VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science

Botany Course structure

(I-IV semester)

With effect from

2024-25

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105

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

DEPARTMENT OF STUDIES IN BOTANY

I-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		
FIRST	DSC1	24BOT1C1L	**Plant diversity and Phytogeography**	30	70	100	4	-	-	4	3
	DSC2	24BOT1C2L	**Systematics of Angiosperms**	30	70	100	4	-	-	4	3
	DSC3	24BOT1C3L	**Plant pathology and protection**	30	70	100	4	-	-	4	3
	DSC4	24BOT1C4L	**Ecology &Ecoinformatics**	30	70	100	4	-	-	4	3
	SEC1	24BOT1S1LP	**Modern Methods of Plant Analysis**	20	30	50	1	-	2	2	2
	DSC1L1	24BOT1C1P	**Plant diversity and Phytogeography**	20	30	50	-	-	4	2	4
	DSC2L2	24BOT1C2P	**Systematics of Angiosperms**	20	30	50	-	-	4	2	4
	DSC3L3	24BOT1C3P	**Plant pathology and protection**	20	30	50	-		4	2	4
Total Marks for I Semester						**600**				**24**	

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	24BOT2C5L	**Plant Anatomy and Histochemistry**	30	70	100	4	-	-	4	3
	DSC6	24BOT2C6L	**Cell Biology and Genetics**	30	70	100	4	-	-	4	3
	DSC7	24BOT2C7L	**Plant developmental biology**	30	70	100	4	-	-	4	3
	DSC8	24BOT2C8L	**Economic Botany and Ethnobotany**	30	70	100	4	-	-	4	3
	SEC2	24BOT2S2LP	**Bioinformatics and applications in Biology**	20	30	50	1	-	2	2	2
	DSC5L4	24BOT2C4P	**Plant anatomy and Histochemistry**	20	30	50	-	-	4	2	4
	DSC6L5	24BOT2C5P	**Cell Biology and Genetics**	20	30	50	-	-	4	2	4
	DSC7L6	24BOT2C6P	**Plant developmental biology**	20	30	50	-	-	4	2	4
Total Marks for II Semester						**600**				**24**	

III-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		
THIRD	DSC9	24BOT3C9L	**Plant physiology and Biochemistry**	30	70	100	4	-	-	4	3
	DSC10	24BOT3C10L	**Molecular Biology**	30	70	100	4	-	-	4	3
	DSE1	24BOT3E1AL	**A. Gardening and Landscaping**	30	70	100	4	-	-	4	3
		24BOT3E1BL	**B. Applied and Industrial Botany**								
		24BOT3E1CL	**C. Pharmacognosy & Phytochemistry**								
	DSE2	24BOT3E2AL	**A. Medicinal & Aromatic plants**	30	70	100	4	-	-	4	3
		24BOT3E2BL	**B. Seed Technology**								
		24BOT3E2CL	**C. Nanobiology**								
	GEC1	24BOT3G1AL	**A. Forensic Botany**	20	30	50	2	-	-	2	1.5
		24BOT3G1BL	**B. Biofertilizers & Biopesticides**								
		24BOT3G1CL	**C. Aquatic Botany**								
	SEC3	24BOT3S3LP	**Research Methodology**	20	30	50	1	-	2	2	1
	DSC9P7	24BOT3C7P	**Plant physiology and Biochemistry**	20	30	50	-	-	4	2	4
	DSC10P8	24BOT3C8P	**Molecular Biology**	20	30	50	-	-	4	2	4
Total Marks for III Semester						**600**				**24**	

IV-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		
FOURTH	DSC11	24BOT4C11L	**Plant Tissue Culture**	30	70	100	4	-	-	4	3
	DSC12	24BOT4C12L	**Plant breeding and propagation**	30	70	100	4	-	-	4	3
	DSE3	24BOT4E3AL	**A. Weed Biology and Ecology**	30	70	100	4	-	-	4	3
		24BOT4E3BL	**B. DNA barcoding of land plants**								
		24BOT4E3CL	**C. Plant Translational Research**								
	DSE4	24BOT4E4AL	**A. Intellectual Property Rights**	30	70	100	4	-	-	4	3
		24BOT4E4BL	**B. Conservation Biology**								
		24BOT4E4CL	**C. Forest Botany**								
	GEC2	24BOT4G2AL	**A. Medical Botany**	20	30	50	2	-	-	2	1.5
		24BOT4G2BL	**B. Curios and Fascinating Plants**								
		24BOT4G2CL	**C. Floriculture**								
	DSC11P9	24BOT4C9P	**Plant Tissue Culture, Plant Breeding and propagation**	20	30	50	-	-	4	2	4
	Project	24BOT4C1R	**Research Project**	30	70	100		-	8	4	4
Total Marks for IV Semester						**600**				**24**	
(I-IV semester)- Total Marks: 2400 and Total credits: 96											

DSC-Department specific Core, DSE- Discipline specific elective, SEC – skill enhancement course, GEC- Generic elective course, IA-Internal Assessment, SEE- Semester end examination, L- Lecture, T-tutorial, P-practical

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science

(I semester)

With effect from

2024-25

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BELLARY-583105

Department of Studies in Botany

Programme: Master of Science (M.Sc.) in Botany
Duration: 2 years (4 semesters)
Programme Overview:

M.Sc. Botany curriculum is designed to mould students for better understanding of subject domain knowledge and technical skills about plants in a holistic manner. It aims to empower the students in all basic and advanced areas of plant sciences with a unique combination of the basic to frontier areas of plant science and elective papers with significant interdisciplinary components. Students have exposure to cutting edge technologies that are currently used in the plant molecular research also made aware about the social and environmental issues, significance of plants and their relevance to national economy through wel,-structured teaching -learning process.

Programme Outcomes (POs)

At the end of the programme the students will be able to

1. Excel the students to scientific research in the area of Plant Sciences
2. Develop a thirst to preserve the natural resources, environment and sustainable development.
3. Inculcate the students to become successful professional and entrepreneurs
4. Students become competent enough in various analytical tools and technical skills in the area of Plant Sciences
5. Excel the students to qualify State and National level competitive exams

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105

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

DEPARTMENT OF STUDIES IN BOTANY

I-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		
FIRST	DSC1	24BOT1C1L	**Plant diversity and Phytogeography**	30	70	100	4	-	-	4	3
	DSC2	24BOT1C2L	**Systematics of Angiosperms**	30	70	100	4	-	-	4	3
	DSC3	24BOT1C3L	**Plant pathology and protection**	30	70	100	4	-	-	4	3
	DSC4	24BOT1C4L	**Ecology &Ecoinformatics**	30	70	100	4	-	-	4	3
	SEC1	24BOT1S1LP	**Modern Methods of Plant Analysis**	20	30	50	1	-	2	2	2
	DSC1L1	24BOT1C1P	**Plant diversity and Phytogeography**	20	30	50	-	-	4	2	4
	DSC2L2	24BOT1C2P	**Systematics of Angiosperms**	20	30	50	-	-	4	2	4
	DSC3L3	24BOT1C3P	**Plant pathology and protection**	20	30	50	-		4	2	4
Total Marks for I Semester						**600**				**24**	

M.Sc. Botany First semester

Course: Plant diversity and Phytogeography	Course code: 24BOT1C1L
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 world of microbes and important types: viruses, fungi, and bacteria
2. To study the algal diversity, distribution, pigmentation, life cycles, and economic importance of algae
3. Study of lower plants Bryophytes- diversity, external and internal morphology, and phylogeny
4. The study of Pteridophytes- diversity, external and internal morphology, and phylogeny
5. Study of stelar evolution, the evolution of sporangium, and heterospory and seed habit in pteridophytes
6. The study of naked seed plants Gymnosperms: diversity, distribution, external and internal morphology, phylogeny, reproduction, and economic botany

Unit-1 **Plant diversity:** Introduction to Plant diversity. Species diversity: importance and threats. Genetic diversity: Importance and conservation strategies. Ecological diversity: importance and threats. Plant diversity in world. Plant diversity in India. Diversity based on habit, habitat, size, lifespan, nutrition, Angiosperm diversity based on stem nature. Conservation strategies of plant diversity. **11 hrs**

Unit-2 **Microbial diversity: Viruses:** Introduction, classification, diversity of virus in structure and function. **Viroids, Virusoid & Prions**: Sturcture and functions. **Bacteria**: Introduction, classification, morphological diversity of bacteria in structure and function. **Mycoplasma**: Introduction, classification and sturcture of mycoplasma. **11 hrs**

Unit-3 **Algae** : Introduction, classification, thallus organization, importance of Algae. **Fungi** : Introduction, **structural composition, biochemical properties, taxonomy, and their** importance**. Lichens** : Introduction, classification, thallus organization, importance of Lichens. Evolutionary relationships among each taxa. **11 hrs**

Unit-4 **Bryophytes**: Introduction, classification, structural organization and importance of Bryophytes. **Pteridophytes**: Introduction, classification, structural organization and importance of Pteridophytes. **Gymnosperms**: Introduction, outline classification, structural organization. Importance of Gymnosperms. Evolutionary relationships among each taxa. **11 hrs**

Unit-5 **Phytogeography**: Botanical zones of India. Modern principles of phytogeography. distribution of taxa based on geography: Endemics. Discontinuous distribution, Factors Affecting Distribution of Species and Theory of Continental drift, Theory of Land Bridge. **11 hrs**

References

1. Kumar HD (1999). Introductory Phycology. Affliliated East-West. Press Pvt. Ltd, Delhi, 2nd edition.
2. Tortora GJ, Funke BR, Case CL (2010). Microbiology: An Introduction, Pearson Banjamin Cummings, USA. 10th edition.
3. Sethi IK and Walia SK (2011) Text book of Fungi & their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos CJ, Mims CW, Blackwell M (1996) Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven P.H., Johnson GB, Losos JB, Singer SR (2005). Biology. Tata McGraw Hill Delhi, India.
6. Vashishta PC, Sinha AK, Kumar A., 2010. Pteridophyta, S.Chand. Delhi, India
7. Bhatnagar SP and Moitra A (1996). Gymnoperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar NS (19910 An introduction to Embryophyta. Vol-1. Bryophyta. Central Book Depot. Allahabad.

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

CO1: Identify the major groups of organisms with an emphasis on plants also able to classify them within a phylogenetic framework.

CO2: This course also offers to compare and contrast the characteristics of plants, non-vascular and vascular plants that differentiate them from each other and from other forms of life.

CO3: Able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth.

CO4: Able to give specific examples of the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.

CO5: Understand the relationships between environment and life on earth by tracing energy and nutrient flow through the environment.

Able to relate the physical features of the environment to the structure of populations, communities and ecosystems.

M.Sc. Botany First semester

Course: Systematics of Angiosperms	**Course code: 24BOT1C2L**
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. Acquire knowledge of plant identification using dichotomous keys and classify plant diversity
2. Understanding of plant morphology terminologies and identifying morphological peculiarities of plant families
3. Major features and evolutionary origins of vascular plants
4. Understand the core systems of classification of angiosperms, nomenclature and interdisciplinary approaches and development of various classification systems
5. Recognize members of the major angiosperm families by identifying their diagnostic features and economic importance
6. Evaluate the medicinal importance of selected angiosperms

Unit-1 **Systematics:** A key science, importance, relevance to conservation, taxonomic structure -taxonomic hierarchy, the species concept, categories and ranks, alpha and omega taxonomy, taxonomy as synthetic discipline. **11 hrs**

Unit-2 **Taxonomy:** Scope, History and Principles of Taxonomy; Carolus Linnaeus and his contributions to plant Taxonomy; A brief account of the concept of family, genus and species; concept of primitive flower and evolutionary tendencies. ICN - Principles, priority, valid publication and effective publication, citation. ICNCP, Classification of cultivated plant species, documentation and registration of cultivated plants. **11 hrs**

Unit-3 **Herbaria and their importance.** Preparation and maintenance of herbarium specimens. Brief account on the herbaria of world and India. Botanical gardens of world and India. Importance of Botanical gardens. Establishment of Botanical garden. Botanical Survey of India. **11 hrs**

Unit-4 **Taxonomic study:** Ranunculaceae, Magnoliaceae, Leguminoceae, Caryophyllaceae, Meliaceae, Rhiophoraceae, Orchidaeae, Aristalochacae, Asclepiadaceae, Dioscoriaceae, Bignoniaceae, Solanaceae, Lauraceae, Loranthaceae, Euphorbiaceae, Asteraceae, Arecaceae, Typhaceae and Poaceae. **11 hrs**

