AC 25.04.24 ITEM NO: 25.3

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Autonomy based

Syllabus for

Program: Bachelor of Science

Course: T.Y.B.SC.

Subject: BOTANY

Choice Based Credit System (CBCS)
with effect from
Academic Year 2024-2025

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in **Science** Program will be able to	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

Deccan Education Society's
Kirti M. Doongursee College (Autonomous)
Proposed Curriculum as per Autonomy.
Year of implementation- 2024-25
Name of the Department: BOTANY

Semester	Course Code	Course Title	Credit
V	KUSBOT24501	PLANT DIVERSITY III	2.5
	KUSBOT24502	PLANT DIVERSITY IV	2.5
	KUSBOT24503	FORM AND FUNCTION III	2.5
	KUSBOT24504	CURRENT TRENDS IN PLANT SCIENCES II	2.5
	KUSBOT24P5	Practicals based on Two Courses in Theory (501 & 502) – 6 Units	3
	KUSBOT24P6	Practicals based on Two Courses in Theory (503 &504) – 6 Units	3
			16
VI	KUSBOT24601	PLANT DIVERSITY III	2.5
	KUSBOT24602	PLANT DIVERSITY IV	2.5
	KUSBOT24603	FORM AND FUNCTION III	2.5
	KUSBOT24604	CURRENT TRENDS IN PLANT SCIENCES II	2.5
	KUSBOT24P7	Practicals based on Two Courses in theory (601 & 602) – 6 Units	3
	KUSBOT24P8	Practicals based on Two Courses in theory (603 & 604) – 6 Units	3
			16

NB: The syllabus is likely to change, subject to the revision that might be recommended by University of Mumbai.

Course Code	SEM – V: BOTANY-	Credits	Lectures/Week
KUSBOT24501	PLANT DIVERSITY – III	2.5	4

Course Outcomes:

After successful completion of this course, students would be able to

- To gain knowledge about microbial diversity and techniques for culturing and visualization.
- To understand the salient features of three major groups of algae, their life cycle patterns with a suitable example; to be able to identify them.
- To learn the general characteristics and classification of two major groups of fungi along with life cycles of each group; to be able to identify them.
- To understand the scope and importance of Plant Pathology and apply the concepts of various control measures of commonly widespread plant diseases.

Unit	Topics	No of Lectures
I	**MICROBIOLOGY** • **Types of Microbes:** Viruses, Bacteria, Algae, Fungi, Protozoa, Mycoplasma and Actinomycetes. • **Culturing:** Sterilization, media, staining, colony characters. • **Pure cultures**	**15**
II	**ALGAE (G.M. SMITH CLASSIFICATION SYSTEM TO BE FOLLOWED)** • Division Rhodophyta: Classification and General Characters: Distribution, Cell structure, pigments, reserve food, range of thallus, reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of *Polysiphonia*,	**15**

	Batrachospermum. • Classification and General Characters of Xanthophyta: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of *Vaucheria.* • Classification and General Characters of Bacillariophyta: Distribution, Cell structure, pigments, reserve food, range of thallus, Reproduction: asexual and sexual, Alternation of Generations, Economic Importance. • Structure, life cycle and systematic position of *Pinnularia.*	
III	**FUNGI (G.M. SMITH CLASSIFICATION SYSTEM TO BE FOLLOWED)** • Basidiomycetes: Classification and General characters ➢ Life cycle of Agaricus ➢ Life cycle of Puccinia • Deuteromycetae: Classification and General Characters • Life cycle of Alternaria	**15**
IV	**PLANT PATHOLOGY** • **Study of plant diseases:** Causative organism, symptoms, predisposing factors, disease cycle and control measures of the following. ➢ White Rust –Albugo candida ➢ Tikka disease of ground nut: Cercospora ➢ Damping off disease: Pythium ➢ Citrus canker –Xanthomonas axonopodis pv. citri ➢ Leaf curl – leaf curl virus in Papaya. • Study of Physical, chemical and biological control methods of plant diseases.	**15**

Reference books:

1. Industrial Microbiology by Cassida, New Age International, New Delhi
2. Industrial Microbiology Mac Millan Publications, New Delhi
3. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
4. Cryptogamic Botany Vol I and II by G M Smith, Mcg raw Hill
5. A text Book of Palynology by K Bhattacharya, New Central Book Agency Pvt. Ltd., London
6. Book for Degree Students- Algae by B R Vasistha, A.K.Sinha, S Chand Publication.
7. Book for Degree Students- Bryophytes by B R Vasistha, A.K.Sinha, S Chand Publication.
8. Text book of Algae Bilgrami K. S CBS Publishers
9. Textbook Of Microbiology 5th Edition by Dubey R C & Maheshwari D. K. - S Chand & Company
10. Textbook Of Microbiology 5Th Edition May 2016 By Arora And Arora by D R Arora and Brij Bala Arora, CBS PUBLICATION.

