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UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21

Dated:10.10.2022

Notification

Sub:- Syllabus and Examination Pattern of Botany (UG) (III & IV Semester) with effective from the Academic year 2022-23 as per NEP-2020.

Ref:- 1. Decision of Board of Studies in Botany (UG) meeting held on 02-06-2022.
2. Decision of the Faculty of Science & Technology Meeting held on 15-09-2022.
3. Decision of the Academic Council meeting held on 23-09-2022.

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The Board of Studies in Botany (UG) which met on 02-06-2022 has recommended & approved the syllabus and pattern of Examination of Botany Course (III & IV Semester) with effective from the Academic year 2022-23 as per NEP - 2020.

The Faculty of Science & Technology and Academic Council at their meetings held on 15-09-2022 and 23-09-2022 respectively has also approved the above said syllabus and hence it is hereby notified.

The syllabus and Examination pattern is annexed herewith and the contents may be downloaded from the University Website i.e., www.uni-mysore.ac.in.

Draft Approved by the Registrar

DeputyRegistrar(Academic)

Deputy Registrar (Academic)
University of Mysore
Mysore-570 005

To:-

1. All the Principal of affiliated Colleges of University of Mysore, Mysore.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS, in Botany, Manasagangothri, Mysore.
4. The Dean, Faculty of Science & Technology, DoS in Earth Science, MGM.
5. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
6. The Director, PMEB, Manasagangothri, Mysore.
7. Director, College Development Council , Manasagangothri, Mysore.
8. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
10. Office Copy.

B.Sc. BOTANY: Semester - 3
Theory: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
BOT-A-3.1: PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lecture Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT-A-3.1	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course Outcomes:

On completion of this course, the students will be able to:
1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Induction of the enthusiasm on internal structure of locally available plants.
4. Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
5. Observation and classification of the floral variations from the premises of college and house.
6. Understanding the various reproductive methods sub-stages in the life cycle of plants
7. Observation and classification of the embryological variations in angiosperms.
8. Enthusiasm to understand evolution based on the variations in reproduction among plants.

UNIT	PLANT ANATOMY	Teaching Hours
I	**ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES**	**10 Hrs**
	Introduction, objective and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall. ***Tissue and tissue systems*** - meristematic tissue - Classification of meristem: (apical, intercalary and lateral), primary and secondary meristem. ***Apical meristem:*** Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, Histogen theory and Korper - Kappe theory). **Permanent tissues** and **Secretary cells**. Types of vascular bundles and Vascular cambium. Origin, development, arrangement and diversity in size and shape of leaves.	

II	**ANGIOSPERM ANATOMY**	**12Hrs**
	Structure of Dicot root: primary structure and secondary growth (Sunflower), Structure of monocot root (Maize). Structure of Dicot stem: Primary structure and secondary growth (Sunflower), Structure of Monocot stem (Maize). Structure of Dicot leaf: Primary structure (Sunflower), primary structure of Monocot leaf (Maize), Stomatal types. Anomalous secondary growth: Boerhaavia (dicot stem) Dracaena (monocot stem) Applications in Systematics, Forensics and Pharmacognosy.	
	DEVELOPMENTAL BIOLOGY	
III	**MORPHOGENESIS AND DIFFERENTIATION**	**14 hrs**
	Morphogenesis in plants - Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation) **Organogenesis:** 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 apex 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.	
IV	**REPRODUCTIVE BIOLOGY**	**20 Hrs**
	Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy, B.M Johri, M.S. Swaminathan and K.C. Mehta. **Microsporangium**: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions and sporogenous tissue. **Microsporogenesis**- Microspore mother cells, microspore tetrads, Pollinia. **Microgametogenesis**– Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon). **Megasporangium –** Structure of typical Angiosperm ovule. Types of ovule:	

	(Anatropous, Orthotropous, Amphitropous, Hemianatropous, Campylotropous, Circinotropous). **Megagametogenesis–** Types and development of Female gametophyte/embryosac- monosporic- *Polygonum* type, bisporic – *Allium* type, tetrasporic - *Fritillaria* type. Structure of mature embryosac. **Pollination and Fertilization:** Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes. **Endosperm** – Types and its biological importance. Free nuclear (*Cocos nucifera*) cellular (*Cucumis),* helobial types. Ruminate endosperm. **Embryogenesis –** Structure and development of Dicot (*Capsella bursa- pastoris)* and Monocot (*Najas),* embryo. Polyembryony, Apomixis andParthenocarpy.	