Unit-5 **Phylogeny of angiosperms:** monophyletic and polyphyletic origin of angiosperms, herbaceous origin hypothesis, origin of monocotyledons; molecular evidence to angiosperm origin, cradle of angiosperms. Tools in taxonomy: Flora writing: Preparation of dichotomous key, Identification plants by using key. Modern techniques in angiosperm taxonomy: Anatomy in relation to Taxonomy, embryology, cytology, chemotaxonomy, Molecular taxonomy **11 hrs**

References

1. Airy-show, H.K. 1983. Eighth edition. A dictionary of flowering plants and ferns, Cambridge Uni. Press.
2. Cronquist, A. 1968. The Evolution and classification of flowering plants, Thomas Nelson and Sons Ltd., London.
3. Jain S K and Rao RR. 1973. *A Handbook on field herbarium Methods. T*oday and Tomorrow's Printers and Publishers, c1977.
4. Bennet, S.S.R. 1979. An introduction to plant nomenclature, International Book Distributors, Dehradun.
5. Cronquist, A. 1968. The evolution and classification of flowering plants, Thomas Nelson and Sons Ltd.London.
6. N.P. Singh. *Flora of Eastern Karnataka* .Vol I and Vol. II. Mittal Publications, Delhi.
7. O.P. Sharma. *Plant Taxonomy.* Second edition. McGraw Hill Education Pvt.LTd., Chennai.
8. Davis, P.H. (2011). Principles of Angiosperm Taxonomy. Scientific Publishers, Jodhpur
9. Stace, C.A. (1989). Plant Taxonomy and Biosystematics. Edward Arnold Press, UK
10. Singh, V. (2010). Taxonomy. Rastogi Publication, Meerut. 4. Verma, B.K. (2011). Introduction to Taxonomy of Angiosperms. PHI Learning Private Limited, N.Delhi. 5.
11. Subramanyam, N.S.(1996). Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd. New Delhi.
12. Roy, P. (2010). Plant Anatomy. New Central book Agency, New Delhi.
13. Pandey, B.P. (2001). Plant Anatomy. S.Chand& Company Ltd. New Delhi.
14. Dwivedi, J.N. & Singh, R.B. (1986). Anatomy of Angiosperms. Central book Depot, Allahabad.
15. Bhojwani, S.S., Bhatnagar, S.P. &Dantu, P.K. (2014). The Embryology of Angiosperm. Vikas Publishing House Pvt. Ltd., New Delhi.
16. Jeffery, C. 1982. Sec. Edn. An introduction to plant taxonomy, Cambridge Uni.Press.
17. Jhori, B.M. and Bhatnagar, S. P. 1994. Taxonomy of Angiosperms. NarosaPublishers, NewDelhi.
18. Jones, S. B. and Luchsinger, A. E. 1979. Plant Systematics McGrew Hill Book Co. N.Y.
19. Hutchison, J. 1959. Families of flowering plants
20. Stace, C. A. 1989. Plaul. Taxonomy and Biosystematics Etwaed Arnold, London
21. Taylor, D. V. and L. J. Hickey 1997. Flowering plants : Origin, evolution and phylogenyCBSPublishers a Distributors New Delhi.

Course Outcomes (COs)

At the end of the course students will be able to:
CO1: Describe each organ of flowering plants.
CO2: Understand diversity of leaves, flowers, roots, fruits seeds of flowering plants.
CO3: Understand concepts of pollination and behavior of pollinators.
CO4: To classify plants proposed system of classifications.
CO5: Prepare herbarium and techniques of maintaining herbarium.
CO6: Technically describe families of flowering plants.
CO7: Develop concept of Phylogenetic systems of classification
CO8: develop understanding in preparation of dichotomous keys leading to classification and identification of plants

M.Sc. Botany First semester

Course: Plant pathology and protection	**Course code: 24BOT1C3L**
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. Learn the concepts and types of diseases in plants
2. Identify major principles of plant pathology and factors that cause diseases
3. Recognize the etiological agents/microbes responsible for plant disease and disease cycle and life cycle of various important diseases
4. Study and employ methods to diagnose and manage a wide range of plant diseases
5. Describe aspects of integrated pest management
6. Explain the impact of plant disease on humans

Unit-1 **Concept of plant disease:** History and development of plant pathology, Disease concept in plants, disease classification, Effect of the pathogen. Plant pathology in practice- Plant Clinic and Plant Doctor Concept. Effect of the pathogen on the physiology of host plant (photosynthesis, translocation, transpiration, respiration, permeability, transcription, and translation). **11 hrs**

Unit-2 **Epidemiology of plant diseases:** Traditional and modern concepts of disease triangle. Role of the host, pathogen, and environment in disease development. Aerobiology in relation to Epidemiology. Methods of monitoring splash borne and airborne inoculum. **11 hrs**

Unit-3 **Disease assessment**: Methods of assessment of disease incidence and disease severity and estimation of yield loss. Study of plant diseases of major crops Ballari region caused by fungi, bacteria, and viruses (with reference to symptoms, etiology, and control). **11hrs**

Unit-4 **Management of plant diseases:** Regulatory methods- plant quarantine, regulation, inspection, and certification. Physical methods- heat and cold treatment. Cultural methods- crop rotation, flooding, solarization, trap crops. Chemical methods - prophylactics and systemic chemicals. Biological methods- use of antagonistic microorganisms. VAM fungi and control of soil-borne diseases. Cross protection. **11hrs**

Unit-5 **Study of diseases of crop plants:** Potato spindle tuber disease, Tobacco Mosaic Disease, sandal spike disease, the bacterial blight of paddy, citrus canker, late blight of potato, downy mildew of maize, grain and head smut of sorghum, tikka disease of groundnut. Non-parasitic diseases of plants. Seed-borne diseases. **11 hrs**

References

1. Agrios,G.N.PlantPathology, FourthEdition1997,AcademicPress,USA.
2. Burdon:DiseasesandPlantpopulationbiology.CambridgeUniversityPress,Cambridge.
3. S.Nagarajan:PlantDiseaseEpidemiology.OxfordandIBHPublishingCo.NewDelhi(1983).
4. M.S.WolfeandC.E.Caten(Eds.)PopulationofPlantPathogenBlackwellScientificPublicat

ion.Oxford (1987)
5. Ilanchet(Ed.).Innovative Approaches to plant disease Control. Wiley Inter Science
6. Publication, IhonWileyandSonsNewYork (1987)
7. S.A.Tarr.PrinciplesofplantPathology.MacMillanPublishersLtd. London.
8. P. H. Gregery. Microbiology of Atmosphere (2 Ed.) Leonard Hill Books 24 marketSquare, Aylesbury, Bucks(1961)
9. C.T.Ingold.Funalspores,theirliberationanddispersaloxfordUniversityPress, London.(1971)
10. R.T.V.Fox.PrincipleofdiagnostictechniquesinpantpathologyCABInternational,Walling ford,UK. (1993).
11. P.IeffreiesandT.W.Young.Inter-fungal parasitic relationship CAB International,Wallingford.UK. (1994).
12. K.R.Aneja.Experiments in microbiology,PlantPathology and Tissueculture, WiswaPrakash an, NewDelhi, (1993)
13. V. N. Pathak. Laboratory Manual of Plant Pathology (2Ed.) Oxford and IBH Publishers,NewDelhi (1984)
14. Rangaswamy,G.DiseasesofCropPlantsinIndia,PrenticeHall,NewDelhi,1979.
15. R.S.Singh,IntroductiontoPrinciplesofPlantpathology, OxfordandIBHNewDelhi.
16. Wheeler,B.E.J.AnIntroductiontoPlantdiseases,JohnWiley&SonsLtd.UK.1972

Course outcomes (COs)

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

CO1: Know the national and international relevance as it is dealing with the protection of food from pests and diseases for sustained food security.

CO2: Understand the science of the development of plant pathology in India and the World and the role of plant clinics and plant doctors in alleviating crop losses.

CO3: Explain the various pathological events during the progression of an infectious disease

CO4: Apply the principle of epidemiological sciences in studying the underlying mechanisms of the spread of disease and controls required thereof to combat the spread of pathogens.

M.Sc. Botany First semester

Course: Ecology and ecoinformatics	**Course code:** 24BOT1C4L
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. Learn about the different ecosystems and describe the habitats within ecosystem
2. Observe and identify organisms with similar needs that compete for resources
3. Describe the climate changes which cause organisms to thrive become ill or perish
4. To systematically learn the ecosystem, and ecosystem functioning
5. Describe how organism modify environment to meet their needs

Unit-1 **Ecosystem organization**: Ecosystem structure and functions, primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition; mineral cycles in terrestrial and aquatic ecosystems Ecosystem management: Concepts; sustainable development; sustainability indicators. **11 hrs**

Unit-2 **Community ecology**: Concepts of community and continuum; community attributes; species diversity (α, β and γ); community coefficients; concept of ecological niche. Community development: Models and mechanisms of ecological succession; changes in ecosystem properties during succession; Concept of climax. **11 hrs**

Unit-3 **Earth and its Atmosphere.** Air pollution: Types and sources, Effects of SO2, NO2, O3, HF, photochemical smog and particulates on plants. Water Pollution: Types and sources; Effects on water quality, plants. Thermal pollution. Soil pollution: Types and sources, Effects of pesticides and heavy metals on ecosystems, mechanisms of metal toxicity, metallophytes. Radioactive pollution: Sources and hazards. Soil erosion and conservation. **11 hrs**

Unit-4 **Global Environmental Change.** Global Environmental change issues. Stratospheric ozone layer: Evolution of ozone layer; Causes of depletion and consequences; Effects of enhanced UV-B on plants, microbes, animals, human health and materials; Biological action spectra; Global efforts for mitigation ozone layer depletion. Climate change: Greenhouse effects; Drivers of climate change; Greenhouse gases and their sources; Implications on climate, oceans, agriculture, natural vegetation, wildlife and humans; Effects of increased CO2 on plants; International efforts on climate change issues. **11 hrs**

Unit-5 **Ecoinformatics**: Definition and Components, Development, Platforms and Types. ; Indian Remote Sensing Satelites and Sensors. GIS Data Structures: Types (spatial and Non-spatial), Raster and Vector Data Structure. **11 hrs**

References:

1. Ambasht, R.S. and Ambasht, N.K.1999. A Text book of plantEcology.
2. **Brij Gopal and N. Bhardwaj Elements ofEcology**. Vikas publishing House. New Delhi.
3. Clements, F.E. (1916) Plant Succession: Analysis of the Development of Vegetation. Carnegie Institution of Washington Publication Sciences, 242, 1-512.E.P.Odum and G.W. Barrett. 2005. Fundamentals of Ecology. Cengage Learning India Pvt. Ltd.
4. H. R. Byers. 2006. General Meteorology. McGraw-Hill. 4. K. S. Valdiya. 1987. Environmental Geology. Tata McGraw-Hill.
5. **Hanson, H.C. and E.D. Churchill, The Plantcommunity.**
6. J. M. Wallace and P. V. Hobbs. 2006. Atmospheric Science – An introductory survey.Campbell J. B., 2007: Introduction to Remote Sensing, Guildford Press.
7. J.S. Singh, S.P. Singh and S.R. Gupta. 2008. Ecology, Environment & Resource Conservation. Anamaya Publications.
8. Jensen J. R., 2004: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice Hall.
9. Joseph, G. 2005: Fundamentals of Remote Sensing, United Press India.
10. **Kormondy, E.J. 1989. Concepts ofEcology**.
11. Lillesand T. M., Kiefer R. W. and Chipman J. W., 2004: Remote Sensing and Image Interpretation, Wiley. (Wiley Student Edition).
12. **Microbiology of the atmosphere, by P.h.Gregory.**
13. Nag P. and Kudra, M., 1998: Digital Remote Sensing, Concept, New Delhi.
14. **Odum, E.P. 1971. Fundamentals ofEcology.**
15. Rees W. G., 2001: Physical Principles of Remote Sensing, Cambridge University Press.
16. **Robert Leo. Smith 1980. Elements of Ecology and fieldBiology.**
17. Sarkar, A. (2015) Practical geography: A systematic approach. Orient Black Swan Private Ltd., New Delhi 10. Chauniyal, D.D. (2010) SudurSamvedanevamBhogolikSuchanaPranali, Sharda Pustak Bhawan, Allahabad
18. **Sharma, P.D. 1999. Ecology andEnvironment.**
19. Singh R. B. and Murai S., 1998: Space-informatics for Sustainable Development, Oxford and IBH Pub.
20. T. R. Oke. 2006. Boundary layer climates. Methuen & Co. Ltd. 2. S. Pal Arya. 2001. Introduction to Micrometeorology. Academic Press.
21. Wolf P. R. and Dewitt B. A., 2000: Elements of Photogrammetry: With Applications in GIS, McGrawHill.

