VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science
(I-IV semester)

With effect from
2021-22

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Botany

Jnana Sagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme I to IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

II – SEMESTER

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC5	21 BOT 2C5L	Plant Anatomy and Histochemistry	30	70	100	4	-	-	4	3
	DSC6	21 BOT 2C6L	Cell Biology	30	70	100	4	-	-	4	3
	DSC7	21 BOT 2C7L	Plant developmental biology	30	70	100	4	-	-	4	3
	DSC8	21 BOT 2C8L	Economic Botany and Ethnobotany	30	70	100	4	-	-	4	3
	SEC2	21BOT2S2LP	Bioinformatics and applications in Biology	20	30	50	1	-	2	2	1
	DSCL	21 BOT 2C4P	Plant anatomy and Histochemistry	20	30	50	-	-	4	2	4
	DSCL	21 BOT 2C5P	Cell biology	20	30	50	-	-	4	2	4
	DSCL	21 BOT 2C6P	Plant developmental biology	20	30	50	-	-	4	2	4
Total Marks for II Semester						**600**				**24**	

M.Sc. Botany Second Semester

Course : Plant anatomy and histochemistry	Course code: 21 BOT 2C5L
Teaching hours/week (L-T-P): 4-0-0	No. of credits:04
Internal assessment: 30 marks	Semester End Examination: 70 Marks

Course objectives:

1. Plant anatomy is a much-awaited subject, it helps to reveal the relationships between structure, function, taxonomy, ecology, and developmental genetics.
2. Students should understand the types of stomata and trichomes. Isolation and study of wood elements by acid maceration method
3. Understand the various components of stem and wood during its secondary growth
4. It also helps us to distinguish between monocots, Dicots, and gymnosperms. Such, a study is linked to plant physiology. Hence, it helps in the improvement of food crops
5. The study of plant anatomy helps us to understand the structural adaptations of plants with respect to diverse environmental conditions.
6. How to address plant diseases and stressful conditions

Unit-1 **Plant Anatomy:** Primary vegetative body of the plant; Anatomical features of leaf, stem, and root (dicot and monocot); leaf of fern and gymnosperm; Structure of modified leaves- Kranz anatomy and C4 photosynthesis; Ultra-structure and chemistry of the cell wall; formation of the cell wall and its uses. **11 hrs**

Unit-2 **Anatomy of Vascular Tissue:** Ultrastructure and differentiation of xylem and phloem tissues; Apical meristems- shoot apex in Pteridophytes, Gymnosperms, and Angiosperms, theories, root apical meristems. **11 hrs**

Unit-3 **Secondary Growth:** Vascular cambium, secondary xylem of gymnosperms and dicots and secondary phloem of Gymnosperms and dicots; Periderm and bark; Anomalous secondary growth in monocots and climbers; Leaf ontogeny - Dicot- simple, compound, Monocot; Floral anatomy-flower parts, floral meristem, vascular system. **11 hrs**

Unit-4 **Plant Histochemistry**: Tests for minerals, carbohydrates, lignins, polyphenols, proteins, histones, lipids, cutin, suberin and waxes, ascorbic acid, lipids, and nucleic acids; Study of instruments: (a) Camera lucida (b) Micrometry (c) Microtome. Principles of histochemical stains; Killing, fixing and staining of plant tissues; Double staining- TBA method. **11 hrs**

Unit-5 **Staining technique**: Principles of histochemical stains, killing, fixing, and staining of plant tissues. Important reagents and chemicals needed in the fixatives: FAA, Carnoy's fluid, Navashins solution, dehydrating agents, mounting media, double staining, safranin, fast green, embedding, TBA method, embedding for the electron microscope, sectioning, whole mounts maceration. Histochemical -PAS test, Sudan black lipids, Feulgen reaction N acids. **11 hrs**

References

1. Clegg CJ and Cox G (1974) Anatomy and activities of plants- A guide to the study of flowering plants
2. Abraham F. 1982. Plant Anatomy. 3rd edn. Pergamon Press. Oxford
3. Cutler DF (1978) Applied anatomy, Longman, Newyork
4. Cuttler E. Plant Anatomy: Experiments and interpretation. Part 2. Organs Edward, Arnold, London (1971)
5. Eames EJ and McDaniel's (1947). An introduction to plant anatomy. Mc. Grew Hill, New York and London

6. Easu K (1960) Anatomy of seed plants. John Wiley and Sons
7. Easu K (1965) Plant Anatomy 2nd edition
8. Easu K (1965) Vascular differentiation. Hort, Rinehart and Winston, Newyork
9. Fahn A (1974) Plant anatomy 2nd edition, Pregmon.
10. Krishnamurthy KV methods in plant-histochemistry. Vishwanathan, S, Madras, 1988
11. Roy K (2006) Plant Anatomy, New Central Book Agency (P) Limited, Calcutta. 7) James, D. Mauseth, 1998. Plant anatomy The Benzamin/ Cummins Publishing Co.Inc.

