



BANGALORE UNIVERSITY

DEPARTMENT OF BOTANY

JNANABHARATHI CAMPUS

BANGALORE – 560 056

SYLLABUS FOR

III & IV Semesters Botany Course

Under Graduate (UG) Programme

Framed according to the

National Education Policy (NEP) 2020

AUGUST 2022

Proceedings of the Board of studies in Botany (UG) meeting held on 18-08-2022 in the Department of Botany, Bangalore University, Bangalore to discuss and finalize the syllabus of III and IV Sem B.Sc., Botany (NEP) and other issues as per the agenda.

Members Present

Signature

1. Dr. C. Maya, Professor & Chairperson

2. Dr. Rajkumar H Garampalli : External Member

3. Dr. Suresh Kumar. C : Member

4. Dr. Mamatha. N : Member

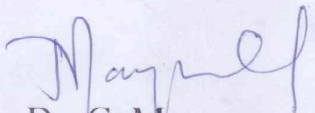
5. Dr. Kempegowda. M. S : Member

6. Dr. Venkateshappa. S. M : Member

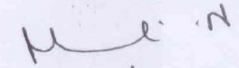
7. Smt. Shylaja. K. S : Member

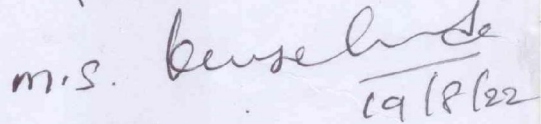
8. Dr. Usha Malini : Co-opted Member

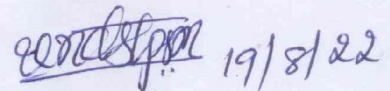
9. Dr. L. Rajanna : Invitee Member

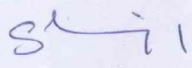

Dr. C. Maya
Professor & Chairperson

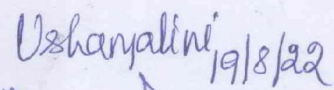


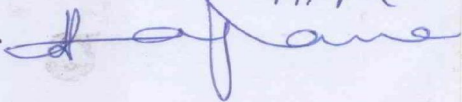




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MINUTES OF THE BoS (UG) MEETING

Chairperson welcomed the members to the meeting and thereafter the agenda was taken up for discussion

1. Discussed and finalized the NEP syllabus of III and IV semester B.Sc., Botany both (Theory & Practicals) question paper pattern, blue print of question paper Formative assessment and scheme of valuation for choice based credit system of NEP Programme.
2. Members also discussed the titles of the papers for V & VI Sem, open electives and disciplines of specific elective papers.
3. The overall N.E.P Module for B.Sc., Botany was discussed, finalized and accepted with modifications wherever necessary.
4. The proposed panel of examiners were recommended for 2022-23 examinations
5. Recommendations were made for the Constitution of BoE for the academic year 2022-23
6. The Chairperson is authorized to change / incorporate corrections as per the direction of University.

The meeting ended with a vote of thanks by the Chairperson.

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M. S. Koushik
18/8/22

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18/8/22

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 Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT-A-3.1	DSCC	Theory	04	04	56 hrs	3hrs	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.

PLANT ANATOMY

Unit 1: ANGIOSPERM ANATOMY, PLANT CELL STRUCTURE AND TISSUES: 14 Hrs

Introduction, objective and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.

Tissue and tissue systems - meristematic tissue, permanent tissue and secretory cells.

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). Quiescent centre, Root cap.

Unit II: DIFFERENTIATION 14 Hrs

Differentiation of root, stem and leaf.

Types of vascular bundles and Vascular cambium, Origin, development.

Structure of Dicot root: primary and secondary structures (*Tridax*),

Structure of monocot root (Maize).

Structure of Dicot stem: Primary and secondary structures (*Tridax*),

Structure of Monocot stem (Maize).

Structure of Dicot leaf: primary structure (*Tridax*),

Primary structure of Monocot leaf (Maize),

Stomatal types: Anomalous secondary growth:

Boerhavia (dicot stem) *Dracaena* (monocot stem)

DEVELOPMENTAL BIOLOGY

Unit III: Morphogenesis

14 Hrs

Differentiation and cell polarity in Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation)

Shoot Apical meristem (SAM): Origin, structure and function and ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds.