Course outcomes (COs):
At the end of the course students will be able to:

CO1: Understand various structure and functions of ecosystem
CO2: Realize Importance minerals, in sustainable development of ecosystem.
CO3: Students will acquire a broad base of knowledge of ecology and environmental systems, including the Earth's atmosphere, hydrosphere, lithosphere, and biosphere.
CO4: The students will be able to assess and conduct environmental impacts and uses of remote sensing and GIS on various ecosystems and this program helps to study the management and control of air, soil and water pollution.
CO5: This programme on a broader sense will enable the students to opt for a career in the academia, central and state pollution control boards, MoEFCC, industries, laboratories, and can opt for Ph.D Programmes.

M.Sc. Botany First semester

Course: Modern Methods of Plant analysis	**Course code:** 24BOT1S1P
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. Learn broad knowledge in modern analytical instrumentation with deep knowledge in its core concepts and its applications
2. Understand the principle, instrumentation of different types of light microscopy and electron microscopy and their applications in various fields of research
3. Acquire knowledge about the basics and latest developments in the instrumentation techniques of centrifugation, electrophoresis, spectroscopy, chromatography and their applications in various research fields
4. Learn about basic radioactivity principles, measurement and its biological applications.

Unit-1 **Microscopy:** **8 hrs**

Principle and applications of dissecting, compound microscope, bright field and dark field microscopes, phase-contrast microscope, fluorescence microscope, confocal microscope, scanning electron microscope (SEM) and transmission electron microscope (TEM), atomic force microscope (AFM), camera lucida

pH meter and centrifugation:

pH meter: principles and applications. Centrifugation: principles, types of centrifuges, types of rotors, ultracentrifugation, application, sonication and freeze drying.

Chromatography:

Chromatography techniques: principle and applications – paper, thin layer, column, gas, high performance liquid chromatography

Unit-2 **Electrophoretic, blotting and PCR techniques:** **8 hrs**

Principle and applications of SDS-PAGE (protein separations), agarose gel electrophoresis (DNA and RNA separations),

Polymerase chain reaction, quantitative real-time PCR, colony PCR, RT-PCR, western blotting, southern blotting and northern blotting techniques,

Genome editing/ Crisper-cas9, radio-immune assay (RIA), ELISA, micro-array and sequencing techniques

Spectroscopy:

Introduction, principle of Beer-Lamberts Law, Colorimetry and Spectrophotometry. Ultra-violet and visible spectroscopy (UV-Vis), Mass-spectroscopy, NMR spectroscopy, Flow cytometry and their applications

Unit-3 Experiments **14 hrs**

1. Microscopy – Light microscopy, principles, parts and function
2. pH meter: instrumentation and working principle
3. Preparation of buffers with acidic pH to alkaline pH
4. Micrometry – calibration of ocular scales and measurement of microscopic objects using micrometer scales
5. Preparation of TLC plates and separation of plant pigments/ primary and secondary metabolites on TLC plates
6. Centrifugation: Instrumentation and working principle
7. Separation of genomic DNA using agarose gel electrophoresis
8. Determination of absorption spectrum of chlorophyll pigment in the visible light range (350 to 700 nm) using spectrophotometry
9. Demonstration of HPLC analysis of purified phytocompounds
10. Study of principle and working of pH meter and measurement of pH of milk, pepsi, lemon juice etc. using pH meter and pH paper
11. Demonstration of PCR -the polymerase chain reaction
12. Study of principle of chromatography and separation of amino acids mixture

References

1. Birren R.E. et al., 2006. Genome analysis-A laboratory manual Vol-I: Analyzing DNA Panima Publishing House (reprinted) New Delhi/ Bangalore.
2. Bold RW and Primerose SB. Principles of gene manipulation- An introduction to genetic engineering. Black Well Scientific Publications. London, Edinburg, Boscon
3. Introduction to plant Biotechnology, Oxford and IBH Publishing Co. Pvt Ltd. New Delhi.
4. Datta A. 2009. Experimental Biology-A Laboratory Manual. Narosa Publishing House. New Delhi.
5. Gurumani N. 2005. Research methodology for Biological Sciences M.J.P.
6. Marimuthu R. 2011. Microscopy and microtechniques
7. Pratibha Devi. 2000. Principles and methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios (India).
8. Rick Wood D and Hames B.D., 1990. Gel electrophoresis of Nucleic acid – A practical approach, III edition IRL presses Oxford. New York
9. Shukla YM., Dhruve JJ., Patel NJ., Bhatnagar R., Talati JG and Kathiria KB., 2009. Plant secondary metabolites, New India Publishing House, New Delhi.
10. Veena Kumari., 2006. Bioinstrumentation. M.J.P. Publication.

Course outcomes (COs)

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

CO1: Knows the general safety routines for laboratory work in molecular biology

CO2: Understand the basic principles of different bioanalytical techniques, electrophoresis, PCR, western blotting,

CO3: Able to separate different biomolecules DNA (genomic/ plasmid/ recombinant plasmids), RNA and proteins.

CO4: Separate the proteins from the mixture cellular/tissue extracts using SDS-PAGE and identify the protein of interest on the gel using a western blotting technique
CO5: Can explain the principles of molecular cloning and PCR, cell transfection, and Western blotting
CO6: Develop skills in handling microscope, UV-visible spectrophotometer, chromatography, FACS, electrophoresis. Also develop experiencing in with large datasets.

M.Sc. Botany First semester

Course: Plant diversity and Phytogeography	**Course code: 24BOT1C1P**
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. This course is intended to learn about diversity of plants and their impact on humans
2. To study the algal diversity, distribution and pigmentation.
3. Study of lower plants Bryophytes- Diversity; External and internal morphology; and Phylogeny.
4. The study of comparative accounts of gametophytes of Bryophytes.
5. The Study of Pteridophytes- Diversity; External and internal morphology and Phylogeny
6. Study of stelar evolution, evolution of sporangium and Heterospory and seed habit in Pteridophytes.
7. The study of naked seed plants Gymnosperms- Diversity and distribution; External and internal morphology; Phylogeny; reproduction and economic Botany.

List of experiments

1. Identification of botanical zones of India.
2. Tools to study plant diversity in field and laboratory.
3. Study of algae: Collection, preservation and identification.
4. Isolation of fungi from soil using serial dilution technique
5. Study of morphological and reproductive structures of fungi
6. Study of Bryophyte diversity in Ballari region.
7. Study of pteridophytes diversity in Ballari region.
8. Study of gymnosperm diversity in Ballari region.
9. Study of Angiosperm diversity in Ballari region.
10. Study of morphological character of Hydrophytes (Eichhornia, Hydrilla and pistia). Determination of Relative density of plant species by quadrant method
11. Staining of Bacteria: Gram's staining.

Note: Submission of any five collected specimens from each plant groups.

References

1. Krishnamurthy K. V. 2007. An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IHB Publishing Co. Pvt. Ltd. New Delhi.

2. Christian Leveque and Jean-Claude Mounolou, 2003. Biodiversity. John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.

3. Jeffries Michael J. 2006. Biodiversity and conservation, 2nd edn. Taylor and Francis Group, New York.

4. Holt, J.G., Krige, N.R., Sneath., P.H.A. Stuley, J.T. and Williams, S.T. 2010. Bergey`s Manual of Determinative Bacteriology, 9th edn. Williams and Wilkins, USA.
5. Smith, G.M. 1951. Manual of Phycology. Pub. Co. Waltham., Mass.
6. Schenck, N.C. and Perez, Y.1990. Manual for the identification of VA mycorrhizal fungi. InternationalCulture Collection of VA Mycorrhizal Fungi. Synergistic Publications, Gainesville, Florida, USA.
7. Jain, S.K. 1995. Manual of Ethno-botany, Scientific Publishers, Jodhpur.
8. Sambrock, J., Fritch, E.F., and Maniatis, T. 1989. Molecular cloning- a laboratory manual.
9. Croiat, 1952. Manual of Phytogeography.

Course outcomes

At the end of the course students will be able to

CO1: Review characteristics of organisms belonging to the kingdom plantae
CO2: Review the alternation of haploid and diploid cells and structures in plants
CO3: Develop understanding the concept and scope of plant diversity
CO4: Identify and causes and implications of loss of biodiversity
CO5: Apply skills to manage plant biodiversity
CO6: Classify the bacteria into two broad categories by Gram staining techniques
CO7: Concepualize the role of plants in human welfare with special reference to India

M.Sc. Botany First Semester

Course: Systematics of Angiosperms	**Course code:** 24BOT1C2P
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. Understand the systems of classification of angiosperms, nomenclature and interdisciplinary approaches
2. Provide lab-based training in writing short species description and illustration
3. Recognize members of the major angiosperm families by identifying their diagnostic features and economic importance
4. Evaluate the medicinal importance of selected angiosperms
5. Develop skills for identification of plants using dichotomous keys
6. Collect, preserve and identify herbarium specimens in a phylogenetic context
7. Pursue higher studies to get employability opportunities.

List of Experiments

1. Description of plants using technical terms sketching, classification, and identification of at least 10 families represented in local flora.
2. Identification of plants to family and species level
3. Exercises on nomenclature problems: Author citation, principle of priority, transfer of taxa, effective and valid publication.
4. Preparation of Dichotomous Key for identification
5. Preparation of herbarium of locally available plants
6. Chemotaxonomy
7. Study of Endemic species
8. Anatomical study supporting to taxonomy
9. Study of RET species
10. Several One-day botanical excursions to botanically rich locations.

NOTE:

a. Submission of herbarium, preparation of field notes and its submission prepared for the plants collected during study tour/trip.
b. Botanical excursion of about one week to any botanically rich location preferable outside the State.

References

1. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.A. and Donoghue, M.J. 2002. Plant Systematics: A phylogenetic Approach. Sinauer Associates, Inc., Massachusetts.
2. Gurucharan Singh. 2004. Plant Systematics: Theory and Practice, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Jeffrey, C. 1982. An introduction to Plant Taxonomy. II Edn., Cambridge Uni. Press.

4. Mondal, A.K. 2009. Advanced Plant Taxonomy. New Central Book Agency Pvt. Ltd., Kolkata, WB.
5. Pullaiah, T. 1998. Taxonomy of Angiosperms. Regency Publications, New Delhi.
6. Johri, B.M. and Bhatacharjee, S.P. 1994. Taxonomy of Angiosperms. Narosa Publishers, New Delhi.
7. Lawrence, G.H.M. 191. Taxonomy of Vascular Plants. MacMillan, London.
8. Chase, M.W. and Reveal, J.L. 2009. A phylogenetic classification of the land plants to accompany APG III. Botanical Journal of Linnaean Society, 161: 122-127.
9. Nei, M. and Kumar, S. 2000. Molecular Evolution and Phylogenetics. Oxford Univ. Press, New York

Course outcomes

At the end of the course students will be able to

CO1: Understand the plant morphological terminologies and morphological diversity of plants
CO2: Learn the system and scheme of classification of angiosperms, nomenclature and identification of plants
CO3: Gain proficiency in the use of taxonomic keys and identification manuals for identifying any unknown plants to species level
CO4: Provide lab-based training in writing short species descriptions and illuatration with floral diagram
CO5: Recognize members of the major angiosperm families by identifying their diagnostic features and study their ecological distribution and their economic importance
CO6: Learn the techniques of herbarium preparation and maintenance

M.Sc. Botany First Semester

Course: Plant pathology and protection	**Course code:** 24BOT1C3P
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. Introduce students to basic principles and concepts of plant pathology
2. Introduce and illustrate the major groups of organisms that cause plant diseases
3. Identify the etiological agents of disease
4. Employ methods to diagnose and manage a wide range of plant diseases
5. Explain the impact to plant disease on human affairs

List of Experiments

1. Study of locally available diseases: Tobacco mosaic, bacterial blight, downy mildew of maize, powdery mildew of cucurbits, grain smut of sorghum, leaf rust of coffee, root knot of mulberry, bunchy top of banana, grassy shoot of sugar cane, little leaf of brinjal, potato spindle tuber disease (PSTVd)
2. Study of Koch's postulations
3. Assessment affected leaf area by Stover's method
4. Field visits to assess disease incidence and severity
5. Estimation percent of spore germination
6. Experiment to show fungicidal inhibition of spore germination
7. Study of Fungal bio-control agents.
8. Isolation of fungi from disease plants/ parts
9. Isolation of bacterial, fungal, and nematode plant pathogens of crop plants.
10. Study of mineral deficiency diseases of Tomato and French bean.