Course outcomes

CO1: Students develop skills necessary to section and stain fresh plant material in preparation for the study of plant anatomy

CO2: Students gets trained in the proper use of the compound light microscope and to give them experience in interpreting images that they see through the microscope in terms of how plant structure is related to the function

CO3: Students develop skills in the modern microscope with digital image capture, processing, and analysis techniques useful in plant anatomical studies

CO4: know the ontogeny of a simple and compound leaf of dicot and monocot, floral anatomy, floral meristem, vascular system

CO5: Learn the techniques of histochemistry to test minerals, carbohydrates, lignin, polyphenols, proteins, lipids and nucleic acids.

CO6:Aquire proficiency to handle and use microtome, camera lucida, and micrometry

CO7: Learn the techniques to kill, fix and preserve and stain the plant tissues, double staining methods and preparation of histochemical slides.

M.Sc. Botany Second Semester

Course: Cell Biology	Course code: 21 BOT 2C6L
Teaching hours/week (L-T-P): 4-0-0	No. of credits:04
Internal assessment: 30 marks	Semester End Examination: 70 Marks

Course objectives

1. To study the basic properties of cells (prokaryotic and eukaryotic), different cell organelles (their structure and function). Cytoskeleton and cell motility, cellular reproduction, and cell signalling.
2. Understand the structure and chemical composition of chromatin and the concept of cell division
3. Provides insight into the structure and number of chromosomes using microscopic analysis. For instance, a decrease or an increase in the chromosomal number or translocation of one to another chromosome or even chromosome behaviour during mitosis and meiosis
4. Additionally, the course provides insight on chromosome mapping approaches in modern genomics, polyploidy and cytogenetic aspects of crop evolution.

Unit -1 **Chromatin organization:** Components of chromatin- chromosome structure, euchromatin and heterochromatin. Chromatin organization – structure and organization of nucleosome in chromatin, solenoids, loops and scaffolds, nucleosome phasing, active and inactive states of chromatin. Chromatin remodelling, dosage compensation, X-chromosome inactivation. Structural and numerical chromosomal abnormalities 11 hrs

Unit -2 **Chromosome abnormalities:** Structural chromosomal abnormalities – origin of breaks and gaps, ring chromosomes, Isochromosmes, centric fission-Mechanisms involved. Deletions, duplications, inversions, translocations. Numerical chromosome abnormalities- Aneuploidy, polyploidy. Non-disjunction and anaphase lag. Chromosome instability and associated syndrome. Sister chromatic exchanges and its significance 11 hrs

Unit -3 **Detection and analysis of chromosomal alterations**: Karyotyping and its significance, Banding techniques (G, Q, T, R etc.), Studies on polytene chromosomes for cytogenetic mapping, Chromosome break points mapping (deletion mapping, translocation mapping, inversion mapping). In-situ hybridization, FISH and GISH. 11 hrs

Unit -4 **Cell:** Structure and function of cellular organelles - endoplasmic reticulum, Golgi apparatus, lysosomes vacuoles, peroxisomes, mitochondria, chloroplast, secretory pathway. Cytoskeleton and extracellular matrix (microtubules, intermediate filaments, microfilaments, integrins, focal adhesions, hemidesmodomes, selectins, cadherins, adherin junctions, desmosomes, tight juctions, plasmadesmata and cell wall 11 hrs

Unit -5 **Cell cycle:**Phases of cell cycle, restriction points, cell cycle determining genes, G_0 phase –quiescence phase, points of no return), totitpotency of stem cells. Chromosome segregation in mitosis and meiosis -mitotic apparatus, distribution

of microtubule organizing centres, formation of synaptonemal complex, cytokinesis. Cell dealth- Apoptosis (extrinsic and intrinsic pathways), necrosis and autophagy. 11 hrs