Course Code	**SEM – V: BOTANY-**	**Credits**	**Lectures/Week**
KUSBOT24502	**PLANT DIVERSITY – IV**	**2.5**	**4**

Course Outcomes:

After successful completion of this course, students would be able to

- To acquire knowledge of different fossil forms and understand their role in evolution.describe plant cell structure and Genetic terminology.
- To provide plant description, describe the morphological and reproductive structures of seven families and also identify and classify according to Bentham and Hooker's system.
- To gain proficiency in the use of keys and identification manuals for identifying any unknown plants to species level.
- To relate anomalies in internal stem structure with function and appreciate the salient features of the root stem transition zone.
- To get exposure to pollen study and learn to apply it in various fields.

Unit	Topics	No of Lectures
I	**PALEOBOTANY** • *Lepidodendron*– All form genera root, stem, bark, leaf, male and female fructification. • *Lyginopteris*– All form genera root, stem, leaf, male and female fructification. • *Pentoxylon*– All form genera. • Contribution of Birbal Sahni, Birbal Sahni Institute of Paleobotany, Lucknow.	**15**
II	**ANGIOSPERMS I** • Morphology of flower – All Parts of Flower. • Complete classification of Bentham and Hooker (only for prescribed families), Merits and demerits. • Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic and medicinal importance for members of the families. (Special stress on fruit morphology to be given) ➢ Capparidaceae ➢ Umbelliferae ➢ Cucurbitaceae ➢ Rubiaceae ➢ Solanaceae ➢ Commelinaceae ➢ Graminae	**15**

III	**ANATOMY I** • **Anomalous secondary growth** in the Stems of *Bignonia*, *Salvadora*, *Achyranthes*, *Dracaena*. Storage roots of Beet, Radish • **Root stem transition** • **Types of Stomata**– Anomocytic, Anisocytic, Diacytic, Paracytic and Graminaceous	**15**
IV	**PALYNOLOGY** • **Pollen Morphology** • **Pollen viability**–storage • Germination and growth of pollen • Application of Palynology in honey industry, coal and oil exploration, Aerobiology and pollen allergies, forensic science	**15**

Reference books:

1. An introduction to Embryology of Angiosperms by P Maheshwari, McGraw Hill Book Co.
2. Plant Systematics by Gurcharan Singh, Oxford and IBH Publ.
3. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publ.
4. A text Book of Palynology by K Bhattacharya, New Central Book Agency Pvt. Ltd., London
5. Pollen Morphology and Plant Taxonomy by G. Erdtman, Hafner Publ. Co., N.Y.
6. Embryology of Plants by Bhojwani and Bhatnagar

Course Code	SEM – V: BOTANY-	Credits	Lectures/Week
KUSBOT24503	FORM AND FUNCTIONS- III	2.5	4

Course Outcomes:

After successful completion of this course, students would be able to

- To acquire knowledge about two important organelles and molecular mechanisms of translation.
- To understand water relations of plants, inorganic and organic solute transport, and apply the knowledge to manage mineral nutrition and survival in challenging abiotic stresses.
- To understand succession in plant communities and study remediation technologies in order to apply knowledge acquired for cleanup of polluted sites.
- To get exposure to principles and techniques of plant tissue culture and apply these studies for improving agriculture and horticulture and to become an entrepreneur.

Unit	Topics	No of Lectures
I	**CYTOLOGY AND MOLECULAR BIOLOGY** • Structure and function of nucleus • Structure and function of vacuole • Structure and function of giant chromosomes • The genetic code: Characteristics of the genetic code • Translation in Prokaryotes and Eukaryotes. .	**15**
II	**PLANT PHYSIOLOGY I** • **Water relations:** Potential, osmosis, transpiration, imbibition, • **Solute transport:** Transport of ions across cell membranes, active and passive transport, carriers, channels and pumps.	**15**

