S. K. E. Society's

GOVINDRAM SEKSARIA SCIENCE COLLEGE

Tilakwadi, Belagavi-590006

(AUTONOMOUS)

POST GRADUATE DEPARTMENT OF BOTANY

CURRICULUM FRAMEWORK FOR POSTGRADUATE COURSE

STRUCTURE & SYLLABUS OF MASTER OF SCIENCE

In

BOTANY

M. Sc. 1st year
(I & II Semester)

w. e. f.

Academic year 2024-25 and onwards

Submitted by Chairman,
Board of Studies of PG Department of Botany,
G. S. S College (Autonomous), Belagavi.

SKE's

GOVINDRAM SEKSARIA SCIENCE COLLEGE(AUTONOMOUS), BELAGAVI

POST GRADUATE DEPARTMENT OF BOTANY

Course Structure

Sem No.	Course No	Title of the course	Credits	Teaching Hr/week	Maximum Marks		
					Exam proper	I.A.	Total
		Compulsory Courses:					
I	1.1	Microbial Diversity	4	4	80	20	100
	1.2	Biodiversity and Conservation Biology	4	4	80	20	100
	1.3	Systematic Botany of Angiosperms	4	4	80	20	100
	1.4	Evolutionary Biology & Plant Geography	4	4	80	20	100
	1.5	Practical I (Based on 1.1 & 1.2)	4	8	80	20	100
	1.6	Practical II (Based on 1.3 & 1.4)	4	8	80	20	100
II		**Compulsory Courses:**					
	2.1	Biochemistry and Bio-Physics	4	4	80	20	100
	2.2	Developmental Biology	4	4	80	20	100
	2.3	Genetics and Plant Breeding	4	4	80	20	100
		Open Elective Course:					
	2.4	Medicinal Plants	4	4	80	20	100
		Compulsory Courses:					
	2.5	Practical III (Based on 2.1)	4	8	80	20	100
	2.6	Practical IV (Based on 2.2 & 2.3)	4	8	80	20	100

Sem No.	Course No	Title of the course	Credits	Teaching Hr/week	Maximum Marks		
					Exam proper	I.A.	Total
		Compulsory Courses:					
III	3.1	Plant Physiology	4	4	80	20	100
	3.2	Cell Biology and Molecular Biology	4	4	80	20	100
	3.3	Medicinal Plants & Herbal Drug Technology	4	4	80	20	100
		Open Elective Course:					
	3.4	Plant Propagation Techniques	4	4	80	80	100
		Compulsory Courses:					
	3.5	Practical V (Based on 3.1)	4	8	80	20	100
	3.6	Practical VI (Based on 3.2 & 3.3)	4	8	80	20	100
IV		**Compulsory Courses:**					
	4.1	Mycology and Plant Pathology	4	4	80	20	100
	4.2	Ecology and Environmental Biology	4	4	80	20	100
	4.3	Plant Biotechnology	4	4	80	20	100
	4.4	Research methodologies and Techniques in Botany	4	4	80	20	100
		Compulsory Courses:					
	4.5	Practical VII (Based on 4.1 & 4.2)	4	8	80	20	100
	4.6	Project	4	8	80	20	100
	Total		96	128			2400

M.Sc., BOTANY SYLLABUS

SEMESTER I

1.1 Microbial Diversity

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Introduction to Microbial diversity: Introduction of Microbes (Bacteria, algae and virus) – general characteristics, recent classifications, habitat diversity, methods used for identification, applications and economic importances of microorganisms

UNIT II **15 hours**

Agricultural Microbiology: Microorganisms in soil, role of microorganisms biogeochemical cycles. Plant growth promoting bacteria, rhizosphere and phyllosphere microflora and positive and negative roles. Mycorrhiza- types and their role in agriculture and horticulture; Biostimulants and their uses

UNIT III **15 hours**

Methods of studying microbial biodiversity, various culture methods. Isolation techniques, environmental genomics, screening libraries, preservation of microbial biodiversity, polyphasic taxonomy of microorganisms.

UNIT IV **15 hours**

Structural diversity, distribution, general characteristics, recent classification and the ecological significance of lichens.

Structural diversity, distribution, general characteristics, recent classification and the ecological significance of Fungi.

