HAVERI UNIVERSITY, HAVERI

B.Sc. (BOTANY)

04 – Year B.Sc. (Hons.) Program

SYLLABUS

[Effective from 2022-2023]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM III AND IV AND OPEN ELECTIVE COURSE (OEC) FOR SEM III AND IV.

AS PER NEP- 2020

HAVERI UNIVERSITY, HAVERI.

Four Years Under Graduate Program in Botany for B.Sc. (Hons.)
Effective from 2022-23

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration Of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
III	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-3	Theory	03 hrs	42	02 hrs	40	60	100	03
IV	DSCC	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-4	Theory	03 hrs	42	02 hrs	40	60	100	03

B.Sc.: Semester – III
Subject: Botany
Theory: Discipline Specific Core Course (DSCC)

The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper- 033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course No.: 05
Course code (Theory): 033 BOT 011

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
033 BOT 011	DSCC	Theory	04	04	56 hrs	3hrs	40	60	100

Title of the Course and Code:
DSSC 033 BOT 011: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

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, objectives and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall.
Tissue and tissue systems **-** meristematic tissue, permanent tissue and secretary 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.
Evolution and concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory continuing meristematic residue, cytohistological zonation).

Unit II: Plant Anatomy **14 Hrs.**

Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves.Structure and function of root apical meristem (RAM)origin of lateral roots

Structure of Dicot root: primary and secondary structures (Tridax/Sunflower), Structure of monocot root (Maize).

Shoot Apical meristem (SAM): Origin, structure and function

Structure of Dicot stem: Primary and secondary structures (Tridax/Sunflower), Structure of Monocot stem (Maize), Nodal anatomy.

Structure of Dicot leaf: primary structure (Tridax/Sunflower), primary structure of Monocot leaf (Maize), Stomatal types. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem)

Applications in systematics, forensics and Pharmacognosy.

DEVELOPMENT BIOLOGY

Unit III: Morphogenesis and Differentiation

Morphogenesis in plants - Differentiation of root, stem and leaf. **14 Hrs**

Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Acetabularia*) and multicellular system (root hair and stomata formation), Cytohistological zonation and Ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy

Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves)

.

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.

Unit IV: Reproductive Biology **14 Hrs.**

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

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, 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. 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 composition of zygote ,Dicot (*Capsella bursa-pastoris)*and Monocot (*Najas)* embryo development. A general account of seed development.

B.Sc. BOTANY: Semester - 3
Practical: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT 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
033 BOT 012	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) and 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) and Anomalous secondary growth: *Aristolochia*, *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 of 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 & embryosac development and 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 Chilli, Mounting of endosperm: Cucumis.

Practical No. 09
Histochemical localization of proteins/ carbohydrates.

Practical No. 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.

Pedagogy

Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

Question Paper Pattern

1.	Prepare a temporary micro preparation of specimen A	5 Marks
2.	Mounting of Embryo / Endosperm from Specimen B	5 Marks
3.	Mounting of ---------- from Specimen C	3 Marks
4.	Comment on D and E	4 Marks
5.	Project Report	3 Marks
6.	Viva voce	2 Marks
7.	Record Book	3 Marks

Instruction to the Examiners

I. Give any specimens for A – Dracaena, Aristalochia, Boerrhavia
II. Specimen – B (Cucumber , Chilli)
III. Specimen – C (Stomata, Trichome, Cystolith, Lenticells, Tylosis, Raphides)
IV. Slides / Specimen / Photographs from Embryology and Anatomy

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
3. Soh, Springer Netherlands,
4. Coutler E. G. , 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
5. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
6. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
7. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
8. 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
9. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
10. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
11. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
12. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
13. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
14. Nair P .K .K - Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
15. Pandey S.N. 1997, Plant Anatomy and Embryology. A. Chadha, Vikas Publication House Pvt Ltd;
16. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
17. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
18. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
19. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
20. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
21. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications.
22. N. N. Bhandari The Microsporangium.
23. F. Bouman The Ovule.
24. M. T. M. Willemse, J. L. van Went: The Female Gametophyte.
25. R. B. Knox :The Pollen Grain.
26. J. L. van Went, M. T. M. Willems :Fertilization.