	• **Translocation of solutes:** Composition of phloem sap, girdling experiment. • **Pressure flow model (Munch's hypothesis):**Phloem loading and unloading, anatomy of sieve tube elements and mechanisms of sieve tube translocation. • **Mineral Nutrition:** Role of Macro and Micro nutrients, physiological functions and deficiency symptoms.	
III	**ENVIRONMENTAL BOTANY** • **Bioremediation:** Principles, factors responsible and microbial population in bioremediation. • **Phytoremediation**: Metals, Organic pollutants • **Plant succession**: Hydrosere and Xerosere – Formation of Barren Space, Succession on the Land Citing Different Seres leading up to the Climax, Succession in Water, Ecesis, Poly and Mono-climax theories.	**15**
IV	**PLANT TISSUE CULTURE** • **Aspects of Micro-propagation with reference to Floriculture:** Detailed study of Orchid Cultivation • **Plant cell suspension cultures for the production of secondary metabolites:** With special reference to Shikonin production. • Somatic Embryogenesis and Artificial Seeds. • **Protoplast Fusion and Somatic Hybridization:** i) Concept, Definition, and various methods of Protoplast Fusion ii) Applications of Somatic Hybridization in Agriculture	**15**

Reference books:

1. Introduction to Plant Physiology by Noggle and Fritz, Prentice Hall Publishers(2002)
2. Plant Physiology by Salisbury and Ross CBS Publishers
3. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. Publishers,2002
4. Physiological Plant Anatomy by Haberlandt, Mac Millan and Company
5. Plant Biotechnology by K. Ramawat

6. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Dr. P. S. Verma, Dr.V. K. Agarwal, S. Chand publication

Course Code	**SEM – V: BOTANY**	**Credits**	**Lectures/Week**
KUSBOT24504	**CURRENT TRENDS IN PLANT SCIENCES – II**	**2.5**	**4**

Course Outcomes:

After successful completion of this course, students would be able to

- To get exposure to the technique of mushroom cultivation and explore the possibility of entrepreneurship in the same.
- To learn ethnobotanical principles, applications and utilize indigenous plant knowledge for the cure of common human diseases and improvement of agriculture.
- To gain knowledge about the latest molecular biology techniques for isolation and characterization of genes.
- To learn principles and application of commonly used techniques in instrumentation.
- To gain proficiency in the monograph study and pharmacognostic analysis of six medicinal plants.

Unit	**Topics**	No of Lectures
I	**ETHNOBOTANY AND MUSHROOM INDUSTRY** • **Ethnobotany**- Definition, history, sources of data and methods of study. • **Applications of ethnobotany:** ➢ Ethno-medicines.	15

	➢ Agriculture. ➢ Edible plants. • **Traditional medicines** used by tribals in Maharashtra towards ➢ Skin ailments: *Rubia cordfolia, Sandalwood* ➢ Liver ailments: *Phyllanthus, Andrographis* ➢ Wound healing and ageing: *Centella, Typha, Terminalia, Tridax.* ➢ Fever: *Vitex negundo, Tinospora cordifolia* leaves ➢ Diabetes: *Momordica charantia, Syzygium cuminii* • **Mushroom industry:** ➢ Detail general account of production of mushrooms with respect to methods of Composting, spawning, casing, harvesting of mushroom. Cultivation of *Pleurotus, Agaricus, Volvariella* mushroom. ➢ General account of mushrooms: Nutritional value, picking and packaginig , economic importance.	
II	**PLANT BIOTECHNOLOGY I** • Construction of genomic DNA libraries, Chromosome libraries and c- DNA libraries. • Identification of specific cloned sequences in c-DNA libraries and Genomic libraries • **Analysis of genes and gene transcripts –**Restriction enzyme, analysis of cloned DNA sequences. Hybridization(Southern Hybridization)	**15**
III	**INSTRUMENTATION** • **Colorimetry and Spectrophotometry** (Visible, UV and IR) – Instrumentation, working, principle and applications. • **Chromatography:** General account of Column chromatography. Principle and bedding material involved in adsorption and partition chromatography, ion exchange Chromatography, molecular sieve chromatography.	**15**

IV	**PHARMACOGNOSY AND MEDICINAL BOTANY** • Monographs of drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants- *Strychnos* seeds, *Senna* leaves, Clove buds, *Allium sativum, Acorus calamus* and *Curcuma longa*	**15**

Reference books:

1. A handbook of Ethnobotany by S.K. Jain, V. Mudgal
2. Plants in folk religion and mythology (Contribution to Ethnobotany by S.K.Jain3rdRev.Ed.).
3. Plant Biotechnology by K. Ramawat
4. Ayurveda Ahar by P H Kulkarni

SEMESTER V-PRACTICAL

Course Code	SEM V -Botany practical	Credits	Lectures/ Week
KUSBOT24P5	PRACTICAL PAPER I–PLANT DIVERSITY III	1.5	

Microbiology

- Study of aeromicrobiota by petriplate exposed method: Fungal culture, Bacterial culture.
- Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected microorganism.
- Study of antimicrobial activity by the disc diffusion method.

