in day today agricultural practices and economic wellbeing.

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
3	39	0	00
<b>Content of Theory Course 2.3: BIOFERTILISERS</b>			<b>39 hrs</b>
<b>UNIT-I. General account, isolation and mass multiplication</b>			<b>13 hrs.</b>
General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. <i>Azospirillum</i> : isolation and mass multiplication – carrier based inoculants, associative effect of different microorganisms. <i>Azotobacter</i> : classification, characteristics – crop response to <i>Azotobacter</i> inoculum, maintenance and mass multiplication			
<b>UNIT II. Association of Cyanobacteria and Fungi</b>			<b>13hrs</b>
Cyanobacteria (blue green algae), <i>Azolla</i> and <i>Anabaena Azollae</i> association, nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation  Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM –its influence on growth and yield of crop plants			
<b>UNIT III. Applications of Cyanobacteria and Fungi</b>			<b>13 hrs</b>
Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – bio-compost making methods, types and method of vermin-composting – field Application.			

## **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. New Delhi.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad

**FSB940**

**OPEN ELECTIVE  
SCHEME OF BOTANY THEORY EXAMINATION  
II SEMESTER  
MODEL QUESTION PAPER  
PLANT PROPAGATION, NURSERY MANAGEMENT AND  
GARDENING**

**Time:** 2.5 Hours

**Max Marks-** 60

**Instructions:** Draw neat labelled diagrams wherever necessary

**I. Define/Explain any Four of the following**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSB940**

**OPEN ELECTIVE  
BLUE PRINT OF BOTANY THEORY EXAMINATION  
II SEMESTER  
PLANT PROPAGATION, NURSERY MANAGEMENT  
AND GARDENING**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Weightage of Marks</b>				
<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Mks.</b>
<b>I</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>II</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
<b>III</b>	<b>2X2=4</b>	<b>5X2=10</b>	<b>8X2=16</b>	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## II B.Sc. III-Semester- DSCC

## PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Number of Theory Credits	Number of lecture hours/semester	Number of practical Credits	Number of practical hours / semester
04	56 hours	02	56 hours
Unit	PLANT ANATOMY		Teaching hours
I	ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES		14
	<p>Introduction, objective and scope of Plant Anatomy, Plant cell structure- nature of plant cell wall.</p> <p><i>Tissue and tissue systems</i> - meristematic tissue, permanent tissue and secretory cells.</p> <p><b>Classification of meristem:</b> (apical, intercalary and lateral), primary and secondary meristem.</p> <p><i>Apical meristem:</i> Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, Histogen theory and Korper-Kappe theory).</p> <p>Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.</p>		
II	ANGIOSPERM ANATOMY		14
	<p><b>Structure of Dicot root:</b> primary structure and secondary growth (Sunflower), Structure of monocot root (Maize).</p> <p><b>Structure of Dicot stem:</b> Primary structure and secondary growth (Helianthus annuus), Structure of Monocot stem (Zea mays).</p> <p><b>Structure of Dicot leaf:</b> Primary structure (Helianthus annuus), primary structure of Monocot leaf (Zea mays), Stomatal types.</p> <p><b>Anomalous secondary growth:</b> Boerhaavia (dicot stem) Dracaena (monocot stem) Applications in Systematics, and Pharmacognosy. Forensicbotany.</p>		

<b>III</b>	<b>DEVELOPMENTAL BIOLOGY</b> <b>MORPHOGENESIS AND DIFFERENTIATION</b>	<b>14</b>
	<p><b>Morphogenesis in plants -</b> Differentiation and cell polarity in acellular (Dictyostelium), Unicellular (Acetabularia) and multicellular system (root hair and stomata formation)</p> <p><b>Organogenesis:</b> Differentiation of root, stem, leaf and axillary bud. Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves) Root cap, quiescent centre and origin of lateral roots. Transition from vegetative apex into reproductive Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence - a general account.</p>	
<b>IV</b>	<b>REPRODUCTIVE BIOLOGY</b>	<b>20</b>
	<p>Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, B.M Johri, M.S. Swaminathan and K.C. Mehta.</p> <p><b>Microsporangium:</b> Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue.</p> <p><b>Microsporogenesis-</b> Microspore mother cells, microspore tetrads, Pollinia.</p> <p><b>Microgametogenesis-</b> Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon).</p> <p><b>Megasporangium -</b> Structure of typical Angiosperm ovule. Types of ovule (Anatropous, Orthotropous, Amphitropous, Hemianatropous, Campylotropous, Circinotropous).</p> <p><b>Megagametogenesis-</b> Types and development of Female gametophyte/embryosac- monosporic- <i>Polygonum</i> type, bisporic - <i>Allium</i> type, tetrasporic - <i>Fritillaria</i> type. Structure of mature embryosac.</p> <p><b>Pollination and Fertilization:</b> Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes.</p> <p><b>Endosperm -</b> Types and its biological importance. Free nuclear (<i>Cocos nucifera</i>) cellular (<i>Cucumis</i>), helobial types. Ruminant endosperm. Study of non-endospermic plants from Podostemaceae, Orchidaceae, Trapaceae.</p> <p><b>Embryogenesis -</b> Structure and development of Dicot (<i>Capsella bursa pastoris</i>) and Monocot (<i>Najas</i>), embryo. Polyembryony, Apomixis and Parthenocarpy.</p>	

### **Text Books for Reference:**

1. Bhojwani and Bhatnagar & Dantu , The Embryology of Angiosperms, 6 Edition 2022-Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms, Woong-Young Soh, Springer Netherlands,
3. Coulter E. G. , 1969. Plant Anatomy - Part I Cells and Tissues - Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
- 10.Karp G., 1985. Cell Biology; Mc.Graw Hill Company
- 11.Maheshwari,P 1950. An introduction to the embryology of angiosperms.  
New York: McGraw-Hill
- 12.Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
- 14.Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
- 15.Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
- 16.Saxena M. R. - Palynology - A treatise - Oxford & I. B .H., New Delhi.
17. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
- 18.Vashishta .P.C .,1984. Plant Anatomy - Pradeep Publications – Jalandhar

**PLANT ANATOMY AND DEVELOPMENT BIOLOGY****Lectures: 56 Hours  
(4 Hours/week)****LIST OF EXPERIMENTS TO BE CONDUCTED****Practical No. 1**

- i) Study of meristems (Permanent slides/ Photographs).
- ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

**Practical No.2, 3 & 4**

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root (Cicer), stem (Tridax) and leaf (Datura/Zinnia) and monocot root (Maize), stem (Grass) and leaf (Grass).

**Practical No.5**

Anomalous secondary growth: *Boerhaavia* (dicot stem) *Dracaena* (monocot stem)

**Practical No. 6**

Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials

**Practical No. 7**

Permanent slides of Microsporogenesis and male gametophyte, Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis

**Practical No. 8**

Pollen germination by hanging drop method

**Practical No. 9**

Permanent slides: T.S of Tricarpellary and pentacarpellary ovary, Matured ovule, Placentation types: Axile, Marginal and Parietal types.