B.Sc. – III Semester
Subject: Botany
Open Elective Course (OEC - 3)
(OEC for other students)
Code: OEC-003 BOT 051

Cou rse No.	Type of Cour se	Theory / Practical	Credi ts	Instructio n hour per week	Total No. of Lectures / Hours / Semester	Duratio n of Exam	Formative Assessmen t Marks	Summativ e Assessmen t Marks	Total Marks
003 BOT 051	OEC	Theory	03	03	42 hrs	2 hrs	40	60	100

OEC-3 (OEC for other students): 003 BOT 051
Title of the Paper: BOTANICAL GARDEN AND LANDSCAPING

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

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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, 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**

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, 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) 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.

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).

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions. :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions. :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question. : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise
DSCC 033 BOT 012: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-003 BOT 051
BOTANICAL GARDEN AND LANDSCAPING

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

B.Sc.: Semester – IV
Subject: Botany
Discipline Specific Core Course (DSCC)
The Course Botany in III semester has two papers (Theory paper- 033 BOT 011 for 04 credits and Practical paper- 033 BOT 012 for 02 credits) for 06 credits: Both the papers are compulsory, Details of the courses are as

Course no: 7
Course Code: 034 BOT 011

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

Title of the course (theory): DSSC ECOLOGY AND CONSERVATION BIOLOGY

Course outcome
Students will be able to

- Know the principles and concept of ecosystems- Components, productions**,** Energy and limiting factors.
- Know the concepts of productivity, measurements of productivity, food chain, food webs and trophic levels
- Understand the diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems
- Know the Concept of biotic community with their Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.
- Understand the causes and patterns of ecological succession, concept of climax.
- Know the Concept of ecological niches, species coexistence, overlapping and niche segregation.
- Know the concept of Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation.
- Understand the Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems.
- Know the Patterns of diversity in a community, Diversity measurement and indices.
- Understand the Global distribution of organisms, concept of islands, biodiversity hotspots. Methods of conservation of biodiversity.Centers for origin of cultivator plants.
- Know the population density, Natality and mortality. Life table, population growth curves, carrying capacity.
- Know the positive and negative interactions among the organisms.

Contents of Theory Course		
Unit 1	**Topics**	**Teaching Hours**
I	**Introduction to Ecology and Conservation Biology:** Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organisation. **Ecological factors:** Climatic factors: light, temperature, precipitation and humidity.	14 hrs

	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. Topographic Factors: Altitude **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-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem. Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-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.	14 hrs
III	**Phytogeography and Environmental issues:** 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.	14hrs

IV	**Biodiversity and its conservation:** 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.	14 hrs
Total		**56 Hours**

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
Theory: Discipline Specific Core Course (DSCC)
Title of the Course and Code:
DSSC 034 BOT 012: ECOLOGY AND CONSERVATION BIOLOGY

LIST OF PRACTICALS TO BE CONDUCTED

Practical No.	Experiments
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 *Pistia, Eichhornia, Hydrilla, Nymphaea.* Anatomical adaptations in *Hydrilla*(stem) and *Nymphaea* (petiole).
4	Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, 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.
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.

Pedagogy

Scheme of Practical Examination (Distribution of Marks): 25 Marks for semester end Examination.

Hours – 3 Hrs Max Marks – 25

I.	Identify and mention the anatomical features of the given specimen	A	5 Marks
II.	Perform the Experiment for Salinity / PH /COD / BOD of given sample	B	5 Marks
III.	Identify the Specimen / Slides / Ecological instruments C & D mention the Key features		5 Marks
IV.	Viva-Voce		4 Marks
V.	Field Visit Report		3 Marks
VI.	Record Book		3 Marks

Instruction to the Examiners

I. A – any one specimen from Hydrophytes , Xerophytes, Epiphytes and Halophytes
II. B – Water sample / soil sample
III. C – Ecological instruments, Ecological Slides / Specimens, one from each

B.Sc. BOTANY – IV Semester
Open Elective Course (OEC - 4)
(OEC for other students)
Paper: MEDICINAL PLANTS IN HEALTH CARE
Code: OEC-004 BOT 051

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 -004 BOT 051	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

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, Ethnomedicinal plant Gardens.
Propagation of Medicinal Plants: Objectives of the nursery, its classification, important

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*) or wound healing, antioxidant and anticancer properties,

Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy *(Papaver sominiferum*) for analgesic and antitussive, *Salix* for analgesic, *Cincona* and *Artemisia* for Malaria, *Rauwolfia* as tranquilizer, Belladonna (*Atropa belladonna*) 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.