Algae (G.M. Smith Classification System to be followed)

- Study of stages in the life cycle of the following Algae from fresh / preserved material and permanent slides.
  - *Polysiphonia*
  - *Batrachospermum*
  - *Vaucheria*
  - *Pinnularia*

Fungi (G.M. Smith Classification System to be followed)

- Study of stages in the life cycle of the following Fungi from fresh / preserved material and permanent slides
  - *Agaricus*
  - *Puccinia*
  - *Alternaria*

Plant Pathology

- Study of the following fungal diseases:
  - White rust in Cruciferae (Brassicaceae)

- Tikka disease in Groundnut
- Damping off disease
- Citrus canker
- Leaf curl in *Papaya Leaf*

Course Code	**SEM V -Botany practical**	**Credits**	**Lectures/ Week**
KUSBOT24P5	**PRACTICAL PAPER II–PLANT DIVERSITY IV**	**1.5**	

Paleobotany

- Study of the following form genera with the help of permanent slides/ photomicrographs.

- *Lepidodendron*
- *Lyginopteris*
- *Pentoxylon*

Angiosperms I

- Morphology of Flower – All Parts of Flower
- Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification.

- Capparidaceae
- Umbelliferae
- Cucurbitaceae
- Rubiaceae
- Solanaceae
- Commelinaceae
- Graminae

- Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families

- Identifying the genus and species of a plant with the help of Flora

Anatomy I

- Study of anomalous secondary growth in the stems of the following plants using double staining technique.

1) Bignonia

2) Salvadora

3) Achyranthes

4) Dracaena

- Study of anomalous secondary growth in the roots of

1) Beet

2) Radish

- Types of Stomata

1) Anomocytic

2) Anisocytic

3) Diacytic

4) Paracytic

5) Graminaceous

Palynology I

- Study of pollen morphology (NPC Analysis) of the following by Chitale's Method

- *Hibiscus*
- *Datura*
- *Ocimum*
- *Crinum*
- *Pancratium*
- *Canna*

- Determination of pollen viability
- Pollen analysis from honey sample – unifloral and multifloral honey

• Effect of varying concentration of sucrose on *In vitro* Pollen germination

Course Code	SEM V -Botany practical	Credits	Lectures/ Week
KUSBOT24P6	**PRACTICAL –PAPER III FORM AND FUNCTION III**	**1.5**	

Cytology and Molecular Biology

- Mounting of Giant chromosomes from *Chironomous* larva
- Smear preparation from *Tradescantia* buds
- Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation(Eukaryotic)

Plant Physiology I

- Estimation of Phosphate phosphorus (Plant acid extract)
- Estimation of Iron (Plant acid extract)

Note: Preparation of a standard graph and determination of the multiplication factor for Phosphate / Iron estimation using a given standard phosphate / Standard Iron solution should be done in regular practical as this will also be put as a question in practical exam

Environmental Botany

- Estimation of the following in given water sample
  - Dissolved oxygen demand
  - Biological oxygen demand
  - Hardness
  - Salinity and Chlorinity

Micropropagation

- Plant Tissue culture:
- Identification – Multiple shoot culture, hairy root culture, somatic

embryogenesis

- Preparation of stock solutions for preparation of MS medium

(Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).

Course Code	**SEM V-Botany practical**	**Credits**	**Lectures/ Week**
KUSBOT24P6	**PRACTICAL – PAPER IV CURRENT TRENDS IN PLANT SCIENCES II**	**1.5**	

Ethnobotany and mushroom industry

- Study of plants mentioned in theory for Ethnobotany
- Mushroom cultivation (To be demonstrated)
- Identification of various stages involved in mushroom cultivation – spawn, pin head stage, mature/ harvest stage of *Agaricus, Pleurotus, Volvariella*

Biotechnology I

- Growth curve of E. coli
- Plasmid DNA isolation and Separation of DNA using AGE
- Restriction mapping (problems), Southern blotting

Instrumentation

- Demonstration of Beer Lambert's Law
- Experiment based on ion exchange chromatography for demonstration
- Experiment based on separation of dyes/ plant pigments using silica gel column.