B.Sc. BOTANY: Semester - 3
Practical: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
BOT-A-3.2: PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

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
BOT-A-3.2	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

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.

Text Books for Reference:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –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 S.N. 1997, Plant Anatomy and Embryology .A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications

B.Sc. BOTANY: Semester - 4

Theory: Discipline Specific Core Course (DSCC)Title of the Course and Code:

BOT-A-4.1 ECOLOGY AND CONSERVATION BIOLOGY

Course No	Type of Course	Theory/ Practical	Credits	Instruction Hour Per week	Total No. Lectures/ Hours/ Semester	Duration Of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT A-4.1	DSCC	Theory	04	04	56 hrs	2 hrs	40	60	100

Unit	ECOLOGY AND CONSERVTION BIOLOGY	Teaching Hours
I	**Introduction to Ecology and Conservation Biology:** Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organization. **Ecological factors:** **Climatic factors:** light, temperature, precipitation and humidity. **Edaphic factors**: Soil and its types, soil texture, soil profile, soil formation; soil pH, soil aeration, soil water, soil humus and soil microorganisms. **Topographic Factors**: Altitude and Slope	15 Hrs

	Biotic factors: A brief account **Ecological groups of plants and their adaptations:** Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.	
II	**Ecosystem Ecology:** Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial. **Structure of ecosystem:** Biotic and Abiotic components, detailed structure of a pond ecosystem. **Ecosystem functions and processes:** Food chain, Food web and Ecological pyramids, energy flow in an ecosystem. **Bio-geo chemical cycles:** Gaseous cycles -carbon and nitrogen, Sedimentarycycle-Phosphorus. **Ecological succession:** Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere. **Community Ecology:** Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes. Intra-specific and Inter-specific interactions with examples. **Ecological methods and techniques:** Methods of sampling plant communities – transects and quadrates. Remote sensing as a tool for vegetation analysis, land use – land cover mapping. **Population Ecology:** Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.	15 Hrs
III	**PHYTOGEOGRAPHY AND ENVIRONMENTAL ISSUES**	**11 Hrs**
	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, shola forests and grasslands. An account of the vegetation of the Western Ghats. **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. **Air pollution:** Causes, effect, air quality standards, acid rain, control. **Soil pollution:** Causes, effect, solid waste management, control measures of soil pollution.	
IV	**BIODIVERSITY AND ITS CONSERVATION**	15 Hrs
	Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation. **Values of Biodiversity** – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity.	

	Concept of Biodiversity Hotspots, Biodiversity hot spots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/ Western Ghats. **Biodiversity Conservation-** Indian forest conservation act, Biodiversity bill (2002). Conservation methods – *In-situ* and *ex-situ* methods *In-situ* methods –Biosphere reserves, National parks, Sanctuaries, Sacred grooves. *Ex-situ* methods-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation.	

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.
10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

B.Sc. BOTANY: Semester - 4
Practical: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
BOT-A-4.2: ECOLOGY AND CONSERVATION BIOLOGY

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
BOT-A-4.2	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

LIST OF PRACTICALS IN ECOLOGY AND CONSERVATION BIOLOGY

Practical No.	Experiments
1	Determination of pH of different types of Soils, Estimation of salinity of soil/water samples.
2	Study of Ecological instruments – Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer, etc

3	Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea.* Anatomical adaptations in *Hydrilla* (stem) and *Nymphaea* (petiole).
4	Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia arabica, Aloe vera, Euphorbia tirucalli.* Anatomical adaptations in phylloclade of *Casuarina* .
5	Epiphytes: Morphological adaptations in *Acampe*, *Bulbophyllum*, *Drynaria*. Anatomical adaptations in epiphytic root of *Acampe/ Vanda.* Halophytes: study of Vivipary in mangroves, Morphology and anatomy of Pneumatophores. Parasites- Morphological and Anatomical adaptations in Cuscuta and Viscum
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.