**Practical No. 10**

Mounting of embryo: Tridax /Cyamopsis/Crotolaria, Mounting of endosperm: Cucumis

**Practical No. 11 & 12****Mini project work in groups of 3-5 students, from the following list**

- a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.
- b) Pollen germination of different pollen grains and calculate percentage of germination.
- c) Calculate the percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.
- d) Study of placentation of different flowers.
- e) Any other relevant study related to Anatomy / Embryology



FSC483

SCHEME OF BOTANY PRACTICAL EXAMINATION

III SEMESTER

**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

Time: 3 Hours

Max Marks- 25

- I. Prepare a temporary stained slide of the given material A. Leave the Preparation for evaluation** **5 Marks**  
(Root, Stem, Leaf)  
(Preparation -2 Marks, Identification -1, Diagram with Reasons- 2Marks)
- II. Identify the given slides B, C & D** **3X3=9 Marks**  
(B from Tissues, C from Anatomy, D from Embryology)  
(Identification-1 Mark, Diagram with reasons - 2 Marks)
- III. Mount the material E** **3 Marks**  
(Pollen grain/Stomata/Trichomes)  
(Mounting - 2 Mark, Diagram with Reasons-1 Marks)
- IV. Pollen germination of F by hanging drop method.** **5 Marks**  
(Preparation - 3 Marks, Procedure-2 Marks)
- V. Mount the material of G** **3 Marks**  
(Endosperm / Embryo)

FSC480

**SCHEME OF BOTANY THEORY EXAMINATION**  
**III SEMESTER**  
**MODEL QUESTION PAPER**  
**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

Time: 2.5 Hours

Max Marks- 60

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSC480**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**III SEMESTER**

**PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>UNITS</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks</b>
<b>I</b>	2X1=2	5X2=10	8X1=08	<b>20</b>
<b>II</b>	2X1=2	5X1=5	8X2=16	<b>23</b>
<b>III</b>	2X2=4	5X1=5	8X1=08	<b>17</b>
<b>IV</b>	2X2=4	5X2=10	8X2=16	<b>30</b>
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90</b>

## B.Sc. BOTANY – III Semester

### Open Elective Course (OEC – 3.1)

## Community Forestry

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

### Learning outcomes:

After completion of the course, the students will be able to;

- Understand community forestry and its conservation
- Examine the use of trees and community forestry
- Interpret the role of indigenous / tribal people in conservation of forest
- Examine the role of various community forestry conservation programs
- Measure the different properties of trees such as wood volume, age, height, volume etc.

### Keywords:

Community forestry, Commercial forestry, Conservation Land uses, Timber harvesting

### Unit I

**14 lectures**

Defining community forestry and conservation, Indigenous community-based forestry systems and their changes, Case studies of indigenous forest management systems: India., History of commercial forestry in India, Diseases of commercial forestry, maintenance of forests, Protection from fire, illicit felling, Measurement of Trees- Height, girth, wood density, wood quality, clear and selective felling.

### Unit II

**14 lectures**

Role of community forestry in Environmental conservation, Water shed management, soil management and poverty reduction, Trees as a forest management tool managing vegetation to modify climate, soil conditions & ecological processes, Social considerations on land-uses.

### **Unit III**

**14 lectures**

State-sponsored community forestry and conservation programs, Changing paradigms in forestry and environmental conservation, Community-managed commercial timber harvesting. Community based forestry and collaborative conservation in India, factors contributing to the rise of community forestry, Role of tribes in Forest and management.

### **Suggested Reading**

1. Agrawal, A and C.C. Gibson. (2001). Introduction: The Role of Community in Natural Resource Conservation. In: Agrawal, A and C. C. Gibson (eds).Communities and the Environment. NJ: Rutgers University Press
2. Mosse, D.(2001). 'People's knowledge', participation and patronage: operations and representations in rural development. In: Cook, B & Kothari, U (eds), Participation the newtyranny? Zed Press
3. Ong, C.K. & Huxley, P.K. (1996). Tree Crop Interactions–A Physiological Approach. ICRAF.
4. Robinson, D. (2018). The Economic Theory of Community Forestry (Routledge Explorations in Environmental Economics) Routledge.
5. Sagreiya, K.P. (1979). Forests and Forestry. National Book Trust, India, New Delhi, P1-307.

## B.Sc. BOTANY – III Semester

### Open Elective Course (OEC – 3.2)

## Algal Cultivation and Applications

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.2	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

### Learning outcomes:

#### On completion of this course, the students will be able to;

- Understand core concepts and fundamentals of various levels of algal growth
- Translate various algal technologies for benefit of ecosystem
- Demonstrate algal growth in different types of natural water.
- Analyze emerging areas of Algal Biotechnology for identifying commercial potentials of algal products & their uses.

#### Keywords:

Culture techniques, Algal growth, Algal blooms, Eutrophication, Algal immobilization, Biofertilizers, Pollution indicators

#### Unit I

14 lectures

A brief account of culture techniques and media for algal research. Measurement of algal growth: lag phase, log phase, stationary phase and death phase using biomass, chlorophyll content. Limits to algal growth in natural waters. Dynamics and consequences of marine & freshwater algal blooms;

#### Unit II

14 lectures

Causative factors for eutrophication and its impact on algal blooms. Algal immobilization: methods and applications, Algal technologies for the restoration/maintenance of soil fertility; reclamation of usar soils. Restoration of degraded aquatic systems through algae; High rate algal ponds for the treatment of wastewaters for the production of useful biomass & fuels.

### **Unit III**

**14 lectures**

Emerging areas of Algal Biotechnology: Single cell proteins, bio-fertilizers, Algae as food, medicine, feed, Biofuel, industrial products such as phyco-colloid (Agar-agar, Algin, Carrageenan, Diatomite); A brief account of commercial potentials of algal products & their uses. Algae as indicators of pollution. Biofouling, Sewage disposal. Waste-land reclamation. Use of Algae in experimental studies. Algae in space. Algal toxins.

### **Suggested Readings**

1. Hoek, C. and Van D. (2009) *Algae: An Introduction to Phycology*. Cambridge University Press
2. Bast, F. (2014). An Illustrated Review on Cultivation and Life History of Agronomically Important Seaplants. In *Seaweed: Mineral Composition, Nutritional and Antioxidant Benefits and Agricultural Uses*, Eds. Vitor Hugo Pomin, 39-70. Nova Publishers, New York ISBN:978-1-63117-571-8
3. Kumar, H.D.(1999). *Introductory Phycology*. Affiliated East-West Press, Delhi
4. Sahoo, D. (2000). *Farming the ocean: seaweeds cultivation and utilization*. Aravali International, New Delhi.
5. Bast, F. (2014). Seaweeds: Ancestors of land plants with rich diversity. *Resonance*, 19 (2)1032-1043/ISSN:0971-8044

**B.Sc. BOTANY – III Semester**  
**Open Elective Course (OEC – 3.3)**  
**Landscaping and Gardening**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-3.3	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:****After the completion of this course the learner will be able to:**

- Apply the basic principles and components of gardening
- Conceptualize flower arrangement and bio-aesthetic planning
- Design various types of gardens according to the culture and art of bonsai
- Distinguish between formal, informal and free style gardens
- Establish and maintain special types of gardens for outdoor and indoor land scaping

**Keywords:**

Gardening, Landscaping, Flower arrangement, Vertical gardens, Roof gardens, Computer aided designing

**Unit I****14 lectures**

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features. Green house. Special types of gardens, trees, their design, values in land scaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.

**Unit II****14 lectures**

Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Bio-aesthetic planning, definition, need, round country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.



### **Unit III**

**14 lectures**

Vertical gardens, roof gardens. Culture of bonsai, art of making bonsai. Parks and public gardens. Land scape designs, Styles of garden, formal, informal and freestyle gardens, types of gardens, Urban land scaping, Land scaping for specific situations, institutions, industries, residents, hospitals, road sides, traffic islands, dam sites, IT parks, corporate. Establishment and maintenance, special types of gardens, Bio-aesthetic planning, eco-tourism, indoor gardening, therapeutic gardening, non-plant components, water-scaping, xeri-scaping, hardscaping; Computer Aided Designing (CAD) for outdoor and indoor scaping Exposure to CAD (Computer Aided Designing)

### **Suggested Readings**

1. Berry, F. and Kress, J. (1991). Heliconia: An Identification Guide. Smithsonian Books
2. Butts, E. and Stensson, K. (2012). Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).