References

1) Agrios, G. N. 2005. Plant Pathology 5th edn. Academic Press, San Diego.
2) Dickinson, M. 2003. Molecular Plant Pathology, Garland Publishing Inc, CT.
3) Ingram,D.S. and Robertson, N.F. 1999. Plant Diseases, Collins Publishers, London.
4) Johnston, A and Both, C. 1983. Plant Pathologists Pocket-book. 2nd edn. Commonwealth Mycological Institute, Oxford and IBH Pub. Co. Calcutta.

Course outcomes

At the end of the course, students will be able to
CO1: Study the plant diseases caused by different etiological agents, symptoms, epidemiology, and their management
CO2: Understand the disease management practices such as regulatory, cultural, physical, biological, chemical, and biotechnological approaches including IDM
CO3: Know the national and international relevance as it is dealing with the protection of food from pests and diseases for sustained food security.

CBCS Question Paper Pattern for PG Semester End Examination

with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**

Time: 3 Hours **Max.**

Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 14 Marks

Note :Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 14 Marks

Note: Question No.7*, shall be from Unit IV and V*,the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

****

Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max.**

Marks: 30

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

****

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science

(II semester)

With effect from

2024-25

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY,
Department Of Studies In Botany
Janasagara, 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	24BOT 2C5L	Plant Anatomy and Histochemistry	30	70	100	4	-	-	4	3
	DSC6	24BOT 2C6L	Cell Biology and Genetics	30	70	100	4	-	-	4	3
	DSC7	24BOT 2C7L	Plant developmental biology	30	70	100	4	-	-	4	3
	DSC8	24BOT 2C8L	Economic Botany and Ethnobotany	30	70	100	4	-	-	4	3
	SEC2	24BOT2S2LP	Bioinformatics and applications in Biology	20	30	50	1	-	2	2	2
	DSC5L4	24BOT 2C4P	Plant anatomy and Histochemistry	20	30	50	-	-	4	2	4
	DSC6L5	24BOT 2C5P	Cell Biology and Genetics	20	30	50	-	-	4	2	4
	DSC7L6	24BOT 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: 24BOT2C5L
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 **11 hrs**

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.

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. 3rdedn. 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 and Genetics	Course code: 24BOT2C6L
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 **Cell:** Prokaryotic cell, eukaryotic 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, hemidesmosomes, selectins, cadherins, adherin junctions, desmosomes, tight junctions, plasmodesmata and cell wall **11 hours**

Unit -2 **Chromatin organization:** Ultrastructure of chromatin: Multistrand model, Folded fibre model, Nucleosome model. Organization of chromatin: The nucleosome and Beads on String, 30 nm Chromatin fibre, Higher level of DNA packing into metaphase -chromosome. Types of Chromatin: Euchromatin and Heterochromatin. Composition of Chromatin: DNA, Histones, Non-histones. Functions of chromatin. Chromatin remodelling, Dosage compensation, X-chromosome inactivation, C-value paradox and Chromosome abnormalities. **11 hours**

Unit -3 **Chromosome mapping:** Karyotyping and its significance, Banding techniques (G, Q, T, R etc.), Types of chromosome mapping: Genetic mapping and Physical mapping. Chromosome mapping: Karyotyping and its significance, Banding techniques (G, Q, T, R etc.), Types, importance and limitations of chromosome mapping: Genetic mapping and Physical mapping. In-situ hybridization, FISH and GISH. Regulation of cell cycle and cell cycle determining genes. **11 hours**

Unit-4 **Fundamental Genetics**: Mendelism, Genic interaction- allelic and non-allelic gene interaction. Multiple allelism with examples. Linkage - types and theories of linkage. Crossing over- Salient features and

mechanism of crossing over. Sex determination- chromosomal, Environmental, Hormonal and metabolic theories of sex determination. Sex linked inheritance – discovery, types and examples- colour blindness, haemophilia and white eye colour in Drosophila. **11 hours**

Unit-5 **Cytoplasmic Inheritance and Population Genetics**: Salient features of cytoplasmic inheritance. Examples – Shell coiling in Snail, Kappa particles in Paramecium, plastid inheritance in plants, inheritance of pigments in Ephestia. Gene Pool and Gene frequency, Hardy Weinberg Law, Equilibrium and multiple alleles, Application. Calculations, factors affecting Hardy -Weinberg law. Selection, Mutation, genetic drift, Meiotic drive, and Migration.

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
18. 7.2: Mapping Genomes – Biology Libre Texts
19. Griffiths, A. J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C., Gelbart, W. M. (2000). An introduction to genetic analysis (7th ed.). New York: W. H. Freeman.
20. Hartl D. L. (2014). Essential genetics: a genomics perspective (6th ed.). Jones and Bartlett.

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: 24BOT2C7L
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 **Basic concepts of developmental biology:** Development involves major overlapping processes; Stem cell developmental potency; cellular plasticity in plants; determination and differentiation , mechanism of cellular determination; morphogenetic gradients, cell fate and cell lineages **11 hours**

Unit -2 **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 -3 **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- 4 **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 -5 **Molecular genetic approaches to plant growth and development:** Seedling growth, tropisms, and photomorphogenesis of seedling., functional genomics, genetic manipulation of plant for studying the development. Databases: Databases on plant genomics, transcriptomics, and proteomics of various species. **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

.

M.Sc. Botany second semester

Course: **Economic Botany and Ethnobotany**	Course code: 24BOT2C8L
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. Ethnobotany as an interdisciplinary science. Centres of Ethnobotanical studies in India. Ethnobotanicals of Western Ghats. Study of major and minor ethnical groups or tribals of Karnataka. Role of Ethnobotany and its scope in modern medicine. **11 hours**

Unit -3 **Ethnomedicine and Ethnopharmacology:** Introduction and scope. Role of ethnopharmacology in drug development. Differences between herbal or botanicals and pharmacological medicines. Classification and sources of crude drugs. Quality and safety of herbal medicines. Contributions of International, national and Regional ethnobotanists (JW Harshberger, RE Schultes, EK Janakiammal, SK Jain, R.Raghavendra Rao, VV Sivarajan). **11 hours**

Unit -4 **Methodologies of Ethnobotnical studies:** Field work, herbarium, Ancient Literature, Archeological findings, Temples and Sacred places. Anatomical and histochemical methods. Some general principles of phytochemical analysis. 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 **11 hours**

classification methods. Its Importance in Bioprospecting and Conservation of Phytoresources.

References :

1. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers 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., New
5. Delhi
6. Forest Ecology in India-Neena Ambre, 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 software to understand quantitative Ethnobotany.

M.Sc. Botany Second Semester

Course: **Bioinformatics and Applications in Biology**	Course code: 24BOT2S2LP
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 (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 **10 hours**

Unit-III 1.Laboratory Demonstrations for Biological Databases- **11 hours**
a) GenBank,
b) European Molecular Biology Laboratory
c) National Centre for Biotechnology
d) Pubmed
e. DNA Database of Japan
f. Protein Databank

2. Sequence alignment tools:

Pairwise sequence alignment search tools: Basic Local Alignment Sequence search tool (BLAST) and Fast-all (FASTA) tool
Multiple sequence alignment search tools – CLUSTAL-W and CLUSTAL-Omega for sequence alignment studies
3 Phylogenetics software, Homology Modelling, and Model evaluation, AutoDock,
4. Primer Designing software tools

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: 24BOT2C4P
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. Study of the anatomy of hanging roots in Ficus and Vanda
3. Preparation of double-stained permanent slides
4. Preparation and identification of the transverse section of stem of the following plants – Tridax procumbens, Calotropis procera, Aristolochia indica, Tinospora cordifola., Vinca rosea
5. Preparation and identification based on TS, TLS and RLS sections of the following wood- Michelia champaka, Tectona grandis (Teak), Azadirachta indica (neem), Mangifera indica, Tecoma stans, and Pongamia pinnata
6. Epidermal studies
7. Preparation of microtome sections and staining procedures
8. Histochemical staining – PAS test, Sudan black- lipids.
9. Study of anomalous secondary growth
10. Study of special anatomy of monocot leaves

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 and Genetics	Course code: 24BOT2C5P
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 examine the structure of plant cell and different cell division stages
2. To describe the process involved in isolation and separation of DNA
3. Develop basic skills to make cytological preparations and identification of various stages of cell division
4. Understand the Mendelian Inheritance, genetic recombination and chromosome mapping

List of experiments

1. Study mitosis through a temporary mount of the onion root tip
2. Study meiosis by preparing a temporary mount of the from onion flower buds
3. Mounting of Polytene chromosome from Chironomus larva
4. Micrometry and karyotype analysis
5. Mounting of Barr bodies
6. Preparation of karyotype and ideogram from given photograph of somatic metaphase chromosome
7. Study of viruses, prokaryotic cells (bacteria), eukaryotic cells with the help of light and electron micrographs
8. Genetic problems on mendelian inheritance,
9. Genetic problems on chromosome mapping,
10. Genetic problems on sex linked inheritance and population genetics
11. To study the principles and applications of the 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. Learning about karyotyping and its use in detecting mutation

M.Sc. Botany Second Semester

Course: Plant developmental Biology	Course code: 24BOT2C6P
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. Pollen in vitro germination methods: Sitting drop culture, suspension culture, surface culture.
8. Endosperm and Embryo sac mounting of Cucumber, Cucmis melo, Capsicum seeds
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.

CBCS Question Paper Pattern for PG Semester End Examination

with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**

Time: 3 Hours **Max.**

Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 14 Marks

Note :Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 14 Marks

Note: Question No.7*, shall be from Unit IV and V*,the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

****

Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max.**

Marks: 30

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

****

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science

(III semester)

With effect from

2024-25

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105

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

DEPARTMENT OF STUDIES IN BOTANY

III-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		
THIRD	DSC9	24BOT 3C9L	Plant physiology and Biochemistry	30	70	100	4	-	-	4	3
	DSC10	24BOT3C10L	Molecular Biology	30	70	100	4	-	-	4	3
	DSE1	24BOT3E1AL	A. Gardening and Landscaping	30	70	100	4	-	-	4	3
		24BOT3E1BL	B. Applied and Industrial Botany								
		24BOT3E1CL	C. Plant Biochemistry								
	DSE2	24BOT3E2AL	A. Medicinal & Aromatic plants	30	70	100	4	-	-	4	3
		24BOT3E2BL	B. Seed Technology								
		24BOT3E2CL	C. Nanobiotechnology								
	GEC1	24BOT3G1AL	A. Forensic Botany	20	30	50	2	-	-	2	1.5
		24BOT3G1BL	B. Biofertilizers & Biopesticides								
		24BOT3G1CL	C. Aquatic Botany								
	SEC3	24BOT3S3LP	Research Methodology	20	30	50	1	-	2	2	1
	DSC9P7	24BOT3C7P	Plant physiology and Biochemistry	20	30	50	-	-	4	2	4
	DSC10P8	24BOT3C8P	Molecular Biology	20	30	50	-	-	4	2	4
Total Marks for III Semester						**600**				**24**	

M.Sc. Botany III Semester

Course: **Plant Physiology and Biochemistry**	Course code: **24BOT3C9L**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVE

The students will be able to understand the importance of plant physiology with respect to agriculture and horticulture; the In-depth mode of action of important growth regulators and growth retardants; Important growth mechanisms like photosynthesis, photorespiration, and stress in plants.

COURSE CONTENTS

Unit- 1 Photosynthesis **11 hrs**

Photosynthetic pigments: Absorption spectrum. Path of CO2 fixation: Calvin cycle, Hatch and slack pathway and crassulacean acid metabolism. **Photorespiration:** Respiration and its types, Glycolysis, Krebs Cycle, Lactic Acid Fermentation, Pentose Phosphate Pathway, Glycolate-glyoxylate metabolism, electron transport chain and ATP synthesis. Nitrogen fixation: Atmospehric nitrogen fixation, biological nitrogen fixation.

Unit-2 Transpiration and its mechanism. **11 hrs**

Transpiration and its types. Stomata: Categories, physiological structure, function and types of stomata. Photosynthesis in Guard Cells. Starch and Sugar Inter-conversion. Mechanism of stomatal Opening and closing. Factors affecting the role of transpiration. Guttation.

Unit-3 Plant Growth Hormones **11 hrs**

Auxins: Introduction, Localization and transport; physiological effects and mechanisms of action. Gibberellins: Introduction, Localization and transport; physiological effects and mechanisms of action, Cytokinins: Introduction, Localization and transport; physiological effects and mechanisms of action. Introduction, Localization and transport, physiological effects of ethylene, abscisic acid.

Unit-4 Sensory photobiology and Stress Physiology **11 hrs**

Introduction, Structure, function of phytochromes, cryptochromes and phototropins, photoperiodism and Circadian rhythms in plants, vernalization, Seed germination and dormancy. **Stress physiology:** Introduction, Responses of plants to biotic stress: pathogen

stress and insects stress and Responses of plants to abiotic stress: water stress, temperature stress and salinity stress.