Details of Formative Assessment (IA) For DSCC theory/OEC: 40% weightage for Total Marks

Type of Assessment	Weightage	Duration	Comment
Written Test- 1	10%	1 hrs	8th Week
Written Test- 2	10%	1 hrs	12th Week
Seminar	10%	10 minutes	-----
Case study/ Assignment/ Field work/ Project work/ Activity	10%	-----	-----
Total	40% of the Maximum marks allotted for the Paper		

Faculty of Science
04- Year UG Honors Programme: 2022-23

General Pattern of Theory Question paper for DSCC/ OEC
(60 Marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-6 carries 2 marks each. Answer any 5 questions. :10 marks

Part- B

2. Question number 7-11 carries 5 marks each. Answer any 4 questions. :20 marks

Part- C

3. Question number 12- 15 carries 10 marks each. Answer any 3 question. : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Format for Model Question paper Unit wise

DSCC 034 BOT 011: DSCC ECOLOGY AND CONSERVATION BIOLOGY

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----1 Unit III ----1 Unit IV ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----1 Unit IV ----1 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----1 Unit II ----1 Unit III ----1 Unit IV ----1 Total- 4	3	10	30

OEC-004 BOT 051
MEDICINAL PLANTS IN HEALTH CARE

Question Number	Number of question to be set in Unit	Number of questions to be answered	Marks of each question	Max marks for the question
1	Unit-I ----2 Unit II ----2 Unit III ----2 Total- 6	Lower Order Teaching Skills (LOTS) (Remembering and Learning)		
		5	2	10
2	Unit-I ----1 Unit II ----2 Unit III ----2 Total- 5	High Order Teaching Skills (HOTS) (Analyzing, Evaluating and Creating Descriptive Question)		
		4	5	20
3	Unit-I ----2 Unit II ----1 Unit III ----1 Total- 4	3	10	30

HAVERI UNIVERSITY, HAVERI

B.Sc. (BOTANY)

04 – Year B.Sc. (Hons.) Program

SYLLABUS

[Effective from 2022-2023]

DISCIPLINE SPECIFIC CORE COURSE (DSCC-9 to 12),

FOR SEM - V.

AS PER NEP- 2020

BOTANY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR (V SEM) NEP 2020

Sem.	Type of Course	Theory/ Practical	Course Code	Course Title	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
V	DSCC-9	Theory	**035 BOT 011**	Plant Morphology and Taxonomy	04hrs	56	02 hrs	40	60	100	04
	DSCC-10	Practical	**035 BOT 012**	Plant Morphology and Taxonomy	04 hrs	52	03 hrs	25	25	50	02
	DSCC-11	Theory	**035 BOT 013**	Genetics and Plant Breeding	04hrs	56	02 hrs	40	60	100	04
	DSCC-12	Practical	**035 BOT 014**	Genetics and Plant Breeding	04 hrs	52	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	SEC-3	Practical	**035 BOT 061**		04hrs	52	03 hrs	25	25	50	02
	Total										**26**

B.SC: SEMESTER – V

SUBJECT: BOTANY

THE COURSE BOTANY IN V SEMESTER HAS TWO PAPERS (THEORY PAPER- 035 BOT 011 FOR 04 CREDITS AND PRACTICAL PAPER- 035 BOT 012 FOR 02 CREDITS) FOR 06 CREDITS: BOTH THE PAPERS ARE COMPULSORY, DETAILS OF THE COURSES ARE AS

TITLE OF THE COURSE:

PLANT MORPHOLOGY AND TAXONOMY (THEORY)

COURSE CODE: 035 BOT 011

THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-9)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**PLANT MORPHOLOGY AND TAXONOMY (THEORY)**		
Course Code:	**035 BOT 011**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COS):

After the successful completion of the course, the student will be able to:

CO1. Understanding the main features in Angiosperm evolution

CO2. Ability to identify, classify and describe a plant in scientific terms, thereby, Identification of plants using dichotomous keys. Skill development in identification and classification of flowering plants.