Economic importance of Fungi and Lichens

References:

1. Waste Water Microbiology by Garbiel, Bitton. Wiley Publication.
2. Microbial Ecology by Atlas and Bartha.
3. Soil Organic Matter and Biological Activity. Martinus Nigholf W Junk Publisher.
4. Introduction to Environmental Microbiology by Michel Wiley Liss Publication.
5. Advances in Microbial Ecology. K C Marcell, Plenum Press.
6. Textbook of Microbiology by Paniker. Orient Longman Publication.
7. Sullia S.B and Shantaram S.1998" General Microbiology" Oxford and IBH Publishing CoPvt. Ltd. New Delhi.
8. Pelechzar M.J. and Chand ECS and Kreig NR- 1982 "Microbiology" Tata Mc Graw Hill, Book Co. New York.
9. Stainer. R.Y. and Ingraham J.L. "General Microbiology" Prentice Hall of India Pvt. Ltd, New Delhi.
10. Sunderrajan "Tools and Techniques of Microbiology"- Anmol Publications.
11. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
12. Prescott. Lansing, M., Harley John P and Klein Donald, A "Microbiology" WBC. McGraw Hill New York.
13. P.D. Sharma "Microbiology" Rastogi Publications

1.2 Biodiversity and Conservation Biology

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Biodiversity: Definition, levels of diversity - genetic, species and ecosystem diversity. Endemism - concept, types, Status of endemic plants in India, endemism in the Western Ghats, Biodiversity hotspots - general and with special reference to India; Mega-diversity regions. Importance of biodiversity, magnitude and distribution of Biodiversity. An overview of phytodiversity and its conservation status.

UNIT II **15 hours**

Threats to biodiversity, IUCN threatened plant categories and assessment, methods of conservation: *In-situ* methods – Protected area network, National parks, Biosphere reserves, sacred grooves. *Ex-situ* methods: Botanical gardens, Germplasm collection seed bank, pollen bank. conservation case studies.

UNIT III **15 hours**

Environmental movements: Global and regional: Environmental laws, CBD, Forest Conservation Act, Biodiversity bill (2002); People's Biodiversity Register (PBR); Convention on International Trade in Endangered Species (CITES), Ramsar Convention, Funding agencies for biodiversity conservation,

UNIT IV **15 hours**

Biodiversity documentation assessment - Inventory and monitoring, Biodiversity indices, world biodiversity databases.

Biodiversity Management: Sustainable development, Environmental Impact Assessment (EIA) Ecological restoration, Aforestation, Green belt, Social forestry, Agro forestry. Remote sensing in biodiversity management. Human wildlife conflict.

Reference:

1. Ahmedullah, M. and M.P. Nayar, 1986. Endemic plants of the Indian region. Vol 1. Botanical Survey of India.
2. Krishnamurthy K V 20014. An advanced text book of Biodiversity, Principles and Practice. Oxford and IBH Publishing Co. Lvt. Ltd.
3. Negi S S 1933. Biodiversity and its conservation in India. Indus Publishing Company, New Delhi
4. Primack, Richard B 2006. Essentials of conservation biology, 4th edition, Senaceer Associates, Sunderland, Mass.
5. Rao R R 1994. Biodiversity in India (floristic aspects). Bishen Singh Mahendra Pal Singh, Dehradun.
6. Ravikumar K and D K Ved 2000. Illustrated field guide to 100 red-listed medicinal plants of conservation concern in Southern India.
7. Singh, P., et al. "Endemic Vascular Plants of India, Botanical Survey of India, Kolkata." *Government of India Date of Publication: March* (2015): 7.

Websites

8. https://iucn.org/
9. https://www.wcs.org/
10. https://www.cbd.int/island/websites
11. https://moef.gov.in/environmental-impact-assessment-eia
12. http://nbaindia.org/link/304/1/1/home.html
13. https://cites.org/eng

1.3 Systematic Botany of Angiosperms

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Brief history and development of plant classification, Importance and need for classification, systematic and phylogenetic classification. hierarchical classification. phases of plant classification. Overview on pre and post Darwinian classification, Artificial system of classification, Natural system of classification - Bentham and Hooker, Phylogenetic systems of classification - Cronquist, Takhtajan, APG system of classification.