Unit-5 Biochemistry **11 hrs**

Carbohydrate: Introduction, Classification, properties, biological role. Lipids: Introduction, Classification, properties, biological role. Protein: Introduction, Classification, properties, biological role. Aminoacid and vitamins. Enzymes: Introduction, classification, characteristic and properties.

REFERENCES

1. A Text book of Plant Physiology and Biochemistry S.K. Verma, S.Chand & Comp., New Delhi.
2. Applied radiobiology and radiation protection: Granier R and Gambini D J: Ellis Howard, 1990.
3. Biochemistry and physiology of plant hormones –T.C.Moore, Springer and Verlag, Naw York, USA. 3. Plant physiology–L.Taiz and E.Zeiger, 2nd edition, Sinauer Associates. In. Publisher, Massachusetts, USA.
4. Cell Physiology and Biochemistry: Me Elroy W D: Prentice Hall of India,1995.
5. Electrogenic ion pumps: Spanswick R M: Ann. Rev. Plant Physiol. 32, 267-289,1981.
6. Enzymatic reaction mechanisms: Walsh C T: W H Freeman, New York,1979,
7. Introduction to Plant Physiology - Hopkins, John Wiley and Sons, New York, USA. 10. Plant Physiology. Salisbury and Ross, Wadsworth Publ. Co., California, USA.
8. Introduction to plant physiology –W.G. Hopkins ,John Wiley & Sons,Inc.New York USA.
9. Photorespiration protects C3 plants from photo-oxidation: Kozaki A and Takeba G: Nature, 384,557-560,1996.
10. Photosynthesis: Robinowitch E and Govindjee: Wiley, New York1969.
11. Physiology of ion transport across the tonoplast of higher plants: Birkla B J andPantanjo O: Ann. Rev. Plant Physiology, 47, 159-184,1996.
12. Physiology of Plant Growth and Development Edited M.B. Wilkins McGraw Hill, London.
13. Plant membranes-Endo and plasma membranes of plant cells: Robinson D G:West Germany,1985.
14. Plant metabolism Dennis, Turpin, Lefebure and Layzell, Longman Essex, England. 12. Plant Physiology Taiz and Zeiger, Sinauer Associates, Inc Pub. Massachusetts, USA.
15. Plant Physiology C.P. Malik, Kalyani Publishers, New Delhi.
16. Plant Physiology –F.C.Steward, Academic Press ,New York.
17. Plant Physiology, Devlin. Yan Nostrand Reinhold Comp. New York. Affiliated East West Press Pvt.Ltd., New Delhi.
18. Plant physiology–F.B. Salisbury and C.W.Ross, 4th edition, Wadsworth publishing Co. , California. 5. Photoperodism in plants –B.Thomas and D.Vince pure, 2nd edition Academic press, Sandiego, USA.
19. Plant Physiology—S. Mukharji and A.K.Gosh 7. Plant Physiology –D.Hess, Springer Berlin.
20. The Phytochrome chromophore I. Photomorphogenesis in plants: Rudier Wand Thummlar K: Netherlands 51-69,1994.

COURSE OUTCOMES:

1. Understand the detailed mechanism of Photosynthesis.
2. Understand role of growth regulators and growth retardants in growth and development of plants.
3. Understand various aspects of photophysiology like Photoperiodism, vernalization, Circadian rhythms etc.
4. Will be able to distinguish between C3 and C4 plants.
5. Understand how plants behave under biotic and abiotic stress.
6. Understand concepts like photoinhibition, photoperiodism, and Nitrogen metabolism.

M.Sc. Botany III Semester

Course: **Molecular Biology**	Course code: **24BOT3C10L**
L-T-P per week **4-0.0**	No of credits – **04**
Internal Assessment: **30 marks**	Semester end Examination: **70 marks**
Total contact hours: **55**	

COURSE OBJECTIVES

- To know the origin of DNA science and related major discoveries which paved the beginning of molecular biology.
- Learn the detailed molecular processes of DNA replication, Transcription, and translation processes in prokaryotes and eukaryote organisms
- Familiarize with the regulation of cell cycle and molecular processes of DNA Replication, Transcription, and Translation and its implication on cellular function
- Application of molecular biology principle in every life science approaches
- To get introduced to the basic concepts of genetic engineering
- Understand the basics of gene cloning, role of enzymes and vectors for genetic engineering, gene transfer methods and gene therapy

COURSE CONTENTS

Unit-1 Nucleic acids 11 hrs

Molecular biology of the central dogma. Historical perspective, DNA is the carrier of genetic information (Griffith's, Hershey and Chase, Avery, McLeod & McCarty experiments). The structures of DNA and RNA as genetic material: Salient features and types of DNA and RNA. Organization of DNA in prokaryotes, viruses, and eukaryotes. Mitochondrial DNA and Chloroplast DNA. DNA replication. Fine structure of prokaryotic and eukaryotic genes. Genetic code.

Unit-2 Regulation of gene expression in prokaryotes and eukaryotes 11 hrs

General mechanism of transcription and translation in prokaryotes and eukaryotes-initiation, elongation, and termination. Processing and modification of RNA -split genes-concept of introns and exons, removal of introns, spliceosome machinery, alternative splicing eukaryotic mRNA processing (5' cap, 3' poly-A tail). Ribozymes, exon shuffling, RNA editing, and mRNA transport. Ribosome structure and assembly, mRNA. Charging of tRNA, aminoacyl tRNA synthetases. Regulation of lactose metabolism and tryptophan synthesis in E. coli. Transcription factors, DNA methylation.

Unit-3 Transposable elements 11 hrs

Eukaryotic transposons – Ac-Ds system in Maize, P-elements in Drosophila and Retro-elements. Transposable elements in man. Prokaryotic transposons- Insertion, composite and non-composite sequences. Applications of transposons in research and health care system.

Unit-4 Genes and Immunity **11 hrs**

Natural and acquired immunity, immune responses-humoral and cell-mediated immunity, antibody structure, antibody genes, immune system, and malfunctions. Genes and Cancer: Genetic control of cell cycle, the molecular basis of cancer, tumour suppressor genes, oncogenes, prevention, detection, and treatment of cancer

Unit-5 Mutation, DNA damage, and repair **11 hrs**

Definition of mutation, a gain of function and loss of function mutation, forward and reverse mutation, point mutation (transitions, transversions, missense mutation, nonsense mutation, silent mutation, frameshift mutation), spontaneous mutation and induced mutation, Mutagen - physical (ionizing and UV radiation), chemical (base analogs, nitrous acid, acridine dyes, alkylating agents), Causes and types of DNA damage, DNA repair – Photo reactivation, mismatch repair, base excision, nucleotide excision repair, SOS repair.

REFERENCES:

1. Watson JD., Baker TA., Bell SP., Gann A., Levine M., Losick R (2007) Molecular Biology of the Gene, Pearson Benjamin Cummings
2. Snustad DP and Simmons MJ (2010) Principles of Genetics. John Wiley and Sons Inc., U.S>A. 5th edition.
3. Klug WS., Cummings MR., Spencer CA (2009) Concepts of Genetics. Benjamin Cummings U.S.A. 9th edition.
4. Russell P.J. (2010) Genetics – A molecular approach. Benjamin Cummings. U.S.A. 3rd edition
5. Griffiths AIF., Wessler SR., Carroll SB., Doebley J (2010) Introduction to genetic analysis W.H. Freeman and Co., U.S.A. 10th edition.
6. Cell and Molecular Biology – Concept and Experiments. 2nd Edition: Gerald Karp
7. Cell and Molecular Biology (1999) Gupta P. K. Rastogi Publication Meerut, India
8. Concept of Genetics 4th Edition: William S Klung and M.R. Cummings.
9. De Robertis, EDP and De Robertis EMF (2006) Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia
10. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., WH Freeman and Company
11. Voet D and Voet JG (2004) Biochemistry 3rd edition, John Wiley and Son
12. Sharma VK (1991) Techniques in microscopy and Cell Biology. Tata McGraw Hill
13. Reimer L and Kohl H (2008) Transmission electron microscopy. Springer.

COURSE OUTCOMES

On successful completion of this course the student will be able to;

1. Gain detailed know-how of chemical and molecular processes that occur in and between living cells.

2. Understand insight into the most significant molecular and cell-based experimental methods used in molecular biology to expand our understanding of the functioning of biology.
3. Develop precise knowledge and understanding of physical and chemical mutations and the various repair mechanisms that rectify the damage in cellular processes.
4. Develop proficiency in isolation, estimation, and determination of biomolecules to understand cellular mechanisms of operon and RNA interference.
5. To use genetic engineering tools in crop improvement

M.Sc. Botany III Semester

Course: **A. Gardening and Landscaping**	Course code: **24BOT3E1AL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits:**04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVE

- To understand the principles of plant nomenclature and taxonomy and apply this knowledge to the proper communication about landscape plants. Students will clearly distinguish between the hierarchical categories of plants (especially Order, Family, Genus and Species) and will be able to place individual landscape plants in the corresponding category. Students will also master the necessary details of herbaceous and woody plant morphology that will aid in identification.

Unit-1 Principles of gardening and production technology of seasons. 11 hrs

Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Landscaping, basic principles and basic components. Production technology of seasonals (annuals, biennials) and climbers, Herbaceous borders. Selecting trees for landscape. Planting trees and post planting care. Different tree forms & their phenology. Planting schemes for roadsides.

Unit-2 Garden types, features and components 11 hrs

Special types of gardens, their walk-paths, bridges, constructed features. Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, potting, climbers and creepers, palms, ferns, grasses and cacti succulents.

Unit-3 Ornamental Plants 11 hrs

Flowering annuals; Herbaceous perennials; Shrubs, Climbers; Ornamental trees; Ornamental bulbous plants; Palms and Cycads; Potted plants and indoor gardening. Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Lilium, Orchids); Bonsai & Terrariums.

Unit-4 Propagation of Garden Plants and indoor plants 11 hrs

Sexual and vegetative methods of propagation; Role of plant growth regulators. Floral arrangement and bonsai Importance, production details and cultural operations, constraints, post-harvest practices. Culture of bonsai, art of making bonsai. **Importance and role of indoor plants on indoor atmosphere. Indoor plants interior scaping. Effect of light, temperature and water on indoor plants. Common problems of indoor plants and their management.**

Unit-5 Gardening operations **11 hrs**

Soil laying, Manuring, Watering, Management of pests and diseases; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Mulching; Pruning, Topiary making.

REFERENCES

1. Dirr, Michael A. (2009) Manual of Woody Landscape Plants. Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. 6th Edition. Stipes Publishing, Champaign, Illinois.
2. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
3. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
4. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.
5. Hartmann and Kester, 2010. Plant Propagation: Principles and Practices. Pearson Publisher.
6. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
7. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
8. Thakur, A.K., Kashyap, B., Bassi, S.K. and Sharma, M. 2018. Floriculture. S. Dinesh & Co., Jalandhar
9. Saidaiah Pidigam, Sindhuja S., Geetha Amarapalli. (2018)Text Book of Nursery, Gardening and Floriculture, Kalyani Publishers, New Delhi.

COURSE OUTCOMES:

1. Students will be accustomed to the contents and details of gardening and landscaping.
2. Students will be acquainted with the features of different types of gardens.
3. They could categorize annuals, perennials, and flowering trees required for landscaping and gardening.
4. Develop skills in roof/terrace/vertical gardening
5. Understand the role and importance of indoor and outdoor plants as aesthetics.
6. Students will understand the propagation techniques of garden plants.
7. Students will be familiar with various hedges and edge plants.

M.Sc. Botany III Semester

Course: **B. Applied and Industrial Botany**	Course code: **24BOT3E1BL**
Teaching hours/week (L-T-P): 4-0-0	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVE

- Understand various processes of commercial production, extraction, manufacture, and utility of wood, paper, sugar and sugarcane, rubber, essential oils, and vegetable oils, gums, resins, and dyes. Pharmaceutical products like nutraceuticals, and medicines like quinine. Packing of milk and milk products, pickles, jams, jellies, juices, pastes, sauces etc.

Unit-1 Extraction of sugar from sugar cane **11 hrs**

Flow diagram of the process with a critical study of the steps involved, and problems faced by the sugar industry in India. Bye-products of the sugar industry, the distillation of alcohol and other products

Unit- 2 Commercial Wood **11 hrs**

Physical characteristics of Indian woods, methods of seasoning, and chemical treatment of specialized use fireproofing of the wood. Industrial manufacturing of packing material and plywood and the classifications of plywood according to their use. Some important commercial woods: Dalbergia spp., *Shorea robusta, Tectona grandis, Cedrus deodara*, Bamboo-the 'green gold' of India

UNIT 3 **11 hrs**

Paper and Rubber industry: Manufacturing of paper and board from raw plant material. Manufacturing of crude and high-quality paper and recycled paper. The rubber plants of India, extraction of raw rubber and its chemical processing for the manufacturing of finished rubber.