Formative Assessment for Theory PAPER DSCC A-3 & A-4	
Assessment	**40 Marks**
C_1= Test I & II	(10+10)=20 Marks
C_2 = Assignment/Seminar /Viva	20 Marks

Formative Assessment for Practical PAPER A-3 & A-4	
Assessment	**25 Marks**
C_1= I A Test	10 Marks
C_2 = Assignment+ Report or Submission +Record	(5+5+5) 15 Marks

(DSCC)
SCHEME OF BOTANY PRACTICAL EXAMINATION
III SEMESTER: PAPER BOT-A-3.2
MODEL QUESTION PAPER
Title of the Paper: 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)

(DSCC)
SCHEME OF BOTANY THEORY EXAMINATION
III SEMESTER: PAPER BOT-A-3.1
MODEL QUESTION PAPER
Title of the Paper: PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

Time: 2 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.

	Weightage of Marks			DSC A-2
Units	**2 marks**	**5 marks**	**8 marks**	**Total Marks.**
I	2X2=4	5X1=05	8X1=08	17
II	2X1=2	5X2=10	8X1=08	20
III	2X1=2	5X1=05	8X2=16	23
IV	2X2=4	5X2=10	8X2=16	30
S	12 Marks	30Marks	48 Marks	90 Marks

(DSCC)
SCHEME OF BOTANY PRACTICAL EXAMINATION
IV SEMESTER BOT-A-4.2
MODEL QUESTION PAPER
Title of the Paper: 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)

(DSCC)
SCHEME OF BOTANY THEORY EXAMINATION
IV SEMESTER BOT-A-4.1
MODEL QUESTION PAPER
Title of the Paper: ECOLOGY AND CONSERVATION BIOLOGY

Time: 2 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.

Weightage of Marks DSCC				
Units	**2 marks**	**5 marks**	**8 marks**	**Total Marks.**
I	2X1=2	5X1=05	8X2=16	23
II	2X2=4	5X2=10	8X1=08	22
III	2X2=4	5X2=10	8X1=08	22
IV	2X1=2	5X1=05	8X2=16	23
	12 Marks	30Marks	48 Marks	90 Marks

B.Sc. BOTANY – III Semester
Open Elective Course (OEC - 3)
(OEC for other students)
Paper: Community Forestry
Code: OEC-3.1

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)
(OEC for other students)
Paper: Algal Cultivation and Applications
Code: OEC-3.2

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 and 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 Pres

2. Bast, F. (2014). An Illustrated Review on Cultivation and Life History of Agronomically Important Sea plants. In Seaweed: Mineral Composition, Nutritional and Antioxidant Benefits and Agricultural Uses, Eds. Victor 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, NewDelhi.

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)
(OEC for other students)
Paper: Landscaping and Gardening
Code: OEC-3.3

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 landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, 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

Types of gardens: Kitchen gardens,Vertical gardens, roof gardens. Art of making bonsai. Parks and public gardens. Landscape designs, Styles of gardens: formal, informal and freestyle gardens, Urban landscaping, Landscaping for specific situations: institutions, industries, residents, hospitals, road sides, 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

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).

B.Sc. BOTANY – IV Semester

Open Elective Course (OEC - 4)

(OEC for other students)

Paper: Plant Diversity and Human Welfare

Code: OEC-4.1

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
- Concept ualize 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 importance

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 (OEC - 4)

(OEC for other students)

Paper: Medicinal Plants in Health Care

Code: OEC-4.2

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: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.

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

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

Propagation of Medicinal Plants: Propagation through cuttings, layering, grafting and

budding. Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: 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, Belladona as anticholinergic, Digitalis as cardiotonic, 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). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yogaand 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, 16thedn. 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)
(OEC for other students)
Paper: Floriculture
Code: OEC-4.3

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, Lilium, 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