CO3. Interpret the rules of ICN in botanical nomenclature.

CO4. Classify Plant Systematic and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.

CO5. Recognition of locally available angiosperm families and plants and economically important plants. Appreciation of human activities in conservation of useful plants from the past to the present.

CONTENTS	56 Hrs
Unit 1:	**16 hrs**
Morphology of Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham& Hooker's, Engler and Prantl's system and APG IV System (2016).-Merits and demerits of classification. **Taxonomic literatures:** Floras, Monograph. Revisions, Journals. **Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the world and India. Technique of Herbarium Preparation and role of botanical gardens. **Virtual herbarium;** E-flora; Documentation.	
Unit 2:	**12 hrs**
Taxonomic Hierarchy: Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Modes of speciation. Problems with species concepts. Rank less system of phylogenetic systematics **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication, rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species.	
Unit 3:	**18 hrs**
Plant identification: Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (brief account only). **Plant descriptions**: Common Terminologies used for description of vegetative and reproductive parts of the following families. **Study of the diagnostic features of Angiosperm families:** Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae (with sub Families), Myrtaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae.	
Unit 4:	**10 hrs**
Biometrics, Numerical Taxonomy; Phenetics and Cladistics: Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).	

Origin and evolution of angiosperms; Co-evolution of angiosperms and animals; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram). **Plant Taxonomic Evidences:** from palynology embryology, cytology, phytochemistry and molecular data. Field inventory.	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Test-I (Objective type)	10
Test-II (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: PLANT MORPHOLOGY AND TAXONOMY (PRACTICAL)

COURSE CODE: 035 BOT 012

PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-10)

Program Name	**B.Sc. in BOTANY**		Semester	**V**
Course Title	**PLANT MORPHOLOGY AND TAXONOMY (PRACTICAL)**			
Course Code:	**035 BOT 012**		No. of Credits	**02**
Contact hours	**52 Hours**		Duration of Exam	**3 hours**
Formative Assessment Marks		**25**	Summative Assessment Marks	**25**

LIST OF EXPERIMENTS TO BE CONDUCTED

1. Study of root, stem and leaf structure and modifications. Study of inflorescence types. Study of flower and its parts, Study of fruits. Floral diagram and floral formula. **04 hrs**

2. Study of 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's system of classification) and identify up to species using the flora. **24 hrs**

3. Identification of species using the flora **06 hrs**

4. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilly, Tamarind, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annona muricata Catharanthus roseus*, *Rauvolfia serpentina, Justicia adhatoda*, *Vitex negundo* and *Leucas aspera* **18 hrs**

5. Study tour /Local or Outside area. minimum 3 to 5 days

Submission: Tour report and Herbarium (Preparation of 10 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plants from your locality with herbarium label).and 10 Economic Products

Pedagogy: Teaching and learning, conducting experiments, field visits.

Formative Assessment for Practical	
Assessment Occasion/ type	**Marks**
Test-I	05
Test-II	05
Field visit(Tour report and Herbarium)	10
Submission (any 5 economic plant products)	05
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks Note: Proportionate weightage shall be given to each unit based on the number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1.	Identify, classify and describe the specimen A & B taxonomically	6 Marks
2.	Identify the given specimen C with the help of Key using Flora	4 Marks
3.	Write the floral diagram and floral formula of the given specimen D	2 Marks
4.	Identification of Specimen/slides E, F and G	6 Marks
5.	Viva Voce	2 Marks
6.	Submission and Tour Report	3 Marks
7.	Practical Record	2 Marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B)

Q2. Give specimen from family they studied (C)

Q3. Give specimen from family they studied (D)

Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economic importance (G)

Q5. Viva

Q6. Submission of 5 Herberium or Economically important Products (Practical Tour report)

Q7 Record book

Note: Same Scheme may be used for IA (Formative Assessment) examination

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 Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern 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.

TITLE OF THE COURSE: GENETICS AND PLANT BREEDING (THEORY)

COURSE CODE: 035 BOT 013

THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-11)

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**GENETICS AND PLANT BREEDING (THEORY)**		
Course Code:	**035 BOT 013**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

Course Outcomes (COs):

After the successful completion of the course, the student will be able to:

CO1.Understanding the basics of genetics and plant breeding

CO2.Abilitytoidentify, calculate and describe crossing over, allelic generations and frequencies of recombination.