Taxonomic evidence: Chemotaxonomy, Cytotaxonomy, Embryology as taxonomic evidence. Brief account of numerical taxonomy, palynology, anatomy, molecular taxonomy.

Phylogenomics: Modern trends in plant taxonomy

UNIT II **15 hours**

Botanical Nomenclature: Need for scientific names, history of botanical nomenclature. Principles of ICN, typification, rule of priority, ranks of taxa and nomenclature of taxa. Effective and valid publication, Author citation, retention, choice and rejection of names and epithets, conservation of names, naming hybrids and cultivated plants.

UNIT III **15 hours**

Tools of taxonomy: Floras, monographs, revisions: components, design and methods as a checklist, floristic revisionary or monographic study, online resources, artificial dichotomous keys, preserved specimens, protologues.
Herbarium: Introduction, methodology, role, significance.
Botanical gardens: Introduction, role, significance.
Botanical organizations in India and their contribution.
Introduction to taxonomic softwares.

UNIT IV **15 hours**

Major clades in APG-IV: characteristic features of major clades in APG-IV system.
Study of the following families with economic importance, morphology, systematics and phylogeny:

Hydatellaceae, Orchidaceae, Poaceae, Fabaceae, Moraceae, Combretaceae, Anacardiaceae, Apocynaceae, Rubiaceae, Bignoniaceae, Lamiaceae, Asteraceae, Apiaceae, Solanaceae, Araceae, Magnoliaceae, Meliaceae, Loranthaceae, Cactaceae, Malvaceae, Acanthaceae, Euphorbiaceae, Zingiberaceae

References:

1. The Angiosperm Phylogeny Group, M. W. Chase, M. J. M. Christenhusz, M. F. Fay, J. W. Byng, W. S. Judd, D. E. Soltis, D. J. Mabberley, A. N. Sennikov, P. S. Soltis, P. F. Stevens, An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV, *Botanical Journal of the Linnean Society*, Volume 181, Issue 1, May 2016, Pages 1–20, https://doi.org/10.1111/boj.12385
2. Turland, N. J., Wiersema, J. H., Barrie, F. R., Greuter, W., Hawksworth, D. L., Herendeen, P. S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T. W., McNeill, J., Monro, A. M., Prado, J., Price, M. J. & Smith, G. F. (eds.) 2018: *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017*. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books. DOI https://doi.org/10.12705/Code.2018.
3. Bhattacharya B. and B.M. Johre. 1998. Flowering plants Taxonomy and phylogeny. Narosa Publishing House, New Delhi.Gurucharan Singh, 1999.
4. Current Concepts in Plant Taxonomy. Academic Press, London. Heywood V.H., 1976. Botanical Systematics, Academic Press London.
5. Lawrence, H.M., 1966. Taxonomy of vascular plants. The Mac Million Company, New York. Naik, V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill, New Delhi.
6. Plant systematics - Theory and practice. Oxford and IBH Publishing Co., Pvt Ltd., New Delhi.
7. Plant Taxonomy and Biosystematics (2nd Edition. Edward Arnold Ltd., London. Singh G., 1999. Plant Systematics, Oxford and IBH, New Delhi
8. Singh, Gurcharan. *Plant systematics: an integrated approach*. CRC Press, 2019.
9. Simpson, Michael G. *Plant systematics*. Academic press, 2019.
10. Stevens, P. F. (2001 onwards). Angiosperm Phylogeny Website. Version 9, June 2008 [and more or less continuously updated since].

Websites

11. https://www.mobot.org/mobot/research/APweb/
12. https://www.ipni.org/
13. https://powo.science.kew.org/
14. https://www.biodiversitylibrary.org/
15. https://www.worldfloraonline.org/
16. https://sweetgum.nybg.org/science/ih/
17. https://ccdb.tau.ac.il/
18. https://bsi.gov.in/
19. https://www.iapt-taxon.org/nomen/main.php

1.4 Evolutionary Biology and Plant Geography

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Origin of life: concept, history and events. Primitive earth, prebiotic synthesis, origin and evolution of RNA world, Ribonucleoprotein.

Eukaryotes: Theories of evolution - Lamarckism, Neolamarkism, Darwinism, Neo-Darwinism, Germplasm, mutation and Synthetic, adaptive radiation. Endosymbiotic.