Mechanism of leaf primordium: initiation & development

Structure and function of root apical meristem (RAM): 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.

Unit IV: Reproductive Biology

14 Hrs

Introduction, Scope and contributions of Indian embryologists: P. Maheswari and B G L Swamy.

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 ovules- Anatropous, Orthotropous, Amphitropous and Circinotropous.

Megagametogenesis – Types of 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. Significance of double fertilization, Post fertilization changes.

Endosperm – Types and its biological importance. Free nuclear (*Cocosnucifera*) cellular (*Cucumis*), helobial types. Ruminant endosperm.

Embryogenesis – Structure and composition of zygote, Dicot (*Capsella bursa-pastoris*) and Monocot (*Najas*) embryo development.

A brief account of seed development.

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

Practical No.2

Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize)

Practical No.3

Study of Normal secondary growth structure in dicot stem and root (Sunflower)
Anomalous secondary growth: *Boerhaavia* (dicot stem) *Dracaena* (monocot stem)

Practical No. 4

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

Practical No. 5

Permanent slides of Microsporogenesis and male gametophyte Mounting of Pollen grains (Grass and Hibiscus) and Pollinia of Calotropis.

Practical No. 6

Pollen germination (hanging drop method) and effect of Boron and Calcium on pollen germination.

Practical No. 7

Permanent slides of types of ovules, Megasporogenesis & embryo sac development
Types of placentation: Axile, Marginal and Parietal types. Sectioning of ovary, for the studied types of placentation

Practical No. 8

Mounting of embryo: *Tridax* and *Cyamopsis*, Mounting of endosperm: *Cucumis*.

Practical No. 09, 10 and 11

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 calculates percentage of germination.
- c) Calculating 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. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickenson, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - McGraw 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. I., 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 Benjamin/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. 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. of Lectures/ Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
BOT-A-4.1	DSCC	Theory	04	04	56 hrs	3hrs	40	60	100

Contents of Theory Course		
Unit 1	Topics	Hours
I	<p>Introduction to Ecology and Conservation Biology: Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance.</p> <p>Ecological factors: Climatic factors: light, temperature, precipitation and humidity.</p> <p>Edaphic factors: 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>Ecological groups of plants and their adaptations: Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.</p>	14
II	<p>Ecosystem Ecology: Introduction, types of ecosystems with examples - terrestrial and Aquatic.</p> <p>Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem.</p> <p>Ecosystem functions and processes: Food chain, 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>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.</p>	14
	<p>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.</p> <p>Population Ecology: Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.</p>	

III	<p>Phytogeography and Environmental issues:</p> <p>Theory of land bridge and theory of continental drift. Centre of origin of plant – Vavilov’s concept, types. Phytogeographical regions of India.</p> <p>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 of Karnataka.</p> <p>Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment).</p> <p>Water pollution disasters – National mission on clean Ganga,Minimata.</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>	14
IV	<p>Biodiversity and its conservation:</p> <p>Biodiversity: Definition, types of biodiversity - habitat diversity, species diversity and genetic 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>	14
Total		56 Hrs

REFERENCES:

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
10. Biology, 4th Edition. Wiley-Blackwel.
11. 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 EXPERIMENTS TO BE CONDUCTED

Pract. No.	Experiments
1	Determination of pH of different types of Soils. Estimation of salinity of soil/water.
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>Euphorbia tirucalli</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: 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 vegetation/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.

FormativeAssessmentforTheoryPAPERDSCCA-3&A-4	
Assessment	40Marks
C ₁ =TestI&II	(10+10) =20Marks
C ₂ =Assignment and continuous evaluation +Seminar	(10+10) 20Marks

FormativeAssessmentforPracticalPAPER A-3&A-4	
Assessment	25Marks
C ₁ =IATest	15Marks
C ₂ =Assignment+ Project Report	(5+5) 10Marks

(DSCC)