**II B.Sc. IV SEMESTER**  
**Ecology and Conservation Biology**

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
<b>04</b>	<b>56</b>	<b>02</b>	<b>56</b>

<b>Contents of Theory Course</b>		
<b>Unit</b>	<b>Topics</b>	<b>Teaching Hours</b>
<b>I</b>	<p><b>Introduction to Ecology and Conservation Biology:</b> Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation.</p> <p><b>Ecological factors:</b> Climatic factors: light, temperature, precipitation and humidity.</p> <p><b>Edaphic factors:</b> Soil and its types, soil texture, soil profile, soil formation; physico-chemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.</p> <p>Topographic Factors: Altitude</p> <p><b>Ecological groups of plants and their adaptations:</b> Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.</p>	15 hrs
<b>II</b>	<p><b>Ecosystem Ecology:</b> Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial.</p> <p>Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.</p> <p>Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem.</p> <p>Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle- Phosphorus.</p> <p>Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere.</p> <p><b>Community Ecology:</b> Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes.</p> <p>Intra-specific and Inter-specific interactions with examples.</p> <p><b>Ecological methods and techniques:</b> Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping.</p> <p><b>Population Ecology:</b> Population and its characteristics – Population density,</p>	15 hrs

	natality, mortality, age distribution, population growth curves and dispersal.	
III	<p><b>Phytogeography and Environmental issues:</b></p> <p>Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov’s concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests and grasslands. An account of the vegetation of the Western Ghats.</p> <p>Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga ,Minimata, Pacific gyre garbage patch, Exxon valdez oil spill.</p> <p>Air pollution: Causes, effect, air quality standards, acid rain, control.</p> <p>Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.</p>	11 hrs
IV	<p><b>Biodiversity and its conservation:</b></p> <p>Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG’s in biodiversity conservation.</p> <p>Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity.</p> <p>Concept of Biodiversity Hotspots, Biodiversity hot spots of India.</p> <p>Concept of endemism and endemic species.</p> <p>ICUN plant categories with special reference to Karnataka/ Western Ghats.</p> <p>Biodiversity Conservation- Indian forest conservation act, Biodiversity bill (2002).</p> <p>Conservation methods – <i>In-situ</i> and <i>ex-situ</i> methods</p> <p><i>In-situ</i> methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves.</p> <p><i>Ex-situ</i> methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.</p>	15 hrs

### SUGGESTED REFERENCE BOOKS:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.

## Ecology and Conservation Biology

### PRACTICALS

Practical No.	LIST OF EXPERIMENTS TO BE CONDUCTED
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc
3	Hydrophytes: Morphological adaptations in <i>Pistia</i> , <i>Eichhornia</i> , <i>Hydrilla</i> , <i>Nymphaea</i> . Anatomical adaptations in <i>Hydrilla</i> (stem) and <i>Nymphaea</i> (petiole).
4	Xerophytes: Morphological adaptations in <i>Asparagus</i> , <i>Casuarina</i> , <i>Acacia</i> , <i>Aloe vera</i> , <i>Euphorbiatirucalli</i> . Anatomical adaptations in phylloclade of <i>Casuarina</i> .
5	Epiphytes: Morphological adaptations in <i>Acampe</i> , <i>Bulbophyllum</i> , <i>Drynaria</i> . Anatomical adaptations in epiphytic root of <i>Acampe</i> / <i>Vanda</i> . Halophytes: study of Viviparyin mangroves, Morphology and anatomy of Pneumatophores.
6	Study of a pond/forest ecosystem and recording the different biotic and abiotic components
7	Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of Density and frequency.
8	Application of remote sensing to vegetation analysis using satellite imageries
9	Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book.
10	Determination of water holding capacity of soil samples
11	Determination of Biological oxygen demand (BOD)
12	Determination of Chemical oxygen demand (COD)
13	Determination of soil texture of different soil samples.

**FSD483**

**SCHEME OF BOTANY PRACTICAL EXAMINATION  
IV-Semester  
ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 3 Hours**

**Max Marks- 25**

**I. Conduct the experiment A.**

**6 Marks**

(COD/Water holding capacity of soil/Salinity of soil/Water sample)  
(Requirements - 1Mark, Procedure -3 marks, Result - 2Marks)

**II. Write the ecological adaptations of B & C**

**2X3=6 Marks**

(Hydrophytes, Xerophytes, Epiphyte, Halophyte, Parasite)  
(Identification-1 Mark, Diagram with reasons - 2 Marks)

**III. Prepare a temporary stained slide of the given material D. Leave the preparation for evaluation.**

**5 Marks**

(Hydrilla/Nymphaea/Casuarina/Orchid root)  
(Mounting -2 Mark, Identification-1,Diagram with Reasons-2 Marks)

**IV. Comment on E (Ecological instruments)**

**3 Marks**

(Instruments studied in Practicals)

**V. Identify the slides/Chart F & G**

**2 X 2.5=5 Marks**

(One from adaptations, One from Quadrants/Remote sensing of Satellite image)

**FSD483**

**PRACTICAL QUESTION PAPER  
IV-Semester  
ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 3 Hours**

**Max Marks- 25**

- I. Conduct the experiment A. 6 Marks**
- II. Write the ecological adaptations of B & C 2X3=6 Marks**
- III. Prepare a temporary stained slide of the given material D. Leave the preparation for evaluation. 5 Marks**
- IV. Comment on E (Ecological instruments) 3 Marks**
- V. Identify the slides/Chart F & G 2 X 2.5=5 Marks**

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**FSD480**

**BLUE PRINT OF BOTANY THEORY**  
**EXAMINATION IV SEMESTER-BLUE PRINT**  
**ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

**FSD480**

**SCHEME OF BOTANY THEORY EXAMINATION  
IV- SEMESTER  
ECOLOGY AND CONSERVATION BIOLOGY**

**Time: 2.5 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**B.Sc. BOTANY – IV Semester**  
**Open Elective Course**  
**Plant Diversity and Human Welfare**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC - 4.1	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

After the completion of this course, the learner will be able to:

- Develop understanding of the concept and scope of plant biodiversity
- Identify the causes and implications of loss of biodiversity
- Apply skills to manage plant biodiversity
- Utilize various strategies for the conservation of biodiversity
- Conceptualize the role of plants in human welfare with special reference to India

**Keywords:**

Biodiversity, Biodiversity loss, Hotspots, Biodiversity management, Conservation strategies, Biodiversity awareness programmes

**Unit I: Plant Diversity and its Scope**

**14 lectures**

Levels of biodiversity: Genetic, Species and Ecosystem; Agro-biodiversity and cultivated plant taxa and related wild taxa. Values and uses of Biodiversity, Methodologies for valuation, Ethical and aesthetic values, Uses of plants; Ecosystem services.

**Unit II: Loss of Biodiversity and Management of Plant Biodiversity**

**14 lectures**

Loss of biodiversity-causes and implications, Hotspots of biodiversity, extinction of species, projected scenario for biodiversity loss. Organizations associated with biodiversity management, IUCN, UNEP, WWF, UNESCO, NBPGR; Methodology for execution; Biodiversity legislation; Information management and communication.

## **Unit III: Conservation of Biodiversity, Role of Plants in Relation to Human Welfare**

**14 lectures**

Conservation of genetic, species and ecosystem diversity, *In situ* and *ex situ* conservation strategies, India's biodiversity and its conservation Social approaches to conservation, Biodiversity awareness programmes, Sustainable development. Importance of forestry their utilization and commercial aspects; Avenue trees; Ornamental plants of India; Alcoholic beverages; Fruits and nuts; Wood and its uses; their commercial importal,

### **Suggested Readings**

1. Krishnamurthy, K.V. (2004).An Advanced Text Book of Biodiversity-Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S.(2006). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
3. Reddy, K.V. and Veeraiah, S. (2010). Biodiversity and Plant Resources. Aavishkar publication, New Delhi.
4. Heywood, V.H. and Watson, R.T.(1995). Global biodiversity and Assessment. Cambridge University Press.