Pharmacognosy

- Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants.

- *Allium sativum*
- *Acorus calamus*
- *Curcuma longa*
- *Senna angustifolia*
- *Strychnos nux-vomica*
- *Eugenia caryophyllata*

Course Code	SEM – VI BOTANY	Credits	Lectures/ Week
KUSBOT24601	PLANT DIVERSITY – III	2.5	

Course Outcomes:

After successful completion of this course, students would be able to

- To identify, describe and study in detail the life cycles of three Bryophytes.
- To and study in detail classification and general characters of three classes of Pteridophytes and identify as well as describe the life cycles of one
- To study evolutionary aspects and economic utilization of Bryophytes and Pteridophytes.
- To identify, describe and study in detail the life cycles of three Gymnosperms.

Unit	Topics	No of Lectures
I	**BRYOPHYTA (G. M. SMITH CLASSIFICATION SYSTEM TO BE FOLLOWED)** Structure, life cycle, systematic position and alternation of • Life cycle of *Marchantia* • Life cycle of *Pelia* • Life cycle of *Sphagnum*	**15**
II	**PTERIDOPHYTE (G. M. SMITH CLASSIFICATION SYSTEM TO BE FOLLOWED)** • Lepidophyta – Classification, general characters; Life cycle of • *Lycopodium* • Calamophyta – Classification, general characters; Life cycle of • *Equisetum*	**15**

	• Pterophyta - Classification, general characters; Life cycle of *Adiantum* and *Marselia*	
III	**BRYOPHYTES AND PTERIDOPHYTES: APPLIED ASPECTS** • Ecology of Bryophytes. • Economic importance of Bryophytes. • Bryophytes as Indicators. • Evolution of Sporophyte and Gametophyte in Bryophytes. • Economic importance of Pteridophytes • Diversity and distribution of Indian Pteridophytes • Types of Sori and Evolution of Sori in Pteridophytes.	**15**
IV	**GYMNOSPERMS (CHAMBERLAIN'S CLASSIFICATION SYSTEM TO BE FOLLOWED)** • Life cycle of *Thuja*, • Life cycle of *Gnetum* • Life cycle of *Ephedra.* • Economic importance of Gymnosperms	**15**

Reference books:

1. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
2. Cryptogamic Botany Vol I and II by G M Smith, Mcg raw Hill

Course Code	SEM – VI BOTANY	Credits	Lectures/ Week
KUSBOT24602	PLANT DIVERSITY – IV	2.5	

Course Outcomes:

After successful completion of this course, students would be able to

- To study contribution of Botanical gardens, BSI to Angiosperm study and provide plant description, describe the morphological and reproductive structures of seven families.
- To gain exposure to a phylogenetic system of classification.
- To gain insight into the anatomical adaptations of different ecological plant groups.
- To understand development plant of male and female gametophytes, embryonic structure and development.
- To understand the different aspects and importance of Biodiversity and utilize them for conservation of species so as to prevent further loss or extinction of Biodiversity and preserve the existing for future generations.

Unit	Topics	No of Lectures
I	**ANGIOSPERMS II** • **Major Botanic gardens of India**– Indian Botanic Garden, Howrah; National Botanic Garden (NBRI) Lucknow; Lloyd Botanic Garden, Darjeeling; Lalbaugh Botanic Garden, Bangaluru. • Botanical survey of India and regional branches of India • Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families and economic importance, medicinal importance and fruit morphology for members of the families	**15**

	➢ Rhamnaceae ➢ Combretaceae ➢ Asclepiadaceae ➢ Labiatae ➢ Euphorbiaceae ➢ Cannaceae • Hutchinson's classification system of Angiosperms Brief Introduction, Merits and Demerits of Hutchinson's Classification System	
II	**ANATOMY II** • **Ecological anatomy** ➢ Hydrophytes – submerged, floating, rooted ➢ Hygrophytes -*Typha* ➢ Mesophytes ➢ Sciophytes ➢ Halophytes ➢ Epiphytes ➢ Xerophytes	**15**
III	**EMBRYOLOGY** • **Microsporogenesis** • **Megasporogenesis**- Development of monosporic type, examples of all embryo sacs • Types of ovules • Double fertilization • Development of embryo–*Capsella*	**15**
IV	**PLANT GEOGRAPHY** • **Phytogeographical regions of India**. • **Biodiversity**: ➢ Definition, diversity of flora found in various forest types of India	**15**