References

1. Cell Biology: Smith and wood
2. Cell Biology: C.B. Pawar
3. Cell and Molecular Biology: Lewin J, Klein Smith and Valerie M Kish
4. Cell and Molecular Biology – concept and experiments 2nd Ed: General Karp
5. Cell and Molecular Biology (1999). Gupta PK, Rastogi Publication in Meerut India
6. Concept of Genetics 4th Ed: William S Klung and MR Cummings
7. Genetics – Strickberger MW
8. Principles of Genetics: Sinnot and Don
9. Cell and Molecular Biology: PK Gupta
10. Understanding Genetics – A molecular approach: Norman V Rothwell

11. Genetics – Analysis and Principles: Robert J Brooker
12. Genetics – 4th Ed: Susan Elrod and William Stan Field
13. The human Genome: R Scott Hawiey and Catherine and Mori
14. Genetics – Daniel L Hartl
15. Genomes: TA Brown
16. Cell Biology: De Robertis
17. Principles of Genetics_Sinnot, Dunne & Dobzhansky

Course outcome

On successful completion of this course each student will be able to

CO1: Understand the cells as a structural and functional unit of life. Also studying various cellular components of cells. The primary structure and ultrastructure of cellular organelles, their composition, and functions

CO2: Evolution of various chromosomal aberrations (structural and numerical), their applications in alien gene transfer and hybrid seed development

CO3: Cytogenetic tools such as FISH and GISH (fluorescence and genomic in-situ hybridization) techniques, that rely on "painted chromosomes" approach. The behaviour of individual genomes, individual chromosomes or chromosomal fragments in natural and artificial hybrids.

M.Sc. Botany Second Semester

Course: **Plant Developmental Biology**	Course code: 21 BOT 2C7L
Teaching hours/week (L-T-P): 4-0-4	No. of credits: 04
Internal assessment: 30 marks	Semester End Examination: 70 Marks

COURSE OBJECTIVES

1. To understand the structural and functional features of flower i.e. flower morphology, flower types
2. To understand pollination and pollen vectors, male and female gametophyte.
3. To understand various stages of flower development, floral advertisement, Floral rewards,
4. To understand seed development and types of seeds.

Unit -1 **Root and Shoot development:** Root Development: Organization of root and shoot apical meristem (RAM & SAM); vascular tissue differentiation; lateral root hairs; root microbe interactions. radial patterning during vascular development, Root branching; lateral root development, Organogenesis, organ polarity, and differentiation in the shoot. Autonomous pathway, vernalization pathway, Gibberellic acid pathway, temperature, and age-dependent pathways, mi-RNA. **11 hours**

Unit -2 **Leaf and Flower development:** Leaf growth and differentiation, phyllotaxy, control of leaf form, differentiation of epidermis (with special reference to stomata and trichomes), and mesophyll. Floral transition, Floral organ patterning, the importance of ABC genes leading to the development of floral organs, microsporogenesis, megasporogenesis, gametogenesis, and their structures. **11 hours**

Unit- 3 **Fruit and Seed development:** Endosperm development; embryogenesis, ultrastructure, and nuclear cytology, storage proteins of endosperm and embryo; polyembryony, apomixes, embryo. Suspensor development, Fruit development, and growth. Dormancy, importance, and types of seed dormancy, overcoming seed dormancy, bud dormancy. **11 hours**

Unit -4 **Molecular genetic approaches to plant growth and development:** Plant growth kinetics and patterns of growth. Seedling growth, tropisms, and photomorphogenesis of seedling. Generation and characterization of developmental mutants, studying temporal and spatial expression pattern of developmental regulators, functional genomics, genetic manipulation of plant for studying the development **11 hours**

Unit -5 **Databases:** Databases on plant genomics, transcriptomics, and proteomics of various species. Description of plant structure and developmental stages in databases. Ontologies as tools for systematizing knowledge on a subject area. Databases for restructured gene networks. Databases for molecular interactions in gene networks. **11 hours**

References:

1. The Plant Cell. Special Issue on Reproductive Biology of pants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
2. Sedgely M and Griffin AR. 1989. Sexual Reproduction of Tree Crops. Academic Press, London
3. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.
4. Leins P, Tucker SC and Endress PK. 1988. Aspects of Floral Development. J. Cramer, Germany.
5. Shivanna KR and Johri BM.1985. The Angiosperm Pollen Structure and Function. Wiley Eastern Ltd., New Delhi.