**B.Sc. BOTANY – IV Semester**  
**Open Elective Course (OE 4.1)**  
**Medicinal Plants in Health Care**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-4.2	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

On completion of this course, the students will be able to:

- Recognize the basic medicinal plants
- Apply techniques of conservation and propagation of medicinal plants.
- Setup process of harvesting, drying and storage of medicinal herbs
- Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India

**Keywords:**

Medicinal plants, Traditional systems, endangered medicinal plants, Ethnobotany, Folk medicines, Ethnic communities

**Unit I: History and Traditional System of Medicine** **14 lectures**

History, Scope and Importance of Medicinal Plants; Traditional systems of medicine; Definition and Scope.

**Ayurveda:** History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments,

**Siddha:** Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.

**Unani:** History, concept: Umor-e-tabiya, tumors treatments / therapy, polyherbal formulations.

**Unit II: Conservation, Augmentation and Ethnobotany and Folk Medicine** **14 lectures**

Conservation of Eendemic and endangered medicinal plants, Red list criteria; *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethnomedicinal plant Gardens.

**Propagation of Medicinal Plants:** Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of greenhouse for nursery production, propagation through cuttings, layering, grafting and budding.

Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethno-botany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India.

### Unit III Medicinal Plants

14 lectures

Brief description of selected plants and derived drugs, namely Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia* for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardioprotection, turmeric (*Curcuma longa*) for wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, Salix for analgesic, Cincona and Artemisia for Malaria, Rauwolfia as tranquilizer, Belladonna as anticholinergic, Digitalis as cardiotoxic, Podophyllum as antitumor.

### Suggested Readings:

1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
2. AYUSH ([www.indianmedicine.nic.in](http://www.indianmedicine.nic.in)). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya: Handbook of Medicinal and Aromatic Plant Cultivation*.
4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16<sup>th</sup>edn. Philadelphia, PA: Elsevier Saunders Ltd.
6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.
9. Sharma, R.(2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House.
10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.
11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

**B.Sc. BOTANY – IV Semester**  
**Open Elective Course (OEC – 4.2)**

**Floriculture**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures / Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC - 4.3	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

**Learning outcomes:**

After completing this course the learner will be able to;

- Develop conceptual understanding of gardening from historical perspective
- Analyze various nursery management practices with routine garden operations.
- Distinguish among the various Ornamental Plants and their cultivation
- Evaluate garden designs of different countries
- Appraise the landscaping of public and commercial places for floriculture.
- Diagnoses the various diseases and uses of pests for ornamental plants.

**Keywords:**

Gardening, Transplanting, Mulching, Plant growth regulators, Ornamental plants, Commercial floriculture

**Unit I**

**14 lectures**

Introduction: Importance and scope of floriculture and landscape gardening. Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

**Unit II**

**14 lectures**

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and fern allies; Cultivation of plants in pots; Indoor gardening; Bonsai. Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flowerbeds, Shrubbery, Borders, Water-garden. Some Famous gardens of India.

Floriculture and green house technology. Commercial aspects and exporting of flowers and ornamental plants. Quarantine and testing requirements.

### **Unit III**

**14 lectures**

Landscaping Places of Public Importance: Landscaping highways And Educational institutions. Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Liliun, Orchids). Diseases and Pests of Ornamental Plants.

### **Suggested Readings**

1. Randhawa, G.S. and Mukhopadhyay, A. (1986).Floriculture in India. Allied Publishers.
2. Adams, C., M. Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K

### Plant Morphology and Taxonomy

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
<b>04</b>	<b>60</b>	<b>02</b>	<b>56</b>

#### Contents of Theory Course

Unit	Topics	Teaching Hours
<b>I</b>	<p><b>Morphology</b> of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula.</p> <p><b>Introduction to Taxonomy:</b> History, objectives, scope and relevance of Taxonomy.</p> <p><b>Systems of classification:</b> Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham &amp; Hooker's, Engler and Prantl's system and APG System (IV- 2016). Merits and demerits of classifications.</p> <p><b>Taxonomic literatures:</b> Floras, Monograph, Revisions, Journals and <i>Hortus Malabaricus</i>. <b>Herbaria and Botanical gardens:</b> Important herbaria and botanical gardens of the world and India and their importance. Technique of Herbarium Preparation.</p> <p><b>Virtual herbarium;</b> E-Flora- documentation and uses.</p>	15 Hrs
<b>II</b>	<p><b>Taxonomic Hierarchy:</b> Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts.</p> <p><b>Botanical Nomenclature:</b> Principles and Rules (ICBN/ ICN); Latest code. Brief account of Ranks of taxa, Typification, Author citation, valid publication, rejection of names, principle of priority and its limitations.</p> <p><b>Plant Taxonomic Evidences:</b> from Palynology, Embryology, Cytology, Phytochemistry and molecular data. Field inventory.</p>	15 Hrs
<b>III</b>	<p><b>Biometrics, Numerical Taxonomy; Phenetics and Cladistics:</b> Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).</p> <p><b>Phylogenetic Systematics:</b> Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly, clades, synapomorphy, symplesiomorphy, apomorphy, lineage sorting, serial homology etc).</p> <p><b>Origin and evolution of angiosperms;</b> Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).</p> <p><b>Molecular taxonomy:</b> DNA sequences of chloroplast genes (<i>atpB</i>, <i>rbcL</i>, ITS, <i>trnL</i> etc) and nuclear gene (nuclear ribosomal 18s DNA).</p>	15 Hrs
<b>IV</b>	<p><b>Plant identification:</b> Taxonomic dichotomous keys; indented (yoked) and bracketed keys. (brief account only).</p> <p><b>Plant descriptions:</b> Common terminologies used for description of vegetative and reproductive parts of the following families:</p> <p><b>Study of the diagnostic features of Angiosperm families:</b> Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae (with sub Families), Myrtaceae, Apiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Arecaceae, Orchidaceae and Poaceae.</p>	15 Hrs

## References

- 1 Baker. H.G. 1970. *Plant and Civilization*, Wadsworth Publishing Company.
- 2 Colton C.M. 1997. *Ethnobotany – Principles and applications*. John Wiley and sons –Chichester
- 3 Cotton, C.M. 1996. *Ethnobotany – Principles and Applications*. Wiley and Sons
- 4 Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
- 5 Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
- 6 Hall, B.G. (2011). *Phylogenetic Trees Made Easy: A How-To Manual*. Sinauer Associates, Inc. USA
- 7 Heywood - *Plant taxonomy* - Edward Arnold London.
- 8 Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.
- 9 Jeffrey, C. (1982). *An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge
- 10 Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach*, 2nd edition. Sinauer Associates, Inc., USA.
- 11 Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
- 12 Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
- 13 Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
- 14 Manilal, K.S. 2003. *Van Rheedee's Hortus Malabaricus. English Edition*, with Annotations and Modern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
- 15 Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
- 16 Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
- 17 Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974, Harper & Row Publishers, New York.
- 18 Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
- 19 Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
- 20 Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford & I B H New Delhi.
- 21 Any local/state/regional flora published by BSI or any other agency.



**FSE481P**

**III B.Sc. V Semester Practical**  
**Plant Morphology and Taxonomy Practicals**

**Lectures 56 Hours**  
**(4hours /week)**

Practical no.	LIST OF EXPERIMENTS TO BE CONDUCTED
<b>1</b>	Study of root, stem and leaf structure and modifications.
<b>2</b>	Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and flora formula.
<b>3-10</b>	Study of Dicot families mentioned in theory with at least two examples for each family and Make suitable diagrams, describe them in technical terms (Description, V.S. flower, section of ovary floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker' system of classification) and identify up to species using the flora***
<b>11</b>	Construction of plant phylogenetic trees using various loci (atpB, rbcL, ITS, trnL etc) with various phylogenetic methods (Neighbour Joining, Maximum Likelihood etc).
<b>12-13</b>	Identify plants/plant products of economic importance: Binomial name, Family and part used and uses. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, Luffa, Asafoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Ginger, Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane, Annona muricata, Catharanthus roseus, Rauwolfia serpentina, Justicia adhatoda, Vitex negundo and Leucas aspera.
<b>14</b>	<b>Field visit***:</b> Local or outside area/ Botanical garden/ tribal settlements minimum 3 to 5 days. Submission: Record book, Tour report and Herbarium (Preparation of 05 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plant from.