	➢ Levels of biodiversity ➢ Importance and status of biodiversity ➢ Loss of biodiversity ➢ Conservation of biodiversity ➢ Genetic diversity- Molecular characteristics	

Reference books:

1. An introduction to Embryology of Angiosperms by P Maheshwari, McGraw Hill Book Co.
2. Plant Systematics by Gurcharan Singh, Oxford and IBH Publ.
3. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publ.
4. Physiological Plant Anatomy by Haberlandt, Mac Millan and Company

Course Code	**SEM – VI BOTANY**	**Credits**	**Lectures/ Week**
KUSBOT24603	**FORMS AND FUNCTION – III**	**2.5**	

Course Outcomes:

After successful completion of this course, students would be able to

- To study various plant biomolecular structures and appreciate the structures, role, functions and applications of enzymes.
- To gain insight into the Nitrogen and plant hormone metabolism with applications of the same in agriculture and horticulture.
- To understand principles of genetic mapping , mutations and solve problems based on them, gain knowledge of various metabolic disorders and their implications.
- To generate and test hypotheses, make observations, collect data, analyze and interpret results, derive conclusions, and evaluate their significance within a broad scientific context, using suitable statistical techniques.

Unit	Topics	No of Lectures
I	**PLANT BIOCHEMISTRY** • **Structure of biomolecules:** Carbohydrates (sugars, starch, cellulose, pectin, lipids (fatty acids and glycerol), proteins (amino acids) • **Enzymes:** Nomenclature, classification, mode of action, Enzyme kinetics, Michaelis-Menten equation, competitive, noncompetitive and un-competitive inhibitors.	**15**
II	**PLANT PHYSIOLOGY II** • **Nitrogen Metabolism:** Nitrogen cycle, root nodule formation, and leghaemoglobin, nitrogenase activity, assimilation of nitrates, (NR, NiR activity), assimilation of ammonia, (amination and transamination reactions), nitrogen assimilation and carbohydrate utilization. • Physiological effects and commercial applications of Auxins, Gibberillins, Cytokinins and Abscisic acid	**15**
III	**GENETICS** • **Genetic mapping in eukaryotes:** discovery of genetic linkage, gene recombination, construction of genetic maps, three- point crosses and mapping chromosomes, problems based on the same • **Gene mutations:** definition, types of mutations, causes of mutations, induced mutations, the Ame's test • **Metabolic disorders**– enzymatic and non-enzymatic: Gene control of enzyme structure Garrod's hypothesis of inborn errors of metabolism, Phenyl ketone urea.	**15**

IV	**BIOSTATISTICS** • Test of significance student's *t*-test – Paired and Unpaired. • Regression. • ANOVA (one way).	**15**

Reference books:

1. Introduction to Plant Physiology by Noggle and Fritz, Prentice Hall Publishers(2002)
2. Plant Physiology by Salisbury and Ross CBS Publishers
3. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. Publishers,2002
4. Practical Biochemistry by David Plummer, McGraw Hill Publ.
5. DNA barcoding plants: taxonomy in a new perspective 2010. K Vijayan and C H Tsou, Current Science, 1530 –1541.
6. Introduction to Biostatistics by P K Banerjee, Chand Publication.
7. Genetics by Russel Peter Adison Wesley Longman Inc. (5thedition)
8. An introduction to Genetic analysis Griffith Freeman and Company(2000)
9. Fundamentals of Biostatics by Rastogi, Ane Books Pvt. Ltd.(2009).

Course Code	**SEM – VI BOTANY**	**Credits**	**Lectures/ Week**
KUSBOT24604	**Current Trends in Plant Science – II**	**2.5**	

Course Outcomes:

After successful completion of this course, students would be able to

- To gain insight into recent molecular biology techniques for DNA analysis and amplification and Barcoding techniques and applications therein.
- To understand and apply tools of Bioinformatics for data retrieval and phylogenetic analysis.
- To learn about the sources of economically important plants in the field of fats and oils and apply it for extraction, dealing with entrepreneurship in the field.
- To gain knowledge and proficiency in preservation of post-harvest produce and explore the

	possibility of entrepreneurship in the field.	
Unit	**Topics**	**No of Lectures**
I	**PLANT BIOTECHNOLOGY II** • **DNA sequence analysis**– Maxam – Gilbert Method and Sanger's method, Pyro Sequencing. • Polymerase Chain Reaction (PCR). • **DNA barcoding:** Basic features, nuclear genome sequence, chloroplast genome sequence, *rbc*L gene sequence, *mat* K gene sequence, present status of barcoding in plants.	**15**
II	**BIOINFORMATICS** • Organization of biological data, databases • Exploration of data bases, retrieval of desired data, BLAST. • Protein structure analysis and application • Multiple sequence analysis and phylogenetic analysis	**15**
III	**ECONOMIC BOTANY** • **Essential Oils:** Extraction, perfumes, perfume oils, oil of Rose, Sandalwood, *Patchouli*, *Champaca*, grass oils: *Citronella*, Vetiver. • **Fatty oils:** Drying oil (Linseed and Soyabean oil), semidrying oils (Cotton seed, Sesame oil) and non-drying oils (Olive oil and Peanut oil), • **Vegetable Fats**: Coconut and Palm oil	**15**
IV	**POST HARVEST TECHNOLOGY** • **Storage of Plant Produce –**Preservation of Fruits and Vegetables ➢ Drying (Dehydration) – Natural conditions – Sun drying, Artificial Drying – Hot Air Drying, Vacuum Drying, Osmotically Dried Fruits, Crystallized or Candied Fruits, Fruit	**15**

	Leather, Freeze Drying) ➢ Freezing (Cold Air Blast System, Liquid Immersion method, Plate Freezers, Cryogenic Freezing, Dehydro-Freezing, Freeze Drying), ➢ Canning ➢ Pickling (in Brine, in Vinegar, Indian Pickles) ➢ Sugar Concentrates (Jams, Jellies, Fruit juices) ➢ Food Preservatives ➢ Use of Antioxidants in Preservation	

Reference books:

1. A handbook of Ethnobotany by S.K. Jain, V. Mudgal
2. Plants in folk religion and mythology (Contribution to Ethnobotany by S.K.Jain3rdRev.Ed.).
3. Plant Biotechnology by K. Ramawat
4. Pharmacognosy by Kokate, Purohit and Gokhale, Nirali Publications
5. Bioinformatics by Sunder Rajan
6. Instant Notes on Bioinformatics by Westhead (2002), Taylor Francis Publications.
7. Bioinformatics by Ignasimuthu
8. DNA barcoding plants: taxonomy in a new perspective 2010. K Vijayan and C H Tsou, Current Science, 1530 –1541.
9. Economic Botany by A F Hill, TATA McGRAW-HILL Publishing Co. Ltd.
10. Post-Harvest Technology by Verma and Joshi, Indus Publication

SEMESTER VI-PRACTICAL

Course Code	SEM VI -Botany practical	Credits	Lectures/ Week
KUSBOT24P7	PRACTICAL PAPER I–PLANT DIVERSITY III	1.5	

Bryophyta (G.M. Smith Classification System to be followed)

- Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides
  - *Marchantia*
  - *Pelia*
  - *Sphagnum*

Pteridophyta (G.M. Smith Classification System to be followed)

- Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides
  - *Lycopodium*
  - *Equisetum*
  - *Adiantum*
  - *Marselia*

Bryophytes and Pteridophytes: Applied aspects

- Economic importance of Bryophyta
- Economic importance of Pteridophyta
- Types of Sporophytes in Bryophyta (from Permanent slides)
- Types of Sori and Soral Arrangement in Pteridophytes

Gymnosperms (Chamberlain's Classification System to be followed)

- Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides
  - *Thuja*
  - *Gnetum*

- *Ephedra*

- Economic importance of Gymnosperms

Course Code	SEM VI -Botany practical	Credits	Lectures/ Week
KUSBOT24P7	PRACTICAL PAPER II–PLANT DIVERSITY IV	1.5	

Angiosperms II

- Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification.
  - Rhamnaceae
  - Combretaceae
  - Asclepiadaceae
  - Labiatae
  - Euphorbiaceae
  - Cannaceae
- Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families
- Identify the genus and species with the help of flora

Anatomy II

- Study of Ecological Anatomy of
  - Hydrophytes: *Hydrilla* stem, *Nymphaea* petiole, *Eichhornia* offset
  - Epiphytes: Orchid
  - Sciophytes: *Peperomia* leaf
  - Xerophytes: *Nerium* leaf, *Opuntia phylloclade*
  - Halophytes: *Avicennia* leaf and pneumatophore, *Sesuvium* / *Sueda* leaf
  - Mesophytes: *Vinca* leaf