UNIT 4 **11 hrs**

Sources and methods of extraction of essential oils, vegetable oils, and fats and their utilization. Fibers: Classification of fibers, physical and chemical processes involved in the manufacturing of fibers from different types of fiber-yielding plants. Gums and Resin: Classification and extraction and uses. Dyes: sources and extraction methods.

UNIT 5 **11 hrs**

Pharmaceutical and Agro-industries- Production of Plant medicines: An introduction to the pharmaceutical industry in India, extraction of antibiotics from higher plants, Industrial

manufacturing of quinine. Nutraceuticals: source, utility. Agro industries in India with particular reference to Karnataka.

REFERENCES

1. Brown H P (1989). An Elementary Manual on Indian Wood Technology (Reprinted). International Book Distributors, Dehra Dun, India.
2. Kochhar S. L. (1998). Economic Botany in the Tropics. MacMillan India Limited, Delhi.
3. Pandey B P (1984). Economic Botany (3rd Ed.). S. Chand & Company Ltd. New Delhi.
4. Shankar Gopal Joshi (2000). Medicinal Plants. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi. 6. Ambasta S P (1994). The Useful Plants of India. (3rd Ed.). Publications & Information Directorate, New Delhi.
5. Trotter H (1982). The Common Commercial Timbers of India and their Uses. The Controller of Publications, Delhi.

COURSE OUTCOMES

1. Understand various processes of commercial production of wood, paper, essential and vegetable oils.
2. Able to distinguish between commercial and noncommercial plants.
3. Understand procedures and methodology of extraction and manufacture of medicines like quinine.
4. The role of nutraceuticals in human health is well understood.
5. Industrial packing of milk and milk products, pickles, jams, jellies, pastes etc. arouse interest and understood the processes.

M.Sc. Botany III Semester

Course: **Pharmacognosy and Phytochemistry**	Course code**: 24BOT3E1CL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Exam: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVES

1. To know the crude drugs, their uses, and their chemical nature
2. know the evaluation techniques for the herbal drugs
3. To learn the modern extraction techniques, characterization, and identification of herbal drugs and phytoconstituents
4. To learn the preparation and development of herbal formulation
5. To carry out the microscopic and macroscopic evaluation of crude drugs
6. To carry out isolation and identification of phytoconstituents
7. Phytochemical fingerprinting and structure elucidation of phytoconstituents

COURSE CONTENTS

Unit-I Introduction to Pharmacognosy 11 hrs

Definition, history, scope, and development of Pharmacognosy. Sources of drugs – plants, animals, marine and tissue culture. Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilage, oleoresins, and oleo-gum-resins). Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo, and sero taxonomical classification of drugs.

Unit-2 Quality control of drugs of natural origin 11 hrs

Adulteration of drugs of natural origin, evaluation by organoleptic, microscopic, physical, chemical, and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida diagrams of microscopic objects. Controversial drugs, causes of controversy, types of adulteration: intentional and unintentional, and substitution.

Unit-3 Methods of Extraction, isolation phytochemical 11 hrs

Selection of plant samples, processing and storage of samples for extraction; Factors influencing the choice of an extraction, principles of extraction methods, infusion, decoction, digestion, maceration, percolation, solvent extraction, fluid extraction, ultrasound, microwave-assisted extraction, advantage and disadvantage involved in each method, Choice of solvents and interfering compounds for general Isolation and purification of desired phytoconstituents.

Unit-4 Characterisation techniques of Phytopharmaceuticals 11 hrs

Characterization of the following phytopharmaceuticals by UV-vis spectroscopy, Fourier Transmission Infra-Red Spectroscopy, GC-MS, LC-MS, Mass spectroscopy methods : a) Andrographolids, b) Phyllanthin, c) Gingerol, d) Curcumin, e) Lupeol, f) Vasicine g) ellagic acid h) Solasodine

Unit-5 Properties of plant based secondary metabolites 11 hrs

General introduction, composition, chemistry and chemical classes, bioresources, therapeutic uses and commercial applications of the following secondary metabolites. Alkaloids: Vinca, Rauwolfia, Belladonna, Opium. Phenylpropanoids and flavonoids: Lignans, Tea, Ruta. Steroids, Cardiac glycosides and Triterpenoids: Liquorice, Dioscorea, Digitalis. Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander. Tannins: Pomegranate, Green Tea, Catechu. Resins: Acacia, Myrrh, Asafoetida, Guggul. Glycosides: Senna, Aloes, Bitter Almond. Iridoids, and other terpenoids and Naphthoquinones: Gentian, Taxus, Carotenoids.

REFERENCES

1. Indian medicinal plants by RC Trivedi (2009)
2. Medicinal plants of Indian Himalaya by Samant SS and Dhar U
3. Handbookook of Aromatic plants by Bhattacharjee SK (2004)
4. Handbook of MAPs by Bhattacharjee (2009)
5. Mukherjee Pulok, Quality control of herbal drugs, business horizons limited, New Delhi
6. Advances in natural product chemistry, extraction and isolation of biologically active compounds. Wiley, New York
7. Phytochemical methods by JB Harborne, Chapman and Hall, International Edi., London
8. Trease GE and Evans WC. Pharmacognosy WB Saunders Co. Ltd., Harcourt Publishers Ltd. UK
9. Chaudhari RD., Herbal Drug Industry, Eastern Publication.
10. Quality control methods for medicinal plant material, WHO, Geneva
11. Wagner H, Baldt S (1996) Plant Drug Analysis- A thin layer chromatography Atlas, 2nd Ed., Springer-Verlag, Berlin
12. Stahl Ergon, Thin Layer Chromatography, 2nd Edition, Springer Publication
13. Mukherjee PK (2003) GMP for Indian System of medicine. In GMP for Botanicals.
14. Indian Herbal Pharmacopoeia, VOlI-II, SS Handa, RRL Jammu Tawi and IDWA, Mumbai
15. The Ayurvedic Pharmacopoeia of India, 1999. Government of India, Ministry of Health and Family Welfare, Department of Indian Systems of Medicine and Homeopathy, New Delhi

COURSE OUTCOMES

Upon completion of the course, the student shall be able to

1. Know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. To understand the preparation and development of herbal formulation
3. To understand the preparation and development of herbal formulation
4. To understand the herbal drug interactions
5. To carry out isolation and identification of phytoconstituents.

M.Sc. Botany III Semester

Course: **A. Medicinal and Aromatic Plants**	Course code: **24BOT3E2AL**
L-T-P per week **4-0.0**	No of credits **– 04**
Internal Assessment: **30 marks**	Semester end Examination: **70 marks**
Total contact hours: **55**	

COURSE OBJECTIVES

1. To educate the student on the basic concepts of herbal medicine
2. To provide knowledge of the traditional system of medicine and their vast richness
3. To disseminate the knowledge on the classification of plants based on biological sources and drugs of plants
4. To provide an understanding of the usage of herbal medicine based on important chronic and non-chronic diseases
5. To gain knowledge of medicinal plants and awareness of the conservation of plants

COURSE CONTENTS

Unit-1 Medicinal and aromatic plants 11 hrs

: Definition, history, importance, and future prospects. Medicinal plants-past and present status in the world and India. MAPs as industrial crops – constraints and remedial measures. Medicinal plant diversity & local healthcare. Medicinal plant conservation – Issues and approaches. Medicinal plant conservation areas (MPCA), non-timber forest products (NTFP).

Unit-2 Herbal drugs 11 hrs

Method and preparation of herbal drugs for the treatment of heart and blood disorders, nervous disorders, respiratory and intestinal disorders, jaundice, urinary, skin, hair, diabetes, cancer, gynecological disorders, and infertility. Plants are used as general tonics. Medicinal food plants: Cereals, pulses, spices, fruits, vegetables, and wild food plants. Medicinal and nutritive value of mushrooms

Unit-3 Oil yielding plants, cultivation of medicinal and aromatic plants 11 hrs

Regional distribution of aromatic and non-aromatic oil-yielding plants. Use of vegetable oil in food, medicine, and industry. Cultivation practices, diseases, and methods of pest control, harvesting, and storage of medicinal plants. Post-harvest care, deterioration, and disintegration of the active compound during storage (*Rauwolfia*, *Costus*, *Withania*, *Mentha*, *Cymbopogon*). Controversial drugs

Unit-4 Pharmacognosy, Phytochemistry, and Intellectual Property Rights 11 hrs

Raw drug analysis, microscopic, macroscopic characteristics, and preliminary chemical analysis (*Senna*, *Withania*, *Rauwolfia*). Classification of alkaloids, steroids, terpenoids, lectins,

and non-protein amino acids. Principles and applications of MS, UV, IR, NMR spectral analysis, and crystallography. IPR is related to medicinal and aromatic plants.

Unit-5 Important aromatic plants of India 11 hrs

Introduction and background of aromatic plants and cosmetic products. Raw material for perfumes etc. Cosmetic industries. Taxonomic descriptions and uses of important aromatic plants -Citronella, Dhavana, Geranium, Cardamom, Lavender, Lemon grass, Mentha, Holy basil, Rosemary, Eucalyptus, Celery, Tamarind, Saffron, Artemisia, Oreganum, and Curry leaf

REFERENCES:

1. Kirtikar KR and Basu BD (1932) Indian Medicinal Plants
2. Nadkarni AK (1954) Indian Materia medica Vol-I and II
3. Sivarajan VV and Indira B (1994) Ayurvedic drugs and their plant sources. Oxford and IBH Publishing Co., New Delhi
4. Trease GE and Evans WL (1983) Pharmacognosy 12th Ed. Bailliere Tindall, London
5. Vaidya B (1982) Some controversial drugs in Indian medicine. Chaukamba Orientalia, Varanasi
6. Harborne J (1984) Phytochemical methods. Ed. Chapman & Hall, London
7. Mann J., Davidson RS Hobbs JB., Benthorpe DV and Harborne Natural Products, Longman Scientific and Technical Co, Essex
8. Smith PM (1976) The chemotaxonomy of plants Edward Arnold, London
9. Prajapati, Purohit, Sharma and Kumar (2007) Hand Book of Medicinal Plants: A complete source book, Agrobios India
10. Maheshwari JK (2000) Ethnobotany and medicinal plants of Indian Subcontinent, Scientific Publishers, India
11. Rastogi RP and Meharotra BN (1991) Compedium of Medicinal Plants. Vol I and II CDIR Lucknow and Publication and information directorate New Delhi, India.
12. Prajapati et al., (2003) A Hand Book of Medicinal Plants – A complete source book. Agrobios, Jodhpur, India.

COURSE OUTCOMES

After successful completion of this course graduates will be able to:

1. Analyze literature on traditional knowledge of the role of plants and related alternate medicine practices for the treatment of chronic diseases and improvement of health conditions in view of the new evidence provided by modern science and technologies.
2. Identify different medicinal and aromatic plants available in different parts of the country
3. Carryout processing of MAPs for value addition
4. Develop different products from MAPs
5. Become self-employed in related sectors

M.Sc. Botany III Semester

Course: **B. Seed Technology**	Course code: **24BOT3E2BL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVE

To familiarize the importance and need of seed technology and seed certification. To properly select healthy seeds and methods of seed treatment pre and post-harvest. To understand seed act and seed control order.

Unit-1 Seed and Seed technology **11 hrs**

Introduction, definition, and importance. difference between seed and grain. Role of seed technology. Goas of seed technology. Causes of deterioration of crop varieties and their control & maintenance of genetic purity during seed production. Seed quality, characters of good quality seed.

Unit-2 Classes of seed **11 hrs**

Definition and classes of seeds- nuclear seeds, foundation seeds, registered seeds, certified seeds. Certified seed production of important cereals (Sorghum, Wheat, Maize, Rice & Bajra). Foundation and certified seed production of important pulses (Pigeon pea, green gram, etc.). Foundation and certified seed production of important vegetable crops.

Unit-3 Seed storage **11 hrs**

Objective, purpose, and importance of seed storage. Stages of seed storage- (i) storage of seed on plants (physiological maturity until harvest) (ii) storage from harvest until processing (iii) storage of seed in the warehouse, cryopreservation. Requirement and types of seed storage. Factors affecting seed storage and role of moisture, temperature, pH, and moisture equilibrium. Viability nomographs, Seed drying- forced air seed drying, heated air drying, management of seed drying. Processing and their steps

Unit-4 Seed health **11 hrs**

Seed health testing- Direct examination (inspection), incubation tests, blotter tests /seedling symptom tests. Agar plate, examination of the embryo, immunoassay, molecular methods. Significance of seed health. Procedures for seed health test and rules. Seed-borne pathogens-externally and internally borne diseases. Important diseases of cereals, pulses, and vegetables. Use of pesticides, botanicals, and mycotoxins for seed treatments.