**FSE481P**

**V Semester**

**Scheme of Practical Question paper**

**Plant Morphology and Taxonomy**

- 1. Identify, classify and describe the specimen A, B & C taxonomically** **9 Marks**  
(Polypetalae, Gamopetalae and Monochlamydae/ Monocotyledons)
- 2. Describe the plant 'D' using technical terms** **4 Marks**
- 3. Write the floral diagram and floral formula of the given specimen 'E'** **4 Marks**
- 4. Identify the specimen F and G** **4 Marks**  
(F-Morphology and G-Economic Botany)
- 5. Viva Voce** **4 Marks**

**FSE481P**

**V Semester**

**Plant Morphology and Taxonomy**

**Practical Question paper**

**Time: 3 Hours**

**Max. Marks: 25**

- 1. Identify, classify and describe the specimen A, B & C taxonomically** **9 Marks**
- 2. Describe the plant D using technical terms** **4 Marks**
- 3. Write the floral diagram and floral formula of the given specimen E** **4 Marks**
- 4. Identify the specimen F and G** **4 Marks**
- 5. Viva Voce** **4 Marks**

**Note:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

**FSE480**

**SCHEME OF BOTANY THEORY EXAMINATION  
V- SEMESTER  
Plant Morphology and Taxonomy**

**Time: 2.5 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSE480**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**V Semester-BLUE PRINT**

**Plant Morphology and Taxonomy**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## Genetics and Plant Breeding

<b>Number of Theory Credits</b>	<b>Total Lecture Hours/Semester</b>	<b>Number of Practical Credits</b>	<b>Total Practical hours/Semester</b>
<b>04</b>	<b>60</b>	<b>02</b>	<b>56</b>

## Contents of Theory Course

<b>Unit</b>	<b>Topics</b>	<b>Teaching Hours</b>
<b>I</b>	Mendelism: History; Principles of inheritance; Mendelian genetics and its extension; Chromosome theory of inheritance; Autosomes and sex chromosomes. Incomplete dominance and codominance. Multiple alleles, Lethal alleles, Epistasis, Polygenic inheritance; Pleiotropy. Penetrance and Expressivity. Extrachromosomal Inheritance- Chloroplast mutation: Variegation in Four O'clock plant; Mitochondrial mutations in yeast.	15 Hrs
<b>II</b>	Linkage, crossing over and chromosome mapping; Linkage and crossing over- Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Gene mapping; Sex Linkage. Variation in chromosome number and structure. Gene mutations- Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Fine structure of gene, Population and Evolutionary Genetics, Allele frequencies, Genotype frequencies, Hardy-Weinberg's Law, Role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	15 Hrs
<b>III</b>	Cell Biology: Microscopy- Light microscopy, Phase contrast microscopy, Electron microscopy (SEM and TEM) and Fluorescence Microscopy. Ultrastructure and functions of cell wall, cell membrane and cell organelles (nucleus, mitochondria, chloroplast, Golgi apparatus, vacuole, endoplasmic reticulum, ribosome, spherosome and lysosome). Phases of eukaryotic cell cycle: mitosis and meiosis. Regulation of cell cycle and significance of mitosis and meiosis. Structure and function of Chromosome, DNA and RNAs	15 Hrs
<b>IV</b>	Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization, Selection methods- for self-pollination, cross pollination and vegetatively propagated plants. Hybridization: For self, cross and vegetative propagation in plants – Procedure, advantages and limitations. Inbreeding depression and Heterosis, genetic basis of inbreeding depression and heterosis; Applications. Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.	15 Hrs

## References

- 1 Acquaah, G. (2007). Principles of Plant Genetics & Breeding. New Jersey, U.S.: Blackwell Publishing.
- 2 Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
- 3 Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
- 4 Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons
- 5 Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edition. New York, NY: W.H. Freeman and Co.
- 6 Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings
- 7 Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
- 8 Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
- 9 Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
- 10 Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.
- 11 Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.: ASM Press & Sunderland, Sinauer Associates, MA
- 12 Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
- 13 De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- 14 Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
- 15 Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company
- 16 Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013). Essential cell biology (4th ed.). Garland Publishing.
- 17 Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
- 18 Verma, P. S. (2004). Cell Biology, Genetics, Molecular Biology: Evolution and Ecology. India: S. Chand Limited.

**FSE483P**

**V semester practicals**  
**Genetics and Plant Breeding**

**Lectures 56 hours**  
**(4 Hours/week)**

<b>Practical no.</b>	<b>LIST OF EXPERIMENTS TO BE CONDUCTED</b>
<b>1</b>	Hybridization: Emasculation, bagging, pollination and production of hybrids.
<b>2</b>	Pollen viability test- Hanging drop and tetrazolium test
<b>3</b>	Seed viability- TTC and Paper towel method
<b>4-5</b>	Origin, distribution and centre of diversity of crop plants: Wheat, sorghum, rice, chilli, sugarcane, cotton, potato, coffee, sunflower and groundnut.
<b>6</b>	Charts related to plant breeding.
<b>7-8</b>	Genetic problems: 2 each from monohybrid, dihybrid, incomplete dominance and interaction of genes.
<b>9</b>	Study of Aneuploidy: Down's, Klinefelter's and Turner's syndrome.
<b>10</b>	Photographs/ permanent slides showing translocation ring, laggards and inversion bridge.
<b>11</b>	Study of Mitosis in onion root tips
<b>12</b>	Study of Meiosis in onion/ Chlorophytum flower buds.
<b>13</b>	Study of Micrometry Karyotype (onion)

**Genetic problems:**

**PROBLEMS ON MONOHYBRID CROSS**

1) In Tomatoes Red fruit color (R ) is dominant over yellow (r). A pure red fruited plant is crossed to a yellow fruited one. What will be the appearance of F<sub>1</sub>? The F<sub>1</sub> are interbred and produce 320 off springs in the F<sub>2</sub>. Howmany of them will be red and how many yellow? What will be the genotypes of F<sub>2</sub> and in what numbers ?



2) In pea plant, Tallness (T) is dominant over dwarfness (t). A tall pea crossed with dwarf produces offspring of which 50% are tall and 50% are dwarf. What are the genotypes of the parents ?

### PROBLEMS ON DI- HYBRID CROSS

1) In garden pea, yellow seed color (Y) is dominant over green (y) and round seed shape (R) is dominant over wrinkled (r). The character pair segregate separately. A pure yellow wrinkled variety is crossed to a pure green round. Give the phenotypes and genotypes of F<sub>1</sub> and phenotypic ratio of F<sub>2</sub> generation.

20

2) A tall red when crossed with dwarf red produces a dwarf white. Give the genotypes of the parents.

### PROBLEMS ON INTERACTIN OF FACTORS

1. Two white flowered strains of the sweet pea (*Lathyrus odoratus*) were crossed, producing an F<sub>1</sub> with only purple flowers. Random crossing among the F<sub>1</sub> produced 96 progeny plants, 53 exhibiting purple flowers and 43 with white flowers.

- What phenotypic ratio is approximated by the F<sub>2</sub> ?
- What type of interaction is involved ?
- What were the probable genotype of the parental strains.

### PROBLEMS ON 2 POINT TEST CROSSES

1. In tomato, red fruit (R) is dominant over yellow fruit (r) and yellow flowers (W) are dominant over white flowers (w). A cross is made between true breeding plants with red fruit and yellow flowers and plants with yellow fruit and white flowers. The F<sub>1</sub> generation plants are then test crossed to plants with yellow fruits and white flowers. The following results are obtained.