Procter M and Yeo P. 1973. The Pollination of Flowers. William Collins Sons, London.

Course outcomes:

CO1: Understand the molecular basis of plant growth and development

CO2: Understanding the molecular mechanisms underlying the origin and diversification of the Angiosperm flower

CO3: Understand the molecular genetics of plant development – root, shoot, leaves, flower, fruits, and seed development.

CO4: Importance of plant developmental Genetics: Integrating data from different experiments in databases

CO5: Understand the emerging trends in seed quality enhancement

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M.Sc. Botany second semester

Course: **Economic Botany and Ethnobotany**	Course code: 21 BOT 2C8L
Teaching hours/week (L-T-P): 4-0-0	No. of credits:04
Internal assessment: 30 marks	Semester End Examination: 70 Marks

Course Objectives:

1. To understand the interdisciplinary role of Ethnobotany involving knowledge and use of plants and their ecology in the context of their cultural, social and economic significance.
2. To understand analytical tools used in quantitative Ethnobotany
3. To understand the methods of undertaking Ethnobotanical studies.

Unit -1 **Economic Botany:** Introduction, scope of study. Centres of origin of cultivated plants. Economic uses of Wheat, Maize, Rice, Bajra. Pulses, Cereals, and forage legumes–A general account on oil yielding seeds. Fiber yielding plants. Essential oils-aromatic plants. Spices and Condiments- Cinnamomum, Clove, Fennel, Cumin, Coriander, Saffron, Cardamom, Fenugreek. **Industrial Plants:** Rubber, Tea, Coffee Narcotics: Cannabis, Opium, Tobacco. **11 hours**

Unit- 2	**Ethnobotany:** Introduction, Aims, objective and scope.Methods of study of Ethnobotany. Ethnobotany of Karnataka and India. Ethnic groups of Karnataka, major tribes and their life styles. Shifting cultivation and consequential damage to forest ecosystem.	**11 hours**
Unit -3	**Centres of Ethno botanical studies in India**, Ethnobotanicals of Western Ghats. Role of Ethnomedicine and its scope in modern times. Role of Ethnobotany in conservation and sustainable development. Contributions of International, National and Regional ethnobotanists (J.W.Harshberger, R.E.Schultes, E.K.Janakiammal, S.K.Jain, R.RaghavendraRao, V.V Sivarajan).	**11 hours**
Unit -4	**Methods and techniques used in Ethnobotany-**Field level activities for data collection- Approach, Documentation (Audio, Video recording, Photographs, Interview – Methods, Questionnaire and Data sheet), Consent forms, Forest productivity check by analysing the log books of Forest, EDC, VSS etc). Authentication of plant species (Field Book, Herbarium) Field and Lab Procedures, Preparation of Data Sheet and Data Base. Peoples biodiversity Register (PBR) and Role of Karnataka Biodiversity Board in PBR.	**11 hours**
Unit- 5	**Quantitative Ethnobotany**: Dimensions of data, sampling and organisation of data; Data standardization and transformation. Clustering and classification. Different classification of classification methods. Its Importance in Bioprospecting and Conservation of Phytoresources.	**11 hours**

References :

1. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscanpublishers Ltd. London & Sterling, VA, USA Cotton, C.M. (1996).
2. Ecology- Ambushta,CBS Publication.
   Economic Botany- Hill, Mac Graw Hill Book Comp.
3. Economic Botany- Pandey, S. Chand and Com., New Delhi.
   Ethnobotany-Principles and application. John Wiley& Sons Ltd., West Sussex, England
4. Faulks, P.J. (1958). An introduction to Ethnobotany, Moredale Publ. London 6. Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co. Pvt. Ltd.,
5. New Delhi
6. Forest Ecology in India-NeenaAmbre, Foundation Books.
7. Global Environmental agreements- AshaJoshi,GunillaReisch Pub.
8. Jain S.K.(1997). Contribution to Indian Ethnobotany, Sci. Publ. Jodhpur
9. Jain, S. K. (1989). Methods and approaches in Ethnobotany. Society of Ethnobotanists, Lucknow
10. Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur
11. Jain, S. K., Mudgal, V., Banerjee, D. K., Guha, A., Pal, D. C. and Das, D. (1984). Bibliography of Ethnobotany. Botanical Survey of India, Howrah
12. Jose Boban K. (1998). Tribal Ethnomedicine: Continuity and change. APH publishing corporation 5, Ansari Road, Darya Ganj, New Delhi.
    Snehalatha and Jain, S. K. (1998). Historical Archive in Ethnobotany. Institute of Ethnobotany, NBRI, Lucknow.