Unit-5 Quarantine and International procedures of phytosanitary certificates 11 hrs

Phytosanitary certificate (PSC), International plant protection convention (IPPC) 1951. Procedure for inspection and issue of phytosanitary process. Seed Act and Seed Act enforcement Duty and powers of seed inspector, offenses and penalties. Seed control order 1983.

REFERENCES

1. Anonymous, 1992. Legislation on Seeds. NSC Ltd., Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.
2. Dhirendra Khare and Mohan Bhale. 2921. Seed technology Succint Edn. (PB). Scientific
3. Nema, N.P. 1986. Principles of Seed Certification and Testing. Allied Publishers, New Delhi.
4. Nempal Singh, DK Singh, YK Singh, and Virendra Kumar. 2006. Vegetable seed
5. Phundan Singh. 2013. Principles of seed technology. Kalyani Publications, New Delhi Production. International Book, Distribution company. Lucknow publishers, Jodhpur.
6. R L Agarwal. 2017. Seed technology. Oxford and IBH, publishing company, New Delhi.
7. Subirsen N Ghosh. 2014. Seed Science and Technology. Kalyani Publications, New Delhi
8. Tunwar, N.S. & Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.

COURSE OUTCOMES

1. To believe in the role of good quality seed in agriculture
2. To grasp the significance of basic principles of seed production in crop plants
3. To understand legal procedures related to seed quality control
4. To grasp the importance of Indian minimum seed certification standards
5. To know the systems involved in seed production
6. Students will get knowledge on seed storage methods and seed treatment procedures.
7. To really understand the procedure for seed certification.

M.Sc. Botany III Semester

Course: C. Nanobiology	Course code: **24BOT3E2CL**
L-T-P per week **4-0.0**	No of credits – **04**
Internal Assessment: **30 marks**	Semester end Examination: **70 marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES

1. To introduce students to the exciting and emerging field of Nanobiology.
2. Understand the application of nanomaterials in biology and aquire the knowledge about the DNA, proteins, amino acids, drug delivery, biomedicine etc.
3. To make the students understand about the functional principles of Nanobiology
4. To help them understand in broad outline of Nanoscience and Nanobiology

COURSE CONTENTS

Unit-1 Introduction 11 hrs

The nanoscale dimension and paradigm. Definitions and historical evolution and current practice. Types of nanomaterials and their classifications: one dimensional, two dimensional, and three dimensional nanostructured materials, Quantum dots, carbon nanotubes, bucky balls, fullerenes, metal oxides, semiconductors, nanocomposites, nanopolymer, carbon, inorganic, organic, and biomaterials – structures and characteristics.

Unit-2 Physical, chemical, and biological fundamentals of nanomaterials 11 hrs

Overview of synthetic methods, surfactants, polymers, and emulsions. micelles / reverse micelles and colloids. Top-down and bottom-up approaches. Biological methods (plants, microbes, and biomimetics). Growth and stabilization. Self-assembly. DNA-protein nanostructures, DNA-based metallic nanowires, and networks. DNA-gold nanoparticles conjugates

Unit-3 Nanostructured Materials characterization techniques 11 hrs

X-ray diffraction (XRD), SEM, EDAX, TEM, Elemental mapping, FTIR, UV-Visible spectrophotometer, Laser Raman spectroscopy, Thermogravimetric analysis (TGA), Transmission Electron Microscope (TEM), X-ray photoelectron spectroscopy (XPS), Electrochemical characterization measurements.

Unit -4 Nanomaterials and diagnostics/drug delivery and therapeutics 11 hrs

MRI, imaging, surface modified nanoparticles. MEMS/ NEMS based nanomaterials/ Peptide / DNA coupled nanoparticles. Lipid nanoparticles for drug delivery. Inorganic nanoparticles for drug delivery, metal/ metal-oxide nanoparticles (antibacterial/ antifungal / antiviral), anisotropic and magnetic particles (hyperthermia)

Unit-5 Current Application of Nanoparticles in food and medicine 11 hrs

Nanoparticles as carrier for genetic material. Nanotechnology in Agriculture: fertilizer and pesticides. Nanomaterials in biomedical applications: drug delivery, gene delivery, medical imaging,

diagnostics, theranostics, antimicrobial agents, tissue engineering, cancer treatment, biosensors, vaccine delivery, neurosurgery, wound healing, nanofibers, nanobots, nanostars, nanofactories that make drugs In-situ, targeted therapy, nano -implants, medical devices. Potential risks of nanotechnology.

REFERENCES

1. Jain KK (2012) The handbook of nanomedicine, Springer
2. Bhushan Bharat (Ed) 2012. Encyclopedia of Nanotechnology. Springer
3. Sharon M and Sharon M (2012) Bio-Nanotechnology -concepts and applications, CRC Press
4. Cao G Nanostructures and Nanomaterials – Synthesis, properties and applications. Imperial College Press 2006
5. Nanostructured materials: Processing, properties, and potential applications. Edited by Carl C. Koch, Noyes Publications, 2002.
6. David E Reisner (2011) Bionanotechnology II-Global Prospects, CRC Press, Nano/Micro Biotechnology, Springer
7. Niemeyer CM (2006) Nanobiotechnology: Concepts Applications and Perspectives, Wiley - VCH, 2006
8. David S Goodsell Bionanotechnology, John Wiley & Sons, 2004
9. Buddy D Ratner, Allan S Hoffman, Federick J Schoen Jack E Lemons "Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2012.
10. Debasis Bagchi, Manashi Bagchi, Hiroyoshi Moriyama, Fereidoon Shahidi – "Bio-Nanotechnology" A Revolution in Food, Biomedical and Health Sciences" Wiley – Blackwell, 2013.
11. Nanoparticles: from theory to applications – G. Schmidt, Wiley Weinnheim 2004
12. Pradeep T (2012) A textbook of Nanoscience and Nanotechnology, Tata McGraw – Hill education private Ltd.

COURSE OUTCOMES

Upon completion of this course, students should be able to

1. Gain knowledge and understanding about harnessing biological systems to further nanotechnological endeavor
2. Gain knowledge of structure and function of biological systems and cellular systems to construct the functional devices within nanotechnology
3. Apply their learned knowledge to develop Nanomaterials
4. Learn current applications and state of the art within bio nanotechnology.

M.Sc. Botany III Semester

Course: **A. Forensic Botany**	Course code: **24BOT3G1AL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours – **35 hrs**	

COURSE OBJECTIVES:

1. To understand the critical role of basic botanical science for a range of forensic botanical methods and how this science can influence society;
2. Able to articulate ways in which underlying biological variability and similarity can be exploited in a forensic context
3. Capable of reading and understanding primary literature (case studies) in forensic botany;
4. Achieve awareness of the primary literature in basic science that serves as the foundation for forensic literature and field application.

COURSE CONTENTS

Unit-1 Plants as evidence **12 hrs**

Plant classification schemes, sub-specialization of forensic botany- plant morphology, plant anatomy, plant systematic, palynology, plant ecology, limnology, plant architecture roots, stems, flowers, leaves. Various types of woods, timbers, seeds, and leaves and their forensic importance, Identification and matching of various types of wood, timber varieties, seeds, and leaves.

Unit-2 Plant DNA analyses in forensics and poisonous plants **12 hrs**

Types of samples and collection for DNA analyses, Plant species identification. Genotyping methods, DNA extraction, microsatellites, random/anonymous markers. Genetic interpretation. Case studies. Poisonous plants: *Abrus precatorius*, *Anacardium occidentale*, *Argemone mexicana*, *Calotropis*, *Cannabis sativa*, *Atropa belladonna*, *Gloriosa superba*, *Jatropha curcas*, *Nerium indicum*, *Nicotiana tobacco*, *Plumbago*, *Ricinus communis*, *Strychnos nuxvomica*, *Thevetia nerifolia*.

Unit-3 Forensic palynology **11 hrs**

Pollens and spores. Chemical and Physical resistance. Mode of pollen transmission and pollination. Pollen structure and anatomy. Use of pollens in the forensic and non-forensic setting. Plants growing in the relevant locations. Collection and storage of pollen samples. Collection tools and accidental contamination. Case examples- murder and genocide.

REFERENCES

1. Coyle H.M. (2004) Forensic Botany: Principles and applications to criminal casework. CRC Press
2. James SH., Nordby JJ., Bell S (2015). Forensic Science: An Introduction to Scientific and Investigative Techniques. CRC Press; 4 edition
3. Hall DW and Byrd J (2012) Forensic Botany: a practical guide. Wiley -Blackwell, I edition
4. Bock JH and Nirris DO (2016) Forensic plant Science, Academic Press.
5. David W Hall and Jason H Byrd (2012) Forensic Botany, a practical guide. Wiley-Blackwell. A John Wiley and Sons Ltd., Publication.

COURSE OUTCOMES

After completing this course, the learner will be able to:

1. Conceptualize the classification of plants from a forensic point of view
2. Understand the forensic importance of different parts of plants
3. Provide the basic knowledge about the application of Botany to Forensic investigations

M.Sc. Botany III Semester

Course: **B. Biofertilizers and Biopesticides**	Course code: **24BOT3G1BL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours – **35 hrs**	

COURSE OBJECTIVE

- To conceptualize applications of biofertilizers and biopesticides in human welfare and familiarize with the production technology of biopesticides. Get well acquainted with methods of application of biofertilizers, biopesticides, and bioagents.

COURSE CONTENTS

Unit-1 Biofertilizer: 12 hrs

Introduction, scope and types of Biofertilizers: Nitrogen fixing microorganisms: - Rhizobium, Bradyrhizobium, Frankia, Azolla (symbiotic), Azospirillum (associative), Azotobacter (free living). Phosphate solubilizing microorganisms: Bacillus, Pseudomonas (bacteria), Aspergillus, Penicillium (fungi), Mycorrhizae (VAM): ectomycorrhiza and endomycorrhiza. Potash and Zinc solubilizing bacteria : Bacillus sp, Pseudomonas sp. Plant growth promoting rhizobactera (PGPR).

Unit-2 Biopesticides and insecticides 12 hrs

History, concept, scope and importance of biopesticides. Classification of biopesticides. Microbial pesticides (Bacillus thuringiensis, Agrobacterium sps., Pseudomonas fluorescens (Phenazine), Trichoderma sp. Plant-incorporated-protectants (PIPs), Botanical pesticides: Azadirachtin, nicotinoids, natural pyrethrins, rotenoids, neem oil etc. Biochemical pesticides, Biotic agents (parasitoids and predators)

Unit-3 Mechanisms and applications of biofertilizer and bio-controlling agents 11 hrs

Mechanism of biological nitrogen fixation in legume and non-legume plants. Mechanisms action of biocontrol agents, Bacillus thuringiensis and Trichoderma strains. Large scale production of biofertilizer, organic farming carrier materials. Role of biofertilizers and biopesticides in organic farming and sustainable agriculture.

REFERENCES

1. Agrios, G. N. Plant Pathology, Fourth Edition 1997, AcademicPress.
2. Dubey, R. C. (2008): A Textbook of Biotechnology. S. Chand & Co., NewDelhi.
3. Ilan chet (Ed.). Innovative Approaches to plant disease Control. Wiley InterScience Publication, Ihon Wiley and Sons New York(1987).
4. Kannaiyan, S., 2003. Biotechnology of Biofertilizers, CHIPS, Texas.
5. Mahendra K. Rai, 2005. Handbook of Microbial biofertilizers, The Haworth Press, Inc.

New York. Reddy, S.M. et. al., 2002. Bioinoculants for sustainable agriculture and forestry, Scientific Publishers, Jodhpur.
6. Newton, W. E. et al. (1977): Recent Developments in Nitrogen Fixation.Academic Press, NewPlants. Academic Press Inc., San Die go, USA.
7. Saleem, F.and A.R. Shakoori, 2012. Development of Bioinsecticide, Lambert Academic Publishing, Latvia, European Union.
8. Schwintzer, C. R. and Tjepkema, J. D. (1990): The Biology of Frankia andActinorhizal
9. Stewart W. D. P. and Gallon J. R. 1980): Nitrogen Fixation. Academic Press, NewYork.
10. Subba Rao, N. S. (1982): Advances in Agricultural Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
11. Subba Rao, N. S. (2002): Soil Microbiology. 4th ed. Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
12. Subba Rao, N. S. and Dommergues, Y. R. (1998): Microbial Interactions in Agriculture and Forestry. Vol. I, Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
13. SubbaRao N.S., 1995 Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. New Delhi
14. Verma, A. (1999): Mycorrhiza. Springer Verlag,Berlin.
15. Wallanda, T. et a*l*. (1997). Mycorrhizae. Backley's Publishers, TheNetherlands. NewYork.