UNIT II **15 hours**

Patterns of evolution in plants- Evolution of vegetative, reproductive structure in Algae, Fungi, Bryophytes, Pteridophytes and spermatophytes, evolution of sporophytes in Bryophytes. Stellar evolution in Pteridophytes, Heterospory and seed habit. Plant fossil forms.

UNIT III **15 hours**

Population genetics – Population, gene pool, gene frequency, genetic drift, founder effect, genetic polymorphism, Hardy Weinberg's Law, Genetics equilibrium and mechanism of speciation. Concept of species.

UNIT IV **15 hours**

Plant Geography: Origin of islands and Continents. Plant tectonics and Continental drifts. Centres of origin of cultivated plants, Vavilocenters and Zhukosky centres with plants in each region.

Plant distribution and Plant migration- Floristic regions of the world. Phytogeographical regions of India, distribution of plants based on altitude and latitude, endemic distribution. Age and area hypothesis- Wills theory. Plant migration and barriers for plant migration.

References

1. Darwin, C. 1859. On the Origin of Species. London: John Murray (always seek out the first edition, facsimile version, and avoid later editions)
2. Michael George Simpson, 2006. Plant systematics. Elsevier Academic Press. Nei, M. & S. Kumar, 2000. Molecular Evolution and Phylogenetics. Oxford University Press Inc.
3. Peter Skelton and Andrew Smith, 2002. Cladistics: A Practical Primer on CD-ROM with accompanying booklet by Neale Monks. Cambridge University Press.
4. Strickberger, Monroe W. 2000. Evolution. 3rd Ed., Jones & Bartlett Publishers, Inc. 40 Tall PineDrive Sudbury, MA 01776, United States of America.
5. Futuyma, Douglas J. 2005. Evolution. Sinauer Associates, Inc., 23 Plumtree Road, Sunderland, MA 01375, United States of America.
6. Dodson E. O. and Dodson P. 1976. Evolution: Process and Product. 2nd Ed., D. Van Nostrand Company, 450 West 33rd Street, New York, N.Y. 10001.
7. Rastogi, V.B., 2016. *Organic evolution*. Medtech.

PRACTICALS

Teaching Hours per Week: 4
No. of Credits: 4

1.5: Practical I
(Based on Paper 1.1 - Microbial Diversity)

1. Laboratory guidelines, design, tools, equipments and other requirements for studying microorganisms.
2. Positive and negative staining of Bacteria.
3. Gram staining, cell wall staining of Bacteria.
4. Isolation and culture and of fungi
5. Estimation of microbial flora of soil.
6. Isolation of *E. coli* from sewage water samples with the help of EMB agar medium.
7. Isolation of symbiotic *Rhizobium* from plant root nodules.
8. Isolation of micro algae/phytoplanktons in water bodies.
9. Visit to dairy/ food industry/ biofertilizer production unit/microflora of forest

(Based on Paper 1.2 - Biodiversity and Conservation Biology)

1. Study of endemic plants (a minimum of 10) – distinguishing characters, distribution, threats, status and economic use (if any), conservation.
2. GIS and Remote sensing - vegetation mapping (using Software).
3. Rapid EIA (Environmental impact Assessment)
4. IUCN assessment of taxon
5. Study of forest ecosystem (assessment of forest structure, measurement of GBH, Canopy estimation, vegetation analysis)
6. Vegetation analysis (density, frequency, abundance) using quadrats/ line transect/ belt transect
7. Calculation of Biodiversity indices –Shannon, Simpson index, Evenness Index
8. Study of grassland ecosystem (vegetation analysis)
9. Documentation of plant diversity of nearby region.
10. Field visit to Terrestrial ecosystem/ Aquatic ecosystem/ a sacred groove and submitting the report

1.6: Practical II

(Based on Paper 1.3 - Systematic Botany of Angiosperms

1. Identification of families (minimum 10 families) using diagnostic characters (minimum one example for each family to be studied in detail – morphology, floral formula, floral diagram) (1-6)
7. Identification of local plant species using identification keys from Floras, revisions, etc.
8. Construction of dichotomous key.
9. Preparation and submission of 10 herbarium sheets (Use very commonly available species for herbarium preparation, strictly avoid collecting rare plants)
10. Field trips to nearby floristically rich areas and submitting the report.