**SCHEME OF BOTANY PRACTICAL EXAMINATION II
I SEMESTER: PAPER BOT-A-3.2**

MODEL QUESTION PAPER

Title of the Paper: PLANT ANATOMY AND DEVELOPMENTAL BIOLOGY

Time: 3 Hours

Max Marks-50

- I.** Prepare a temporary stained slide of the given material **A**. Leave the preparation for evaluation **10 Marks**
(Dicot/Monocot : Root/Stem)
(Preparation 4 Marks, Identification 1 Mark, labelled diagram 2 Marks, Reasons-3 Marks)
- II.** Identify the given slides **B, C, D, E** **4X4 = 16 Marks**
(**B** from Tissues, **C, D** from Anatomy, **E** from Embryology)(Identification-1 Mark, Diagram 1 Mark, reasons 2 Marks)
- III.** Mount the material **F** and comment **4 Marks**
(Pollen grain/Stomata/Trichomes)
(Mounting-2 Mark, Diagram 1 Mark, Reasons-1 Marks)
- IV.** Mount the material **G** (Endosperm/Embryo) and comment / perform pollen germination. **5 Marks**
(Preparation 2 Marks, Diagram 1 Mark, reasons 2 marks.)
- V. VIVA VOCE**..... **5 Marks**
- Tour report**..... **5 Marks**
- Practical record**..... **5 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-50

I. Conduct the BOD/COD of Water sample A. 10 Marks
 (requirement and procedure-4, Mark, Principle 2 Marks,
 conducting-2 marks, Result-2 Marks)

II. Write the ecological adaptations of B, C & D 3x4=12 Marks
 (Hydrophytes, Xerophytes, Epiphyte, Halophyte, Parasite)
 (Identification-1 Mark, Labelled diagram and comments-
 3 Marks)

III. Comment on E (Ecological instruments) 5 Marks
 (Instruments studied in Practicals. Identification-1 Mark, Diagram
 and description 4 Marks)

IV. Identify the slides/Chart F & G 2x4= 8 Marks
 (One from adaptations, one from Remote sensing of Satellite image or
 quadrat) (Identification 1 Mark, Labelled diagram and comments
 3 Marks)

V. VIVA VOCE..... 5 Marks

Tour report..... 5 Marks

Practical record..... 5 Marks

NOTE: 1. The total marks obtained by the candidate is divided by 2 (50/2= 25 Marks)

2. Same scheme may be used for IA (Formative Assessment) examination

(DSCC)
SCHEME OF BOTANY THEORY EXAMINATION
ON I SEMESTER: PAPER BOT-A-3.1
MODEL QUESTION PAPER

**Title of the Paper: PLANT ANATOMY AND DEVELOPMENTAL
BIOLOGY**

Time: 2^{1/2} 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.

WeightageofMarks				DSCA-2
Units	2marks	5marks	8marks	TotalMarks.
I	2X2=4	5X2=10	8X1=08	22
II	2X1=2	5X1=05	8X2=16	23
III	2X2=4	5X2=10	8X1=08	22
IV	2X1=2	5X1=05	8X2=16	23
S	12Marks	30Marks	48Marks	90Marks

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 landscaping

Unit I**14 Hrs.**

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, plating, climbers and creepers, palms, ferns, grasses and cacti succulents.

Unit II**14 Hrs.**

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 Hrs.**

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 landscaping, Landscaping 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)

REFERENCES:

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, and Plants. Dundurn Group Ltd.
3. Russell, T.(2012). Nature Guide: Trees: The world in your hands (Nature Guides).
4. Sudhir Pradhan (2018). Landscape gardening. Scientific Publishers India.
5. Gavino Merlo (2018). Floriculture and landscaping. Scitus Academics LLC.
6. Percy Lancasters (2004). Gardening in India. Oxford & IBH publishers.
7. LaeeqFutehally (2008). Gardens. National book trust India Publishers.
8. Ekta Chaudhary (2022). Garden Up. Penguin Random House India publishers.
9. Prathap Rao M (2020). Landscape Design. Standard Publishers and Distributors Pvt.
10. Percy Lancasters (2008). Gardening in India. 2nd Edition, Oxford & IBH publishers.

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
- Analyse 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.

Unit I**14 Hrs.**

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

Unit II**14 Hrs.**

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.

Unit III**14 Hrs.**

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.

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