Course outcomes:

On successful completion of this course each student will be able to:

CO1. Appreciate the need to conserve floristic and cultural diversity of the Karnataka.

CO2. Rescue and document Ethnobotanicals for sustainable use of plant resources.

CO3. Understand the need for development of new drugs for safe and more rational use of herbal preparations.

CO4. Recognize and understand intellectual property rights and its benefit to people and society who share their knowledge and wisdom.

CO5. Develop the skills of using the statistical analysis softwares to understand quantitative Ethnobotany.

M.Sc. Botany Second Semester

Course: **Bioinformatics and Applications in Biology**	Course code: 21BOT2S2LP
Teaching hours/week (L-T-P): 1-0-2	No. of credits:02
Internal assessment: 20 marks	Semester End Examination: 30 Marks

Course objectives:

1. Exposure to Bioinformatics - Applications and significance
2. Study of types of databases of Bioinformatics and their applications
3. Hands-on experience of online tools of bioinformatics to access and to interpret the nucleotide and amino acid sequences.
4. Understanding the basic methodology in Bioinformatics also aims to utilize and understand biological databases
5. Gathering, storage, retrieval, analysis, and integration of biological data for generating new knowledge
6. Understanding the biological processes at the molecular level

Unit-I **Introduction to bioinformatics:** Definitions and brief history. Bioinformatics vs computational biology, scope/ research areas of Bioinformatics, nature of biological data, introduction to, different branches of genomics, proteomics, pharmacogenomics, and metabolomics. Bioinformatics in industries and institutions in India and World, Applications of Bioinformatics. **6 hours**

Unit -II **Biological Databases and Sequence Alignments and Visualization:** General Introduction and classification and importance of biological databases. nucleic acid, protein, structure, chemical structure: Secondary and composite types of protein databases, specialized genome databases. Local alignment and Global alignment, Pair-wise alignment (BLAST and FASTA), and multiple sequence alignment **10 hours**

(Clustal-W). Primer designing, Molecular docking – Auto-Dock, Phylogenetic analysis: MEGA and Philip software. Generating motifs and profiles, Needleman and Wunsch algorithm, Smith-Waterman algorithm, BLAST, PSI-BLAST, and PHIBLAST algorithms.

Unit-III **11 hours**

1. Laboratory Demonstrations for Biological Databases- GenBank, EMBL, NCBI, pubmed, DDBJ, PDB.
2. Sequence alignment: BLAST family of programs, FASTA, clustal-W for multiple sequence alignment,
3. Phylogenetics software, Homology Modelling, and Model evaluation, AutoDock, GROMACS,
4. Prokaryotic and Eukaryotic Gene finding softwares
5. programs in PERL.
6. Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - Cn3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol.
7. Modeling- discovery studio 2.0, Docking -Auto dock, HEX.

Reference Books

1. Claverie JM and Notredame C (2003) Bioinformatics for Dummies. Wiley Editor
2. Durbin R., Eddy S., Krogh A and Mithchison G (2007) Biological Sequence Analysis, Cambridge University Press
3. Lesk AM (2005) second edition, Introduction to Bioinformatics. Oxford University Press
4. Fogel GB and Corne DW. (1997) Evolutionary computation in Bioinformatics
5. Rastogi et al. (2003) Bioinformatics: concepts skills and applications . CBS
6. Rashidi and Buchler (2000) Bioinformaticw basics. CRS Press
7. Mount DW. (2004) Bioinformatics- sequence and genome analysis. CSHL Press.