(Based on Paper 1.4 - Evolutionary biology and plant geography)

1. Study of homologous, analogous and vestigial organs with examples.
2. Study of molecular evolution with examples.
3. Evolution of Sporophytes in Bryophytes.
4. Stellar evolution in Pteridophytes.
5. Study of Heterospory
6. Study of adaptive radiation, micro and macro evolution with examples
7. Study of Vavilov centers and Zhnkoskycenters with plant in each region.
8. Study of plant fossils.
9. Construction of phylogenetic tree based on gene sequences available at NCBI database
10. visit to natural history museum/geological museum

SEMESTER II

2.1 **Biochemistry and Biophysics**

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Nucleic acids: Introduction, types and their properties. Conformation of nucleic acids.

Amino acids- classification and characteristics and role.

Proteins – structure and classification of proteins, Ramachandran Plot, Hydropathic index, protein denaturation, protein sequencing methods.

UNIT II **15 hours**

Carbohydrates- structure, classification, properties and functions
Lipids – structure, classification, properties and function.
Enzymes- Classification of enzymes, specificity, enzyme kinetics-Micheaelis-Menten equation, Line weavers Burk plot. Factors affecting enzyme activity, industrial uses of enzymes.

UNIT III **15 hours**

Basic principles of diffusion, osmosis and viscosity, and their application in biology. Electromagnetic spectrum.

Spectroscopic Techniques: Introduction, principles and applications in UV-Vis, fluorescence, Atomic absorption spectroscopy, Infrared and Raman spectroscopy, CD spectroscopy, NMR

UNIT IV **15 hours**

Chromatographic Techniques: Principles; Applications of Paper chromatography, TLC, Column chromatography, HPTLC, HPLC, GC, Affinity and ion exchange chromatography.

Electrophoretic Techniques: Principle, support media, electrophoresis of proteins and nucleic acids, capillary and microchip electrophoresis, isoelectric focusing, staining, activity staining.

References:

1. Principles of Biochemistry (2000) lehningermacmilon , worth publisher.
2. Fundamentals of Biochemistry (1999) D. Voet,J.G.Voet and C. W. Pratt, Johnwiley and sons.
3. Biochemistry (1998) K. C. Van Holde, W.C. Johnson and P. Shing Prentice Hall International.
4. Essential of biophysics (2000) P. Narayan New Agri International publishers.
5. Modern Experimental Biochemistry (2000) R. Boyer, Benjamin, Cumming.
6. Fundamentals of Molecular Spectroscopy (1994) C.V. Banwell and E.M. Mccash TataMcgrew –Hill publishing co. Ltd.

2.2 **Developmental Biology of Plants**

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Basic terms in developmental botany, Concept of Polarity, symmetry & differentiation. Meristem types, organization of meristems and ultra-structure of meristems. Differentiation and cell polarity in acellular (*Dictyostelium*) unicellular (*Acetabularia*, *Fucus* egg, *Equisetum* spore), organogenesis, formation of auxiliary buds.

SAM mutant, Phyllotaxis positioning, vernalization – changes in the biochemical activity.

UNIT II **15 hours**

Mechanism of leaf primordium initiation and stomata formation, Developmental pattern at the flowering apex, ABCDE model, MADS box genes during flower development. Cellular differences in between floral organs. senescence a general account, root hair formation, structure and function of shoot apical meristem (SAM) and root apical meristem (RAM), quiescent centre.

Molecular aspects of organ development

UNIT III **15 hours**

Androgenesis-Microsporogenesis and Micro gametogenesis- wall layers and functions; Tapetum- types, ultra-structural, genetical and functional aspects concept and significance of male germ unit.

Gynogenesis- Ovular structure and types; Development of monosporic, bisporic, tetrasporic and special types of embryo sacs, ultra-structural, genetical and functional aspects concept and significance of female germ unit.

Pollination and fertilization-structural and functional aspects of pollen, stigma and styles in the current aspects of fertilization. Male sterility concept: Types and mechanism.

UNIT IV **15 hours**

Embryogenesis- Cellular and biochemical aspects, composition and function of endosperm in relation to embryo development. Embryo suspensor-composition and function.