CO3.Interprettheresults of mating and pollinations. CO4.ClassifyPlantpollination methods

CO5.Recognitiono f modes of inheritance of traits/ phenotypes and Phenotype-genotype correlation.

CONTENTS	**56 Hours**
Unit 1:	**16 hrs**
Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance. Extrachromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast.	

Unit 2:	**16 hrs**
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; Numerical based on 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); Role of Transposons in mutation. DNA repair mechanisms. Fine structure of gene (Population and Evolutionary Genetics, Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation.	
Unit 3:	**12 hrs**
Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement Introduction: Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self-pollination, cross pollination and vegetative Propagation in plants; Hybridization: For self, cross and in plants – Procedure, advantages and limitations.	
Unit 4:	**12 hrs**
Quantitative inheritance Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs polygenic inheritance Inbreeding depression and heterosis. History, 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..	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Test-I (Objective type)	10
Test-II (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: GENETICS AND PLANT BREEDING (PRACTICAL)

COURSE CODE: 035 BOT 014

PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-12)

Program Name	**B.Sc. in BOTANY**		Semester	**V**
Course Title	**GENETICS AND PLANT BREEDING (PRACTICAL)**			
Course Code:	**035 BOT 014**		No. of Credits	**02**
Contact hours	**52 Hours**		Duration of Exam	**3 hours**
Formative Assessment Marks		**25**	Summative Assessment Marks	**25**

Pedagogy: Teaching and learning and conducting experiments.

Practical: Plant breeding: **26 hrs**

1. Reproductive of biology, self and cross pollinated plants; Vegetative reproduction
2. Hybridization: Emasculation, bagging, pollination and production of hybrids and pollen fertility
3. Origin, distribution and centres of diversity of crop plants: Wheat, Sorghum, Rice, Chilly, Sugarcane, Cotton, Potato, coffee, Sunflower and groundnut

Practical: Genetics **26 hrs**

1. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
2. Chromosome mapping using point test cross data.

   Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
3. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1 and 9:3:4).
4. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
5. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.

Formative Assessment for Practical	
Assessment	**Marks**
Test-I	10 Marks
Test-II	10 Marks
Plant breeding station visit report	05 Marks
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

2. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Test the percentage of pollen viability of the given material **A** by hanging drop technique -5 Marks
2. Calculate the recombinant frequency and state the order of gene from the given data **B-** 4 Marks
3. Solve the genetic problem **C** 4 Marks
4. Identification of Specimen/slides/ Photographs **D** and **E** 4 Marks
5. Viva Voce 3 Marks
6. Practical Record book) 5 Marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1 Material Cassia// Hibiscus/ etc (A)

Q2. Mapping using one point / two point test cross data (B)

Q3. Problems on gene interaction (C)

Q4. Down's, Klinefelter's and Turner's syndromes, Translocation Ring, Laggards and Inversion Bridge (D and E)

Q5. Viva Voce

Q6. Practical Record book)

Note: Same Scheme may be used for IA (Formative Assessment) examination

REFERENCES	
1	Acquaah, G. (2007). Principles of Plant Genetics &Breeding.NewJearsey, 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.

B.SC. – V SEMESTER

SUBJECT: BOTANY

SKILL ENHANCEMENT COURSE (SEC-3)

CODE: 035 BOT 061

Program Name	**B.Sc. in BOTANY**	Semester	**V**
Course Title	**NURSERY AND GARDENING (PRACTICAL)**		
Course Code:	**035 BOT 061**	No. of Credits	**02**
Contact hours	**52 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**25**	Summative Assessment Marks	**25**

Title of the Paper:

Nursery and Gardening

Code: 035 BOT 061

Course outcomes (COs):

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

CO1. Know tools and techniques of nursery

CO2. Techniques of vegetative propagation

CO3. Methods to break seed dormancy

CO4. Components of manures and fertilizers

NURSERY AND GARDENING

(Credits: 2)