Course outcome

At the end of the course students will be able to:

CO1: Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics

CO2: Explain about the methods to characterize and manage the different types of Biological data

CO3: Classify different types of Biological databases

CO4: Understand the basics of sequence alignment and analysis

CO5: Overview about biological macromolecular structures and structure prediction methods

CO6: Understand the concept of pairwise and multiple sequence alignments, algorithms and tools and their significance

CO7: Explainabout various computational methods and tools used for protein secondary structure prediction and genome analysis

CO8: Understand about various techniques used in genomics and proteomics

M.Sc. Botany Second Semester

Course: Plant Anatomy and histochemistry	Course code: 21 BOT 2C4P
Teaching hours/week (L-T-P): 0-0-4	No. of credits:02
Internal assessment: 20 marks	Semester End Examination: 30 Marks

Course objectives

1. To know about the internal structure and reproduction of the most evolved group of plants, the Angiosperm
2. To understand relations between plant anatomy and the other major disciplines of biology including taxonomy, cell biology, physiology, genetics, biochemistry, and ecology
3. To identify the role of anatomy in solving taxonomic and phylogenetic problems
4. To understand the shoot structure and functional development aspects of various tissue systems and organs in plants
5. To gain knowledge on morphogenesis and organogenesis in plants

List of Experiments

1. Preparation of stains and fixatives
2. Staining of xylem and phloem elements
3. Study of the anatomy of roots in Ficus, Musa, Vanda
4. Preparation of double-stained permanent slides
5. Preparation and identification of the transverse section of the following plants – Tridax procumbens, Boerhaaviadiffusa, Bougainvillea spectabilis, Achyranthese aspera, Nyctanthusarbo-terrestris, Leptadinia reticulata, Calotropis procera, Aristolochia indica, Tinosporacordifola, Salvadora persica
6. Preparation and identification based on TS, TLS and RLS sections of the following wood- Micheliachampaka, Dalbargiasiso, Tetona grandis (Teak), Azadirachta indica (neem), Achras sapota (Sapota), Mangifera indica and Tecoma stans
7. Epidermal studies
8. Preparation of microtome sections and staining procedures
9. Histochemical staining – PAS test, Sudan black- lipids, Feulgen reaction- Neucleic acids
10. Study of ecological anatomy
11. Study of vasculature in floral organs
12. Embedding: TBA method, embedding for electron microscope, sectioning, microtomes, whole mounts maceration.

Note: submission of 10 permanent slides

Reference Books

1. Charles B. Beck (2010) An introduction to plant structure and development: plant anatomy for the twenty-first century. Chang Science Library.
2. Ray F, Evert, Susan E Eichhorn (2006) Esau's plant anatomy: meristems, cells and tissues of the plant body: Their structure, function and development. Chang Science Library
3. Eames and McDaniel, 1947. Plant Anatomy. 2nd edn., McGraw Hill, New York.
4. Esau, K. 1965, Plant Anatomy, Joh Wiley and Sons, New York.
5. James, D. Mauseth, 1998. Plant anatomy The Benzamin/ Cummins Publishing Co.Inc.
6. Esau, K. 1979, Anatomy of seed plants- first Wiley eastern reprint. New Delhi.

Course outcomes

CO1: After successful completion of the course students will be able to: Understand the plants anatomical structure and their developmental patterns

CO2: Plant reproductive parts development of male, female gametophytes and fruits

CO3: Vascular tissues and its constituents by sections and maceration, wood anatomy, TS, TLS and RLS

CO4: Differentiate normal and abnormal secondary growth

CO5: Differentiate mechanical tissues (collenchyma, sclerenchyma, stone cells and xylem), Secretary tissues (mucilage canals, resin canals, nectaries and oil glands), laticifers (latex cells and vessels)

M.Sc. Botany Second Semester

Course: Cell Biology	Course code: 21 BOT 2C5P
Teaching hours/week (L-T-P): 0-0-4	No. of credits:02
Internal assessment: 20 marks	Semester End Examination: 30 Marks

Course objectives

1. To provide an introduction to the structure of eukaryotic genomes, from the level of the chromosome down to the level of the gene.
2. Basic cytological techniques including the use of the optical microscope will be covered and supported by laboratory exercises.
3. The lecture will include the application of cytogenetic and molecular techniques in the study of cell divisions, karyotyping, chromosomal structure, recombination, changes in chromosome number and structure, physical mapping and chromosome evolution.