Embryology

• Study of various stages of Microsporogenesis, Megasporogenesis and Embryo Development with the help of permanent slides / photomicrographs • Mounting of Monocot (Maize) and Dicot (Castor and Gram)embryo • *In vivo* growth of pollen tube in *Portulaca /Vinca*
Plant Geography • Study of phytogeographic regions of India • Preparation of vegetation map using Garmin's GPS Instrument • Problems based on Simpson's diversity Index

Course Code	**SEM VI -Botany practical**	**Credits**	**Lectures/ Week**
KUSBOT24P8	**PRACTICAL –PAPER III FORM AND PRACTICAL PAPER III–FORM AND FUNCTION III**	**1.5**	
Plant Biochemistry • Estimation of proteins by Biuret method • Effect of temperature on the activity of amylase • Effect of pH on the activity of amylase • Effect of substrate variation on the activity of amylase			
Plant Physiology II • Determination of alpha-amino nitrogen • Effect of GA on seed germination • Estimation of reducing sugars by DNSA method			
Genetics • Problems based on three-point crosses, construction of chromosome			

maps • Identification of types of mutations from given DNA sequences • Study of mitosis using pre-treated root tips of *Allium*
Biostatistics • Problems based on regression analysis • ANOVA (One Way)

Course Code	**SEM VI - Botany practical**	**Credits**	**Lectures/ Week**
KUSBOT24P8	**PRACTICAL PAPER IV CURRENT TRENDS IN PLANT SCIENCES II**	**1.5**	
Course Outcomes: After successful completion of this course, students would be able to			
Plant Biotechnology II • DNA sequencing by Sanger's Method and Pyro Sequencing Method • DNA barcoding of plant material by using suitable data			
Bioinformatics • BLAST: nBLAST, pBLAST • Multiple sequence alignment • Phylogenetic analysis • RASMOL/SPDBV			
Economic Botany • Demonstration: Extraction of essential oil using Clevenger • Thin layer chromatography of essential oil of *Patchouli* and *Citronella* • Saponification value of Palm oil			
Post-Harvest Technology			

- Preparation of
  - Squash
  - Jam
  - Jelly
  - Pickle

Scheme of Evaluation:

Theory Course: (External)	**60 Marks Each Theory Paper**
Theory Course: (Internal)	**40 Marks Each Theory Paper**
Practical Course : (External)	**30 Marks Each Practical Paper**
Practical Course : (Internal)	**20 Marks Each Practical Paper**

Modality of Assessment:

Theory Evaluation Pattern: 100 Marks (60:40-External: Internal)

A) Internal Assessment - 40%

Theory - 40 marks

Sr No	Evaluation type	Marks
1	One Assignments/Case study/Project	20
2	One class Test (multiple choice questions / objective)	20

B) External Assessment - 60 %

Semester End Theory Assessment - 60 marks

i. Duration - These examinations shall be of two hours duration.

ii. Theory question paper pattern:-

1. There shall be **five** questions each of **12** marks. On each unit there will be one question & fifth one will be based on all the four units.

2. All questions shall be compulsory with internal choice within the questions. Each question will be of **24** marks with options.

3. Questions may be sub divided into sub questions a, b, c & d only, each carrying **six** marks **OR** a, b, c, d,e & f only each carrying **four** marks and the allocation of marks depends on the weightage of the topic.

Practical Examination Pattern: **Total:- 50 marks**

(A)Internal Examination:- 40 % **20 marks**

Sr No.	Particulars	Marks
1	Short Experimental Work	10
2	Filed trip /Excursion /Industrial Visit /Journal /Viva	10

(B) External (Semester end practical examination) :- 60% **30 marks**

Sr No.	Particulars	Marks
1	Laboratory work	25
2	Journal/Viva	05

PASSING STANDARD AUTONOMY Third Year:

- The learners /students shall obtain minimum of 40% marks in the Internal Assessment and External Assessment (Semester End Examination) COMBINED, to pass the course in a particular semester. A learner / student will be said to have passed the course if He/She passes the Internal Assessment + Semester End Examination COMBINED.
- To pass the examination attendance is compulsory in both internal and external (theory plus practical) examination.

NOTE:

Two short field excursions for habitat studies are compulsory. Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.

Practical examination will be held at the college / institution at the end of the semester. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head of the Department/ Co-ordinator of the department; failing which the student will not be allowed to appear for the practical examination.