1. Tools used in nursery and gardening techniques

2. Vegetative propagation techniques: Natural propagation methods

3. Vegetative propagation techniques: artificial propagation methods: cuttings, grafting, air layering and budding

4. Seed structure and types/Seed viability

5. Methods used to break seed dormancy

6. Types of manures: inorganic and organic

7. Common pests and diseases in nursery plants

8. Visit to commercial nursery

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

1. Perform vegetative propagation method in specimen **A** 5 Marks

2. Perform the seed viability test for given specimen **B** **4 Marks**

3. Identify and describe the specimen/tools/photographs of specimen **C, D,** and **E** 6 Marks

4. Viva voce 2 Marks

5. Journal 3 Marks

6. Field visit report 5Marks

Total 25 marks

GENERAL INSTRUCTIONS:

Q1 Vegetative propagation techniques from practical 3 (each one from practical's 1, 6, 7)

Q2 Seed of any kinds

Q3. One from practical 1, practical 6 and one from practical 7 (one from pest and one from disease)

Q4. Viva Voce

Q5. Journal

Q6. Field visit report

References

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.

2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.

3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.

6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

7. Hartmann and Kester. 2017, Plant Propagation: Principles and Practices. (9^{th} Ed.), Pearson Education, Inc., New York.

HAVERI UNIVERITY, HAVERI

04 – Year B.Sc. (Hons.) Programme

SYLLABUS

Subject: Botany

[Effective from 2023-2024]

DISCIPLINE SPECIFIC CORE COURSE (DSCC-13 to 16 AND INTERNSHIP) FOR SEM - VI.

AS PER NEP- 2020

BOTANY AND ANOTHER SUBJECT AS DOUBLE MAJORS IN THIRD YEAR (VI SEM) NEP 2020

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instructionhour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
VI	DSCC-13	Theory	**036 BOT 011**	Cell Biology	04hrs	56	02 hrs	40	60	100	04
	DSCC-14	Practical	**036 BOT 012**	Cell Biology	04 hrs	52	03 hrs	25	25	50	02
	DSCC-15	Theory	**036 BOT 013**	Plant Physiology and Biochemistry	04hrs	56	02 hrs	40	60	100	04
	DSCC-16	Practical	**036 BOT 014**	Plant Physiology and Biochemistry	04 hrs	52	03 hrs	25	25	50	02
	Other subject										04
	Other subject										04
	Other subject										04
	Internship-1		**036 BOT 091**	Internship/ Mini project				50	0	50	02
	Total										**26**

B.SC.: SEMESTER – VI
SUBJECT: BOTANY

THE COURSE BOTANY IN VI SEMESTER HAS TWO PAPERS (THEORY PAPER- 036 BOT 011 FOR 04 CREDITS AND PRACTICAL PAPER- 036 BOT 012 FOR 02 CREDITS) FOR 06 CREDITS: BOTH THE PAPERS ARE COMPULSORY, DETAILS OF THE COURSES ARE AS

TITLE OF THE COURSE: CELL BIOLOGY (THEORY)

COURSE CODE: 036 BOT 011

THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-13)

Program Name	**B.Sc. in BOTANY**	Semester	**VI**
Course Title	**CELL BIOLOGY (THEORY)**		
Course Code:	**036 BOT 011**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COs):

After the successful completion of the course, the student will be able to:

CO1. Understanding of Cell metabolism, chemical composition, physiochemical and functionalorganization of organelle

CO2. Contemporary approaches in modern cell and molecular biology.

CO3.To study the organization of cell, cell organelles and biomolecules (i.e protein, carbohydrate, lipidand nucleic acid)

CO4.To gain knowledge on the activities in which the diverse macro molecules and microscopic structuresinhabiting the cellular world of life are engaged.

CO5.To understand the various metabolic processes such as respiration, photosynthesis etc. which areimportant for life.