Regulation of zygotic embryogenesis

Fruit Development and ripening: Role of hormones in the regulation of ovary to fruit transition, factors affecting fruit development and ripening. Endoreduplication and fruit development.

Seed development and germination- Physiology and biochemistry expression of genes during seed germination. Seed dormancy and role of hormones. Photoreceptors- structure and function.

References

1. Bell P.R. 2000 Green Plants, their origin and Diversity, Cambridge University Press,
2. Bhojwani, S. S.and Bhatnagar, S. P. 1978. The embryology of Angiosperms. Vikas Publishing House, New Delhi.
3. Eames, 1961. Morphology of Angiosperms. McGraw Hill book Co., Inc., New York.
4. Johri, B. M. 1982. The experimental embryology of vascular plants. Springer Verlag, New York.
5. Johri, B. M. 1984. The embryology of Angiosperms. Springer Verlag.
6. Maheshwari, P. 1950. An introduction to the embryology of Angiosperms. McGraw Hill book Co., Inc., New York.
7. Maheshwari, P. 1963. Recent advances in the embryology of angiosperms. ed. New Delhi
8. Raghavan V. 1986 Embryogenesis in Angiosperms, Cabridge University Press Cambridge.
9. Robert F. Lyndon 1988 The Shoot Apical Meristem, Cambridge University, Press, UK.
10. Swamy, B.G.L. & Krishnamurthy, K. V. 1982. From flower to fruit: The embryology of angiosperms. Tata McGraw Hill Co. New Delhi.
11. Wearing P.F. and Philips, I.D.S.1981 Growth and Differentiation in Plants. Pergamon
12. Taiz, L, Zeiger E., Moller I.M., Murphy A. 2014. Plant Physiology and Development 6^{th} Eds.

2.3 Genetics and Plant Breeding

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

Genetics: An over view of Mendelian Genetics, extension of Mendelian's principles-Quantitative inheritance, multiple alleles, lethal allele. Extra nuclear inheritance: Inheritance of mitochondrial and chloroplast genes, male sterility in plant.

Linkage and crossing over, Cytological and molecular basis of crossing over, Recombination: homologous and non-homologous, Linkage maps mapping by 2 point and 3-point test cross.

UNIT II **15 hours**

Population Genetics: Population and gene pools, Allele frequencies and genotype frequencies, Hardy-Weinberg's Law, Factors effecting allelic frequencies in population-Mutation, Migration, Non-random mating, selection, genetic drift, genetic equilibrium.

UNIT III **15 hours**

DNA as genetic material, Gene concept, Mechanism of DNA replication in prokaryotes and eukaryotes, Enzymes in DNA replication. Types and role RNA, Genetic Code-Contribution of Nirenberg and Khorana. Structural and numerical abnormalities. Introduction and application of bioinformatics.

Sex determination: Role of chromosomes and hormones in sex determination, molecular basis of sex determination. Genetic disorders in human, sex determination in plants.

UNIT IV **15 hours**

Plant Breeding: Mode of reproduction, methods of hybridization in self- and cross-pollinated plants, Plant Introduction, Domestication and acclimatization, patterns of evolution in crop plants. Heterosis-genetic basis of heterosis. Breeding plants for resistance to abiotic and biotic stresses. Marker Assisted Selection (MAS) in plant breeding. Designing of experiments for plant breeding. Mutational breeding.

References:

1. Concept of Genetics 4th Ed: William S Klung and M R Cummings
2. Elementary Principles of Plant Breeding, Chaudhary H K.
3. Genetics 4th Ed: Susan Elrod and William Stan field.
4. Genetics: Denial J Fairbanks.
5. Genetics-Analysis and Principles: Robert J Brooker.
6. Heterosis, Frankel R and Bet Dagan.
7. Molecular Genetics: G S Stent.
8. Plant Breeding, Singh B D.
9. Plant Breeding-Theory and Practices, Chopra V L.
10. Principles and Practices of Plant Breeding, Sharma J K.
11. Principles of Genetics: D Peter Snustad et al.
12. Singh, B.D. (2005). Plant breeding: principles and methods. 7th edn.
13. Strickberger, M.W: Genetics (4th edn). Mcmillan Publishing company, New York.
14. The Human Genome: R Scott Hawley and Catherine and Mori.
15. Understanding GENETICS-A molecular approach. Norman V Rothwell.