333 red fruits/ yellow flowers

64 red fruits/ white flowers

58 yellow fruits/ yellow flowers

50 yellow fruits/ white flowers

Calculate the map distance between the two genes.

2. Two different traits affecting pod characteristics in garden pea plants are enclosed by genes found on chromosome 5. Narrow pod is recessive to normal pod, yellow pod recessive to green pod. A true breeding plant with narrow, green pods was crossed to a true breeding plant with normal yellow pods. The F<sub>1</sub> were then test crossed to plants with narrow, yellow pods. The following results were obtained.

144 normal green pods

150 narrow yellow pods

11 normal yellow pods

9 narrow green pods

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**FSE483P**

## **Genetics and Plant Breeding**

### **SCHEME OF PRACTICAL EXAMINATION**

**Time:** 3 hours

**Max. Marks:** 25

- |  |                |
|--|----------------|
| <b>1. Solve the genetic problem A and B</b>                            | <b>8 Marks</b> |
| (One each from monohybrid/ dihybrid and inter action of genes/linkage) |                |
| <b>2. Perform the experiment C and D</b>                               | <b>6 Marks</b> |
| (Pollen/ seed viability and micrometry/karyotype)                      |                |
| <b>3. Comment on D</b>   | <b>3 Marks</b> |
| (Chart from emasculation and bagging/ Vavilov's centres)               |                |
| <b>4. Make micro preparation of E</b>                                  | <b>4 Marks</b> |
| (Mitosis/Meiosis)  |                |
| <b>5. Viva - Voce</b>  | <b>4 Marks</b> |

**FSE483P**

## **Genetics and Plant Breeding**

### **Practical Question paper**

**Time:** 3 hours

**Max. Marks:** 25

- |   |                |
|---|----------------|
| <b>1. Solve the genetic problem A and B</b> | <b>8 Marks</b> |
| <b>2. Perform the experiment C and D</b>    | <b>6 Mark</b>  |
| <b>3. Comment on D</b>                      | <b>3 Marks</b> |
| <b>4. Make micro preparation of E</b>       | <b>4 Marks</b> |
| <b>5. Viva - Voce</b>                       | <b>4 Marks</b> |

**Note:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visitreports are compulsorily to be submitted by the student.

**FSE480**

**SCHEME OF BOTANY THEORY EXAMINATION  
V- SEMESTER**

**Genetics and Plant Breeding**

**Time: 2.5 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

**\*\*\***

**FSE480**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**V SEMESTER-BLUE PRINT**

**Genetics and Plant Breeding**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## III B.Sc. VI Semester

## Plant Physiology and Plant Biochemistry

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
04	60	02	56

Contents of Theory Course		
Unit	Topics	Teaching Hours
I	<p><b>Plant water relations:</b> Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption.</p> <p><b>Transpiration.</b> Types and process. Mechanism of guard cell movement. K<sup>+</sup> ion mechanism. Antitranspirants.</p> <p><b>Mechanism of ascent of sap:</b> Vital and physical force theories.</p> <p><b>Phloem Transport:</b> Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis.</p> <p><b>Mineral nutrition:</b> A brief account of Micro and macro nutrients.</p>	15 Hrs
II	<p><b>Photosynthesis:</b> Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C<sub>3</sub>, C<sub>4</sub> and CAM pathways of carbon fixation reactions; Photorespiration.</p> <p><b>Respiration:</b> Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.</p>	15 Hrs
III	<p>Definition and classification of plant growth regulators- Hormones. Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development of individual group of hormone- Auxins, Gibberlins, cytokinins, ABA, ethylene.</p> <p>Synthetic growth regulators- classification, their effect on plant growth and development. Practical utility of hormones in agriculture and horticulture.</p> <p><b>Sensory Photobiology:</b> Biological clocks, photoperiodism, function &amp; structure of phytochromes, phototropin &amp; cryptochromes. Senescence, Aging &amp; Cell Death (PCD and Autophagosis). Plant Movements.</p>	15 Hrs

<b>IV</b>	<p><b>Nitrogen metabolism:</b> Biological nitrogen fixation; Nitrate and ammonia assimilation. <b>Proteins and amino acids:</b> classification, structure - primary, secondary, tertiary and quaternary. <b>Enzymes-</b> classification, kinetics and mechanism of action.</p> <p><b>Vitamins</b> - classification, distribution, structure, production, function.  <b>Lipid Metabolism:</b> classification, structure, biosynthesis of fatty acids and functions. <b>Secondary plant products:</b> structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.</p>	15 Hrs
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### REFERENCES

1. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc. Wilson, K. and Walker, J. 1994. Jain V K, 2008. Fundamentals of Plant Physiology. S Chand and Co.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundamentals and Applications. Agrobotanical Publishers.
5. Malik CP, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjee S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Calcutta.
7. Noggle GR, Fritz GJ, Introductory Plant Physiology. Prentice Hall of India.
8. Pandey SN, Sinha BK, 2006. Plant physiology. Vikas Publishing House, New Delhi.
9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributors, New Delhi.
10. Sinha A K, 2004. Modern Plant Physiology. Narosa publishing House, New Delhi.
11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.
12. Verma V, 2007. Text Book of Plant Physiology. Ane Books Pvt. Ltd.

**FSF481P**

**III B.Sc. VI Semester practicals**

**Plant Physiology and Plant Biochemistry**

**Lectures 56 hours  
4 hours/week**

<b>Practical no.</b>	<b>LIST OF EXPERIMENTS TO BE CONDUCTED</b>
<b>1.</b>	Experiment to demonstrate the phenomenon of exosmosis and endosmosis.
<b>2.</b>	To determine the osmotic pressure of the cell sap by plasmolytic method.
<b>3.</b>	To demonstrate root pressure / transpiration pull in plants.
<b>4.</b>	To compare the rate of transpiration from dorsiventral leaf by cobalt chloride paper method.
<b>5.</b>	To demonstrate that oxygen is liberated in the process of photosynthesis.
<b>6.</b>	Separation of photosynthetic pigments by paper chromatography and measure their R <sub>f</sub> values.
<b>7.</b>	To separate the chloroplast pigments by separating funnel. (Demonstration only)
<b>8.</b>	To demonstrate that CO <sub>2</sub> is evolved during anaerobic respiration by gas flow method.
<b>9.</b>	Study of Phototropism
<b>10.</b>	Demonstration of Starch in the leaf
<b>11.</b>	Determination of stomatal index, Area of stomatal aperture and stomatal frequency
<b>12.</b>	Biochemical test for Starch, Protein, Reducing Sugars and Lipids
<b>13.</b>	Estimation of diurnal fluctuation using CAM plants.
<b>14.</b>	Industrial visit.



**FSF481P**

**III B.Sc. VI Semester**

**Practical scheme**

**Plant Physiology and Plant Biochemistry**

- |   |                |
|---|----------------|
| <b>1. Conduct major experiment A</b>        | <b>8 Marks</b> |
| <b>2. Perform the experiment B and C</b>    | <b>8 Marks</b> |
| <b>3. Micro chemical test of material D</b> | <b>5 Marks</b> |
| <b>4. Viva - Voce</b>                       | <b>4 Marks</b> |

**FSF481P**

**III B.Sc. VI Semester**

**Practical Question paper**

**Plant Physiology and Plant Biochemistry**

- |   |                |
|---|----------------|
| <b>1. Conduct major experiment A</b>        | <b>8 Marks</b> |
| <b>2. Perform the experiment B and C</b>    | <b>8 Marks</b> |
| <b>3. Micro chemical test of material D</b> | <b>5 Marks</b> |
| <b>4. Viva - Voce</b>                       | <b>4 Marks</b> |

**Note:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visit reports are compulsorily to be submitted by the student.