CONTENTS	**56 Hrs**
Unit 1:	**18 hrs**
Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryoticcells (primary and secondary wall), Glycocalyx, Cell-cell interactions/ Junctions, pit connections chromosome, its morphology, types and ultra structure (nucleosome model). Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role ofprotein kinases;	
Unit 2:	**12 hrs**
Structure and replication of DNA, Chromosome; structure, Types and Functions Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer. Structure and functions of cell membrane, active and passive transport, proton pumps associated (Na-K, Ca+ calmodulin etc.and their distribution), phagocytosis, pinocytosis, exocytosis.	
Unit 3:	**14 hrs**
Structural organization, function, marker enzymes of the cell organelles, biogenesis of mitochondria and chloroplasts, brief account of transport in mitochondria and chloroplasts (Tim/Tom; Tic/Toc) and semi autonomous nature of mitochondria and chloroplast. Nuclear envelope, structure of nuclear pore complex, nuclear lamina, transport across nuclear membrane, Nucleolus, Study of RNA or rRNA processing.	
Unit 4:	**12 hrs**
Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes. Structure and functions of other cell organelles	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Test-I (Objective type)	10
Test-II (Objective type)	10
Assignments	10
Seminar	10
Total	**40 Marks**
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: CELL BIOLOGY (PRACTICAL)
COURSE CODE: 036 BOT 012
PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-14)

Course Title	**CELL BIOLOGY (PRACTICAL)**	Practical Credits	**02**
Course Code	**036 BOT 012**	Contact Hours	**52 Hours**
Formative Assessment	**25Marks**	Summative Assessment	**25 Marks**
PRACTICAL CONTENT			
1. Study of plant cell structure with the help of epidermal peel mount of Onion/ Rhoeo/ Crinum. 2. Study of cell and its organelles with the help of electron micrographs. 3. Measurement of length and breadth of plant cell using micrometry. 4. Study different stages of mitosis and meiosis (Onion/ Rhoeo/ Crinum) 5. Isolation of cell organelle – Chloroplast. 6. Study of giant Chromosomes			

Formative Assessment for Practical	
Assessment	**Marks**
Test-I	10 Marks
Test-II	10 Marks
Submission of 2 Slides (1 mitotic and 1 meiotic)	05 Marks
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

4. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 25 marks for the Semester end examination

CELL BIOLOGY

Time =03 hrs Marks =25

1.	Preparation of squash/ smear of material A, identify, Sketch and label the any two stages with reasons	06marks
2.	Find out cell length and breadth of the given material B using micrometry	04marks
3.	Mounting of Giant Chromosome	04 Marks
4.	Identify the slides C & D	04 marks
5.	Viva-voce	02 marks
6.	Submission Slides	03 marks
7.	Practical Record Book	02 Marks
	Total 25 marks	

GENERAL INSTRUCTIONS:

Q1. Give specimen from Onion/ Rhoeo/ Crinum plant (A)
Q2. Give specimen from Onion/ Rhoeo leaf (B)
Q3. Larva Chironormus / Drosophila
Q4. Give slide from mitosis (C) meiosis (D)
Q5. Viva-voce
Q6. Submission of Cytological slides
Q7. Prctical Record Book

Note: Same Scheme may be used for IA (Formative Assessment) examination

REFERENCES	
1	Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.:ASM Press & Sunderland, Sinauer Associates, MA
2	Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
3	De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. LippincottWilliams and Wilkins, Philadelphia.
4	Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San fransisco.
5	Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H.Freeman andCompany
6	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.
7	Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8	Verma, P. S. (2004). Cell Biology,Genetics, Molecular Biology: Evoloution and Ecology. India: S. Chand Limited.

TITLE OF THE COURSE: PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)
COURSE CODE: 036 BOT 013
THEORY: DISCIPLINE SPECIFIC CORE COURSE (DSCC-15)

Program Name	**BSc/ BOTANY**	Semester	**VI**
Course Title	**PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (THEORY)**		
Course Code:	**036 BOT 013**	No. of Credits	**04**
Contact hours	**56 Hours**	Duration of Exam	**2 hours**
Formative Assessment Marks	**40**	Summative Assessment Marks	**60**

COURSE OUTCOMES (COs):

After the successful completion of the course, the student will be able to:

CO1. Importance of water and the mechanism of transport.
CO2.To understand biosynthesis and breakdown of biomolecules.
CO3. Role of plant hormones in plant development and about secondary metabolites.
CO4. Preliminary understanding of the basic functions and metabolism in a plant body.
CO5. To understand the importance of nutrients in plant metabolism and crop yield.