2.5: Practical III

(Based on Paper 2.1 Biochemistry and Bio-Physics)

1. Extraction of chloroplast pigments and demonstration of their absorption spectra.
2. Determination of The Acid Value of a Fat
3. Estimation of protein by Lowry's method
4. Separation of Chlorophyll pigment by paper chromatography
5. UV and Visible spectra of biomolecules.
6. Fractionation of proteins by gel filtration.
7. Estimation of phospholipids.
8. Preparation of buffer solution and measurement of pH.
9. Separation of proteins/ nucleic acids by Electrophoresis.
10. Qualitative analysis of carbohydrates (Glucose and starch).
11. Visit to nearby science research laboratory

2.6: Practical IV

(Based on Paper 2.2 Developmental Biology)

1. Microtome sectioning and studying histochemical nature using (PAS, Protein and RNA)- shoot/root/floral buds.
2. Tracing the course of stomatal development and observations on stomatal types.
3. Study of trichomes, stomatal types (*Crotalaria*/ *Portulaca*/ *Taliniurn*/ *Tridax*, *Petunia*/*Datura*/ *Barleria*/ *Rheodiscolor*/ *Commelina*/ *Brassica*/ *Cyperus*/Grass).
4. Multiple staining for localizing pollen tubes in the pistil.
5. *In-vitro* pollen germination to find out the percentage of viability.
6. Study to composition of wet and dry stigmatic papillae (RNA, Proteins)
7. Pollen morphology studies by acetolysis.
8. Biochemical test for sugars – ripe and unripe fruit.
9. Estimation of proteins during seed development.
10. Visit to agriculture/ horticulture institute/plant breeding center.

(Based on 2.3 Genetics and Plant Breeding)

1. Study of cell division (1 & 2).
2. Karyotype analysis in *Allium cepa*.
3. Polytene chromosome in Chironomous larvae /Fruit flies.
4. Study of genetic disorders using karyotype.
5. Genetic problems on hardy Weinberg's law.
6. Genetics problems on linkage and crossing over, gene mapping and population genetics.
7. Demonstration of hybridization technique.
8. Plant selection methods.
9. Estimation of lethal dose (LD50).
10. Demonstration of MAS in plant breeding.
11. Visit to nearby agriculture or horticultural institute.

2.4 OPEN ELECTIVE: MEDICINAL BOTANY

Teaching Hours per Week: 4
No. of Credits: 4

UNIT I **15 hours**

History, scope and importance of medicinal plants. A brief account of Indigenous medicinal sciences- Ayurveda, Siddha and Unani. Brief account of herbal formulations and preparations. Traditional knowledge, Ethnic communities of India. Ethnobotany and folk medicine, Applications of ethnobotany.

Organization and institutes: national medicinal plant board (NMPB) foundation for revitalization of local health tradition (FRLHT) national botanical research institute (NBRI) central institute for medicinal and aromatic plants (CIMAP) AYUSH

UNIT II **15 hours**

Plant identification- Elementary knowledge of Binomial nomenclature, importance of scientific names and classification, important website for plant nomenclature, Herbarium techniques and importance of herbarium, databases for medicinal plants.

UNIT III **15 hours**

Study of some important medicinal plants with reference to their distribution, methods of propagation, active ingredients, medicinal uses and adulterants of *Justicia adhatoda*, *Azadirachta indica*, *Phyllanthus emblica*, *Curcuma longa*, *Ocimum tenuiflorum*, *Centella asiatica*, *Aloe vera*, *Terminalia bellirica*, *Annona reticulata*, *Coriandrum sativum*, *Rauvolfia serpentina*, *Citrus × limon*, *Zingiber officinale.*

UNIT IV **15 hours**

General account of Methods of preparation and identification of bioactive compounds in herbal extracts. Pharmacological activities, medicinal plants and plant products used in the treatment of common diseases (diabetes, cancer, jaundice, cardiac diseases). Conservation of medicinal plants- In situ and Ex situ. IPR and Patenting.

References:

1. Trivedi, P. C. (2006). Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
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