**FSF480**

**SCHEME OF BOTANY THEORY EXAMINATION  
VI- SEMESTER  
Plant Physiology and Plant Biochemistry**

**Time: 2.5 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSF480**

**III B.Sc. VI Semester**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**VI SEMESTER-BLUE PRINT**

**Plant Physiology and Plant Biochemistry**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## III B.Sc. VI Semester

## Plant Biotechnology

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
04	60	02	56

Contents of Theory Course		
Unit	Topics	Teaching Hours
I	Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and cybrids; Cryopreservation; Germplasm Conservation).	15 Hrs
II	Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC and briefly PAC, MAC, HAC). Gene Cloning (Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning) Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; Probes-oligonucleotide, heterologous, PCR;	15 Hrs
III	Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP). Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Biosafety concerns.	15 Hrs
IV	Introduction to Bioinformatics- Definition, history, scope and applications. Opportunities in Bioinformatics. Introduction to Genomics, Proteomics, Metabolomics and Pharmacogenomics. Biological databases: Nucleotide databases, Protein databases. Genome databases. Organization of data in NCBI, DDBJ, EBI, PDB, SwissPROT and software used.	15 Hrs

**FSF483P**

**III B.Sc. VI semester practicals**  
**Plant Biotechnology**

**Lectures : 56 hours**  
**(4 hours/week)**

<b>Practical no.</b>	<b>LIST OF EXPERIMENTS TO BE CONDUCTED</b>
<b>1.</b>	(a) Preparation of MS medium. (b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of Tobacco/Datura/Brassica etc.
<b>2.</b>	Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & Preparation of Artificial/Synthetic seeds.
<b>3.</b>	Preparation of Artificial/Synthetic seeds.
<b>4.</b>	Isolation of protoplasts – Mechanical isolation
<b>5.</b>	Study and description of binary vectors by using photographs
<b>6.</b>	Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, micro projectile bombardment
<b>7.</b>	Study of steps of genetic engineering for production of Bt cotton, Golden rice, FlavrSavr tomato through photographs.
<b>8.</b>	Isolation of DNA.
<b>9.</b>	Isolation and spectrophotometric quantification of DNA
<b>10.</b>	Separation of DNA using agarose gel electrophoresis and gel documentation.
<b>11-12</b>	Study of databases of NCBI, DDBJ, EMBL, PDB
<b>13.</b>	Charts/ Photographs related to Biotechnology.
<b>14.</b>	Visit to Biotech Labs in nearby places.

**REFERENCES**

Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition

Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition

Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

Arthur M. Lesk. (2003). Introduction to Bioinformatics, Oxford University Press, Indian edition..

Des Higgins and Willie Taylor. (2000). Bioinformatics, Sequence, structure and databanks. A practical approach. Oxford University Press, Indian edition, Second impression, New Delhi.

ImtiazAlam Khan. (2005). Elementary bioinformatics. Pharma Book Syndicate, Hyderabad.

Krane Dan, E. and Raymer M.L. (2004). Fundamental concepts of Bioinformatics. Pearson education. New Delhi. Second Indian reprint.

Rastogi, S.C., Mediratta, N. and Rastogi. P. (2004). Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd., New Delhi.

Baxevanis, A. D. and Ouellettee, B. F. F. (2002). Bioinformatics: A Practical Guide to the analysis of Genes and Proteins. (2nd Ed.), New York, John Wiley & Sons, Inc. Publications.

Attwood, T. K. and Parry-Smith, D. J. (2001). Introduction to Bioinformatics Delhi. Pearson Education (Singapore) Ptd. Ltd

**FSF483P**

**III B.Sc. VI Semester**  
**Scheme of Practical Examination**  
**Plant Biotechnology**

**Time =03 hours**

**Max. Marks =25**

- |   |                 |
|---|-----------------|
| <b>1. Isolation of plant DNA/ spectrophotometric quantification of DNA- (A)</b>   | <b>05 marks</b> |
| <b>2. Preparation of B</b><br>(Artificial /Synthetic Seed/ Inoculation using leaf and nodal explants)   | <b>04 marks</b> |
| <b>3. Comment on C and D</b><br>(Bt cotton, Golden rice, Flavr Savr tomato, microinjection, micro projectile bombardment, Agarose /PAGE electrophoresis, Transilluminator, PCR) | <b>06 marks</b> |
| <b>4. Comment on E (Bioinformatics)</b>   | <b>05 marks</b> |
| <b>5. Viva-voce</b>   | <b>05 marks</b> |

**Note:** Duly valued, Certified practical record & Submissions/ Assignments/ Tour or field visitreports are compulsorily to be submitted by the student.



**FSF482**

**SCHEME OF BOTANY THEORY EXAMINATION  
VI- SEMESTER**

**Plant Physiology and Plant Biochemistry**

**Time: 2.5 Hours**

**Max Marks- 60**

**Instructions: Draw neat labelled diagrams wherever necessary**

**I. Define/Explain any Four of the following:**

**2X4=8 Marks**

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

**II. Answer any Four of the following:**

**5X4=20 Marks**

- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

**III. Answer any Four of the following:**

**8X4=32 Marks**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

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**FSF482**

**BLUE PRINT OF BOTANY THEORY EXAMINATION**

**VI SEMESTER-BLUE PRINT**

**Plant Biotechnology**

**Time: 2.5 Hours**

**Max Marks- 60**

<b>Units</b>	<b>2 marks</b>	<b>5 marks</b>	<b>8 marks</b>	<b>Total Marks.</b>
<b>I</b>	2X1=2	5X1=05	8X2=16	23
<b>II</b>	2X2=4	5X2=10	8X1=08	22
<b>III</b>	2X2=4	5X2=10	8X1=08	22
<b>IV</b>	2X1=2	5X1=05	8X2=16	23
	<b>12 Marks</b>	<b>30Marks</b>	<b>48 Marks</b>	<b>90 Marks</b>

## **Internship for Graduate Programme**

<b>Course title</b>	Internship Discipline specific
<b>No of contact hours</b>	90
<b>No credits</b>	2
<b>Method of evaluation</b>	Presentations/Report submission

- Internship shall be Discipline Specific of 90 hours (2 credits) with duration 4-6 weeks.
- Internship may be full-time/part-time (full-time during semester holidays and part-time in the academic session)
- The student should submit the final internship report (90 hours of Internship) to the mentor for completion of the internship.
- The detailed guidelines and formats shall be formulated by the universities separately as prescribed in accordance to UGC and AICTE guidelines.
- BOS resolved to adopt and to formulate the structure for graduate internship program after getting the suitable guidelines from the University of Mysore.

## Employability skills paper

### Floriculture

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
<b>03</b>	<b>45</b>	<b>02</b>	<b>45</b>

<b>Course Pre-requisite(s):</b>	
<b>Course Outcomes (COs):</b> After the successful completion of the course, the student will be able to:.	
CO1: Identify and describe the ornamental flowering plants.	
CO2: Practice the methods of preparing soil and water, cultivation and propagation methods. CO3: Design, prepare and apply appropriate combinations of plants and methods of cultivation for commercial setup.	
CO4: Adapt to the job role of Floriculturist (employment/ entrepreneurship)	
<b>Contents</b>	<b>45Hrs</b>
<b>Unit1:</b>	<b>15hrs</b>
Introduction to floriculture, tools and equipments. Study of diversity in shape, size, and colour of flowers (including basic botany, nomenclature, common name and general uses). Identification and preparation of an inventory of herbaceous flowering plants, climbers, shrubs, and trees around the campus. Study the various physico-chemical properties of soil.	
<b>Unit2:</b>	<b>15hrs</b>
Methods of preparation of floral beds, soil preparation, greenhouse design and fumigation methods. Methods of seed sowing and raising flowering plants through seeds, bulbs and through vegetative methods in planters, containers and in outdoor environments. Role of light, plant growth regulators and nutrients in blooming and flowering. Bacterial and fungal diseases and pests of ornamental flowers and their management.	
<b>Unit3:</b>	<b>15hrs</b>
Interior decoration methods, flower arrangements (Japanese, Western and Indian). Harvesting, methods to increase the shelf life of flowers, post-harvest care and marketing platforms for the floriculture industry. Field visit to nearby nursery/garden to understand basic aspects of Garden design. Five flowering plants that are grown commercially, their share in the global market, methods used for selling the products and importance of the floriculture industry in job creation.	