CONTENTS	**56 Hrs**
UNIT 1	**16Hrs**
Plant water relations: 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. **Transpiration.** Types and process. Mechanism of guard cell movement. K+ ion mechanism. Antitranspirants. **Mechanism of ascent of sap:** Vital and physical force theories. **Phloem Transport:** Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. **Mineral nutrition:** A brief account on Micro and macro nutrients**.**	
UNIT 2	**12Hrs**
Enzymes - classification, kinetics and mechanism of action. **Proteins and amino acids**: classification, structure - primary, secondary, tertiary and quaternary**.** **Vitamins** - classification, distribution, structure, production, function. **Lipids:** classification, structure, function and biosynthesis of fatty acids. **Secondary plant products**: structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.	
UNIT 3	**14Hrs**
Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration. **Respiration**: aerobic and anaerobic respiration, Glyoxylate, Oxidative Pentose Phosphate Pathway. **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.	
UNIT 4	**14Hrs**
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. Synthetic growth regulators- classification, their effect on plant growth and development. Practical utility in agriculture and horticulture**.** **Sensory Photobiology**: Biological clocks, photoperiodism, function & structure of phytochromes, phototropin & cryptochromes. Senescence, Ageing & Cell Death (PCD and Autophagosis).Plant Movements.	

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Assessment	**Marks**
Test-I (Objective type)	10 Marks
Test-II (Objective type)	10 Marks
Seminar	10 Marks
Assignment	10 Marks
Total	40 Marks
Formative Assessment as per guidelines are compulsory	

TITLE OF THE COURSE: PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY (PRACTICAL)
COURSE CODE: 036 BOT 014
PRACTICAL: DISCIPLINE SPECIFIC CORE COURSE (DSCC-16)

Course Title	**PLANT PHYSIOLOGY AND BIOCHEMISTRY (PRACTICAL)**	Practical Credits	**2**
Course Code	**036 BOT 014**	Contact Hours	**52 Hours**
Formative Assessment	**25 Marks**	Summative Assessment	**25 Marks**

PRACTICAL CONTENT

1. Experiment to demonstrate the phenomenon of osmosis by physical and physiological method.
2. To determine the osmotic pressure of the cell sap by plasmolytic method.
3. To demonstrate root pressure / transpiration pull in plants.
4. To compare the rate of transpiration from the two surfaces of leaf by using Garrreau's potometer.
5. Experiment to measure the transpiration by using Ganong's photometer.
6. To demonstrate that oxygen is liberated in the process of photosynthesis.
7. Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
8. Experiment to demonstrate the fermentation.
9. To isolate and identify the amino acids from a mixture using paper chromatography.
10. Study of plant movements.
11. Qualitative test for Starch, Protein, Sugars and Lipids.
12. Estimation of TAN (Titratbale acid Number) from *Bryophyllum* leaves/*Aloe vera*.

Pedagogy: Teaching and learning, Seminar, Assignments, etc

Formative Assessment for Practical	
Assessment	**Marks**
Test-I	10 Marks
Test-II	10 Marks
Project report / Industrial visit	05 Marks
Total	**25 Marks**
Formative Assessment as per guidelines are compulsory	

GENERAL PATTERN OF THEORY QUESTION PAPER

(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions: 10 marks

Part-B

11. Question number 07- 11 carries 05 Marks each. Answer any 04 questions: 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub-questions for 7+3 or 6+4 or 5+5if necessary)

Total: 60

MarksNote: Proportionate weightage shall be given to each unit based on number of hours prescribed.

SCHEME OF PRACTICAL EXAMINATION

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Time =03 hrs **Marks =25**

1. Conduct Major Experiment A 06 marks
2. Comment on minor Experiments B & C 06 marks
3. Micro Chemical test D 03 marks
4. Viva-voce 05 marks
5. Practical Record/ Journal 05 marks

Instruction to the Examiners

A – Practical's 2, 3, 4, 5, 7, 9, 12,

B - Practical's 1, 6, 8, 10, 11

C – Starch, Protein, Sugar & Lipids

References

1. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc. Wilson, K. and Walker, J. 1994
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INTERNSHIP/ MINI PROJECT FOR VI SEMESTER

Type of Course	Theory/ Practical	Course Code	CourseTitle	Instructionhour/ week	Total hours / sem	Duration of Exam	Marks			Credits
							Formative	Summative	Total	
Internship-1		**036 BOT 091**	Internship/ Mini project				50	0	50	02