List of experiments

1. Mitotic cell division from onion root tips
2. Meiotic cell division from onion flower buds
3. Polytene chromosome from Chironomus larva
4. Micrometry in chromosome studies
5. Structural and numerical changes induced by EMS and Colchicine
6. Genetic recombination and chromosome mapping
7. Preparation of polytene chromosomes
8. Barr body identification
9. Karyotype analysis
10. chromosome banding patterns and Chromosome painting

Reference Books

1. Genetics – 4th Ed: Susan Elrod and William Stan Field
2. The human Genome: R Scott Hawiey and Catherine and Mori
3. Genetics – Daniel L Hartl
4. Genomes: TA Brown
5. Cell Biology: De Robertis
6. Principles of Genetics_Sinnot, Dunne & Dobzhansky
7. Molecular cell biology. 4th edition, Lodish H, Berk A, Zipursky SL et al., New York : WH Freeman, 2000
8. Molecular Biology of cell: 6th edition by Bruce Alberts and Alexander D Johnson
9. Human Chromosme Authors: Orlando J Miller &Eerva Therman 4th Edition
10. Chromosome techniques (Third Edition) Theory and Practice Author(s): Arun Kumar Sharma and Archana Sharma
11. The cell: A Molecular Approach by Geoffrey Cooper and Robert Hausmann
12. Cell and Molecular Biology. EDD De Robertis& EMF De Robertis, Waverly publication.

Course outcomes

1. Understand the methods of preparations of prophase, metaphase and anaphase cell
2. Define the important structural units of chromosome
3. Explains chromosome structure and packing of DNA into chromosomes
4. Learning about giant chromosome and its functions
5. Explains mapping of genes in humans by somatic cell hybridization
6. Use of two and three factor cross in mapping of genes
7. Knowing about mutation and classification of mutation
8. Learing about karyotyping and its use in detecting mutation

Course: Plant developmental Biology	Course code: 21BOT2C6P
Teaching hours/week (L-T-P): 0-0-4	No. of credits:02
Internal assessment: 20 marks	Semester End Examination: 30 Marks

Course objectives:

1. To observe, understand and make critical comments on modifications of floral parts, stamens, and carpels.
2. To dissect, observe and draw floral parts of flowers.
3. To observe and understand different types of stamens and modifications of stamens and carpels.
4. To observe and draw flowers mimic which is adaptation to attract pollinators.
5. Take L.S. of flower to observe the placement of anthers, the position of ovary.
6. Observe characters of different types of fruits and draw.
7. Take a section of anthers (T.S.) and ovules (L.S) and understand placentation.
8. Observe pollens of different flowers and make illustrations.
9. Learn and understand technique of taking sections, mounting of endosperm and embryo sac of flowers.

List of Experiments

1. Study of floral parts: Calotropis procera: Cohesion and adhesion of stamens.
2. Types of flowers: Bisexual and Unisexual flowers.
3. L.S. of flower to observe: placement of anthers, position of ovary,
4. Modifications of stamens and carpels: Euphorbia sps. Rose etc.
5. Types of fruits: Simple, aggregate and composite type.
6. Anthers (T.S.) and ovules (L.S)
7. Types of Pollens observation
8. Endosperm and Embryo sac mounting
9. Different types of seeds
10. Isolation and mounting of embryo using Symposis/ Senna/ Crotolaria

References:

1. Leins P, Tucker SC and Endress PK. 1988. Aspects of Floral Development. J. Cramer, Germany.
2. Shivanna KR and Johri BM.1985. The Angiosperm Pollen Structure and Function. Wiley Eastern Ltd., New Delhi.
3. Procter M and Yeo P. 1973. The Pollination of Flowers. William Collins Sons, London.
4. Bold HC, Alexopolus CJ and DelevoryasTMorphology of Plants and Fungi. Harper C Row New York.
5. B. M. Johri and P. S. Srivastava. Reproductive Biology of Plants. Spriner Link.
6. Rajesh Tandon, KR Shivanna and Monika Koul. Reproductive Ecology of Flowering Plants: Patterns and Processes.Springer Nature Singapore Pte.LTd.

Course outcomes:

On successful completion of this course each student will be able to:

1. Identify and understand the adaptations of flowers in order to facilitate pollinations and attract pollinators.
2. Dissect the flowers and understand the arrangement of stamens on the flowers
3. Mount the Endosperm and Embryo and understand different types from different flowers.
4. Develop observation skills to mount and observe minute pollen grains under microscope and make illustrations.
5. Differentiate between cohesive and adhesive attachment of stamens which are important to understand formation of flower.
6. Collect different types of fruits, understand their parts and draw.

7. Develop the skill of illustrations by doing so will create interest and student will remember the content for long time.