CourseTitle	<b>Floriculture(Practical)</b>	PracticalCredits	<b>02</b>
CourseCode	<b>BOTV2 -BP</b>	ContactHours	<b>45Hours</b>
FormativeAssessment	<b>25Marks</b>	SummativeAssessment	<b>25Marks</b>

### **Practical Content**

1. Common garden operations using different implements. Identification & practice Bio-fertilizer.
2. Handling of soils, purpose of nursery bed, potting media, potting etc.
3. Propagation by cutting, budding, greating.
4. Handling of seeds, bulbs, cut flowers, nursery plants, pot plants.
5. Acquaintance with soil types, various manures, fertilizers, Vermi compost, pesticides, growth regulator.
6. Systematic waste disposal keeping environment pollution in view

### **References**

1	Randhawa, G.S., Mukhopadhyay, A. (1986). Floriculture in India. New York, NY: Allied Publishers.
2	Larson, R. A. (Ed.). (2012). Introduction to floriculture. Elsevier
3	Pal, S. L. (2019). Role of plant growth regulators in floriculture: An overview. J. Pharmacogn. Phytochem, 8, 789-796.
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	Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming AktaPrakashan, Nadiad

## Landscaping and Gardening (Theory)

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
<b>03</b>	<b>45</b>	<b>0</b>	<b>0</b>

### Course Pre-requisite(s):

**Course Outcomes (COs):** After the successful completion of the course, the student will be able to:

- CO1. Students would be able to identify the ornamental plants,
- CO2. They will have an understanding of cultivation methods, landscaping and making the flower arrangement.
- CO3. To understand the concept of different types of gardening practices
- CO4. Apply the basic principles and components of gardening
- CO5. Learn to design various types of formal and informal gardens
- CO6. Establish and maintain special types of gardens for outdoor and indoor landscaping

### Contents

**45Hrs**

#### Unit1:

**15hrs**

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening. Landscaping Places of Public Importance: Landscaping highways and Educational institutions.  
 Planning and layout (parks and avenues); gardening traditions - Ancient Indian, European, Mughal and Japanese Gardens; Specialized Gardens: Aquatic garden, Rock garden, Kitchen garden, Herb Garden, Butterfly garden, Botanical garden, English garden, Terrace garden

#### Unit2:

**15hrs**

Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping.  
 Urban forestry; policies and practices.  
 Soil and its characteristics, Potting Mixtures, Essential soil elements, Mineral nutrition and Garden implements.

#### Unit3:

**15hrs**

Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.  
 Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables.  
 Propagation Methods: Seeds (Germination, Viability, Dormancy, Storage, Transplantation), Grafting, Cutting, Layering, Division, Budding, Scaling, Scoping, Microgreens.  
 Introduction and methodology of hydroponics.

## References

- 1 Nambisan KMP (1992) Design elements of Landscape gardening Oxford and IBH
- 2 Sudheer K P and Indira V (2007) Post harvest technology of Horticultural crops New India Publication agencies
- 3 Bose T K., Maiti R G., Duha R S and Das P (1999). Floriculture and Landscaping Naya Prakash
- 4 Biomass for renewable energy, fuels, and chemicals. D.L. Klass, Academic Press, <http://www.sciencedirect.com/science/book/9780124109506>
- 5 Sistemi a biomasse: progettazione e valutazione economica. E. Bocci, A. Caffarelli, M. Villarini, A. D'Amato, Maggioli Editore, <http://www.maggiolieditore.it/9788838759697- sistemi-a-biomasse- progettazione-e-valutazione economica.html>

## Mushroom Cultivation Technology (Theory)

<b>Number of Theory Credits</b>	<b>Total Lecture Hours/Semester</b>	<b>Number of Practical Credits</b>	<b>Total Practical hours/Semester</b>
<b>03</b>	<b>45</b>	<b>0</b>	<b>0</b>

<b>Contents of Theory Course</b>		
<b>Unit</b>	<b>Topics</b>	<b>Teaching Hours</b>
<b>I</b>	Mushrooms -Taxonomical rank-History and Scope of mushroom cultivation- Edible and PoisonousMushrooms-Vegetative characters. Button mushroom (Agaricusbisporus), Milky mushroom (Calocybeindica), Oyster mushroom(Pleurotussajorcaju) and paddy straw mushroom (Volvariellavolvacea).	15 Hrs
<b>II</b>	Structure and construction of mushroom house, Sterilization of substrates, Spawn production - culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation, Spawning spawn running, harvesting. Cultivation of oyster and paddy straw mushroom Problems in cultivation - diseases, pests and nematodes, weed moulds and their management strategies.	15 Hrs
<b>III</b>	Nutritional and medicinal values of mushrooms, (Medicine mushroom, Shiitake, Ganoderma, CreminiEnoki species) Therapeutic aspects- antitumor effect Preservation of mushrooms - freezing, drying, canning, quality assurance and entrepreneurship, Value added products of mushrooms.	15 Hrs

<b>References</b>	
1	Marimuthu, T. et al. (1991). Oster Mushroom, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore
2	Nita Bhal. (2000), Hand book on Mushrooms, 2 <sup>nd</sup> ed. vol. 1 and 2 Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
3	Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation, Emkey Publications
4	Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology, Agrobios, Jodhpur
5	Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation, Mittal Publication, New Delhi.
6	Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
7	V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/Vedams EBooks Pvt Ltd., New Delhi (2000)



## Community Forestry (Theory)

Number of Theory Credits	Total Lecture Hours/Semester	Number of Practical Credits	Total Practical hours/Semester
03	45	0	0

Contents of Theory Course		
Unit	Topics	Teaching Hours
<b>I</b>	Forests and its importance, forest societies, interactions between forests and people, importance of forests in traditional farming systems, livestock economy and forests, social and cultural factors of forest management, man in ecosystem in relation to eco-philosophy. Afforestation programmes and forest conflicts, wildlife and human conflicts, important forest movements like Chippko/Appiko Movement, Gender dimension of forest management, tribal economy and forests. Pastoralists and their dependence on forests. Forests and livelihood security of tribals.	15 Hrs
<b>II</b>	Management of Commons and Common Property Resources (CPRs) and open access resources, forest management and sustainable livelihood strategies, forests and food security, eco-tourism and local development, land use change and forestry. Case studies of Padmashri Salumarada Timmakka and Padmashri Tulasi Gowda.	15 Hrs
<b>III</b>	Forest rights, customary rights of people, community participation, biodiversity and ethnobotany, Joint Forest Management, global environmental change and land use; dams, forests and resettlement of tribals and non-tribals – case study, poverty alleviation and forests, tourism and forest management, role of NGOs and other CBOs community based organization in forest management.	15 Hrs

### References

1	Annamalai R. 1999. Participatory Learning Action and Microplanning for JFM. Dean SFRC, Coimbatore
2	FAO. 1978. Forestry for Local Community Development. FAO Publ.
3	Shah SA. 1988. Forestry for People. ICAR.
4	Tiwari KM. 1988. Social Forestry and Rural Development. International Book Distr
5	Vyas GPD. 1999. Community Forestry. Agrobios.
6	Ref related to Salumarada Timmakka and Tulasi Gowda.