COURSE OUTCOMES

On successful completion of this course, the students will be able to :

1. Realize the importance of eco-friendly fertilizers and pesticides.
2. Demonstrate skills in culture and mass production of biofertilizers and biopesticides.
3. Acquire sound knowledge on application of the biofertilizers and biopesticides for various crops. Study the efficacy of biofertilizers and biopesticides in organic farming.

M.Sc. Botany III Semester

Course: C. Aquatic Botany	Course code: **24BOT3G1CL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours – **35 hrs**	

COURSE OBJECTIVES

1. Comprehend the marine diversity of lower Cryptogams and Angiosperms
2. Understand the morphology, anatomy, physiology, reproduction, and life cycle pattern
3. Their diversification and familiarity with various ecological niche
4. Economic benefits of marine seaweeds
5. To understand the ecological functions and economic uses of aquatic plants with special emphasis on Taxonomy, physiology, ecology, and economic importance of marine and freshwater plants.
6. Other special topics such as biofuel generation from aquatic plants

COURSE CONTENTS

Unit -1 Diversity of Aquatic plants and economic uses 12 hrs

Distribution, morphology, reproduction, and growth physiology of seaweeds. Important cultivable species of aquatic plants, seaweeds, and microalgae. Biodiversity of seaweeds along the coast of India. Seaweed polysaccharides, chemical structure, properties, and extraction of agar, carrageenan, and alginic acid. Important marine algal research centers in India and their work.

Unit -2 Phytoplankton 12 hrs

Diversity of plankton – cyanobacteria, chlorophytes, heterokontophytes, pymnesiophytes, dinophytes, cryptophytes, raphidophytes and rhodophytes. Role of phytoplanktons in geochemical cycles – nutrient requirements, marine food webs, distribution and abundance, biological carbon pump. Phytoplankton physiology and ecology- light acclimatization, bloom formation.

Unit -3 Freshwater higher vascular plants 11 hrs

Biodiversity of freshwater higher vascular plants in India. Taxonomy of economically important freshwater higher vascular plants of higher vascular plants. Distribution, morphology, reproduction, life-cycle, growth physiology, and culture techniques of freshwater higher vascular plants- Typha, Trapa. Products of higher vascular plants

REFERENCES

1. Chapman VJ (1976) Coastal vegetation. 2nd edition. Pergamon Press. New York
2. Desikachary TV (1975) Marine Plants. NCERT. New Delhi
3. Kumar HD. Introduction to Phycology
4. McConnaughey BH (1974) Introduction to Marine Biology
5. Ranade DR and Gadre RV (1988) Microbial aspects of anaerobic digestion. Laboratory Manual M.A.C.S. Pune
6. Sambamurthy AVSS (2005) A text book of Algae
7. Santhanam R, Ramnathan N, Venkataramanjan K and Jegathanam G (1987) Phytoplankton of Indian Seas and Aspects of Marine Botany. Daya Publication Home, Delhi
8. Sharma OP (1986) A Text Book of Algae. Tata McGraw Hill Publication Publications
9. Stein JR (1973) Handbook of Phycological methods. Cambridge University Press.

COURSE OUTCOMES

At the end of the course, the student should be able to understand

1. The biology and diversity of marine phytoplankton
2. The role of phytoplankton plays in the biological carbon pump as well as in the cycles of other important elements
3. Ecology of harmful algal bloom formation and toxin production
4. Commercial products derived from algae

M.Sc. Botany III Semester

Course: **Research Methodology**	Course code: **24BOT3S3LP**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: 3**0 Marks**
Total contact hours: **28 hrs**	

COURSE OBJECTIVES

1. To provide the students with the information, knowledge, and skills to identify academic journals of various quality
2. To teach students how to choose journals based on their quality and submit research articles independently.
3. To understand the advantages, disadvantages, responsibilities, and ethics of collaborative publishing

COURSE CONTENTS

Unit-1 Introduction to Research 8 hrs

Nature and importance of research- Aims, Objectives, and principles: Fundamental research versus applied research with examples. Qualitative versus quantitative research. Theoretical research versus experimental research with examples. Selection of a research problem and sources of literature – Journals, Conferences, Books. Types of sources. Literature survey engines - Scopus, Web of Science, Google Scholar, PubMed, NCBI, Scihub, etc. Science citation index. Citations, h-index, i10 index, impact factor.

Unit-2 Methods of Data Collection 6 hrs

Data collection methods – Framing a hypothesis, designing controlled experiments, choosing the sample size, sampling bias, importance of independent replicates, conducting an experiment, and maintaining a lab notebook to record observations. Identifying experimental errors. Case studies on well-designed experiments versus poorly designed experiments. Correlations versus Causation. Good laboratory practices.

Safety practices in laboratories, Introduction to Chemdraw, Chemsketch, and other basic software.

Unit-3 Data analysis (Practical): Data presentation and Writing 14 hrs

Technical presentation, technical writing, formatting citations. MS Excel for plotting the data (Pie chart, plots, bar chats)

Analysis using software tools: Descriptive statistics: Mean, standard deviation, variance, plotting data, and understanding error bars. Curve fitting: Correlation and regression. Distributions: Normal Distribution, Gaussian distribution, Skewed distribution. Inferential statistics: Hypothesis testing and understanding p-value. Parametric tests: Student's t-test, ANOVA. Tests to analyse categories data: Chi-square test.

REFERENCES

1. C.R. Kothari, Research methodology: Methods and Techniques. II Ed. New Age International Publishers (2009)
2. Shanthibhushan Mishra, Shashi Alok, Hand Book of Research Methodology, I Ed, 2017, Educreation Publishers
3. Basic Statistical Tools in Research and Data Analysis (https://w.w.w.ncbi.nlm.nih.gov/pmc/articles/PMC5037948/).
4. Introduction to statistical methods with MATLAB (MATLAB and Simulink Training (mathsworks.com)

COURSE OUTCOMES

1. Find gaps in the existing research of their interest and conduct the research accordingly
2. To write a research proposal
3. Publish research and review articles in the journal with impact factor
4. Write a project report as well as a research paper
5. To enable the use of statistical, graphical and algebraic techniques wherever relevant. To gain a proper understanding of statistical applications in research

M.Sc. Botany III Semester

Course: **Plant Physiology and Biochemistry**	Course code: **24BOT3C7P**
Teaching hours/week (L-T-P): **0-0-2**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total Contact Hours – **55**	

COURSE OBJECTIVES

To enable students with practical and analytical skills in different analyses and quantification of elements responsible for the overall physiological activities of plants.

LIST OF EXPERIMENTS

1. Separation of chloroplast pigments by Thin layer chromatography.
2. Determination of chlorophyll A, chlorophyll B, and total chlorophylls in C3 and C4 plants.
3. Study of Kranz anatomy in C4 plant leaves.
4. Study of plant growth hormones on seed germination.
5. Bean hypocotyls method of cell elongation.
6. Study of stomatal types and stomatal Index.
7. Study of gravitropism
8. Estimation of reducing sugars in fruits.
9. Quantitative estimation of carbohydrates by Benedict method and DNS method.
10. Estimation of total fat content in seeds

COURSE OUTCOMES:

1. Students will gain technical practice in determining various pigments in plants.
2. Students have got familiarity in process of quantification of carbohydrates, fat,
3. and calcium from crop plants.
4. Understand various aspects of photo physiology like Photoperiodism, vernalization, circadian rhythms.
5. Are able to distinguish between C3 and C4 plants by performing several tests
6. Are able to estimate sugars from fruits.

REFERENCES:

1. Laboratory manual experimental plant physiology-I .2004.
2. Laboratory manual experimental plant physiology-II .2004.

M.Sc. Botany III Semester

Course: **- Molecular Biology**	Course code: **24BOT3C8P**
Teaching hours/week (L-T-P): **0-0-2**	No. of credits: **02**
Internal assessment: marks – **20 marks**	Semester End Examination: **30 Marks**
Total contact hours: **55**	

COURSE OBJECTIVES

This course is aimed to teach students different approaches to performing molecular biology practical aspects and their practical applications in advanced biomolecular research as well as in pharmaceutical industries.

LIST OF EXPERIMENTS

1. Isolation of genomic DNA from E.coli bacteria
2. DNA isolation from plant sources
3. Restriction digestion of DNA
4. Bacterial transformation of plasmids
5. Plasmid DNA isolation
6. Estimation of RNA by Orcinol method
7. Ligation of DNA into plasmid vectors
8. Estimation of DNA by diphenylamine reagent / UV spectrophotometry
9. Study of DNA replication mechanisms through photographs (rolling circle, theta replication, and semi-discontinuous replication).
10. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al., Griffith's, Hershey and Chase's, and Fraenkel and Conrad's experiments)
11. Study of the following mechanisms through photographs: Assembly of spliceosome machinery, splicing mechanism in group-I and group-II introns, ribozyme, and alternative splicing.
12. cDNA synthesis by RT-PCR

REFERENCES

1. Michael R Green and Joseph Sambrook (2012) Molecular Cloning – A laboratory manual – Fourth Edition. Cold Spring Harbor Laboratory Press
2. Plummer DT (1988) An introduction Practical Biochemistry, 3rd ed., TaTa Mc Graw-Hill Pub. Co., New Delhi, pp221
3. Introductory Practical Biochemistry, Editors: SK Sawhney and Randhir Singh, Narosa Pub House, pp 74-75.
4. Molecular Biology of Cell by Bruce Alberts 4th Edition

COURSE OUTCOMES

1. To gain hands-on experience in genomic DNA and plasmid DNA isolation

2. Isolate proteins and RNA molecules from the different plant/animal tissue samples
3. Determine the concentrations of isolated DNA, RNA, and proteins
4. Cloning by PCR approach, DNA and PCR amplification for DNA fingerprinting analysis via RAPD and restriction digestion
5. To conduct gene amplification experiments by PCR analysis
6. This practical experience would enable them to begin a career in biotech as well as the pharmaceutical industry that engages in genetic engineering as well as in R & D laboratories conducting advanced research.

CBCS Question Paper Pattern for PG Semester End Examination

with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**

Time: 3 Hours **Max.**

Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 14 Marks

Note :Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 14 Marks

Note: Question No.7*, shall be from Unit IV and V*,the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

****

Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max.**

Marks: 30

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

****

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science

(IV semester)

With effect from

2024-25

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105
Distribution of Courses/Papers in Postgraduate Programme I to IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

DEPARTMENT OF STUDIES IN BOTANY
IV-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		
FOURTH	DSC11	24BOT4C11L	Plant Tissue Culture	30	70	100	4	-	-	4	3
	DSC12	24BOT4C12L	Plant Breeding and Propagation	30	70	100	4	-	-	4	3
	DSE3	24BOT4E3AL	A. Weed Biology and Ecology	30	70	100	4	-	-	4	3
		24BOT4E3BL	B. DNA barcoding of land plants								
		24BOT4E3CL	C. Plant Translational Research								
	DSE4	24BOT4E4AL	A. Intellectual Property Rights	30	70	100	4	-	-	4	3
		24BOT4E4BL	B. Conservation Biology								
		24BOT4E4CL	C. Forest Botany								
	GEC2	24BOT4G2AL	A. Medical Botany	20	30	50	2	-	-	2	1.5
		24BOT4G2BL	B. Curios and Fascinating Plants								
		24BOT4G2CL	C. Floriculture								
	DSC11P9	24BOT4C9P	Plant Tissue Culture, Plant Breeding and Propagation	20	30	50	-	-	4	2	4
	Project	24BOT4C1R	Research Project	30	70	100		-	8	4	4
Total Marks for IV Semester						**600**				**24**	
(I-IV semester)- Total Marks: 2400 and Total credits: 96											

DSC-Department specific Core, DSE- Discipline specific elective, SEC – skill enhancement course, GEC- Generic elective course, IA- Internal Assessment, SEE- Semester end examination, L- Lecture, T-tutorial, P-practical

M.Sc. Botany IV Semester

Course: **Plant Tissue Culture**	Course code: **24BOT4C11L**
L-T-P per week: **4-0.0**	No of credits – **04**
Internal Assessment: **30 marks**	Semester end Examination: **70 marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES

Course main objective:

1. To recognize the importance of the plant tissue culture techniques
2. Explain and analyze the role of plant growth regulators in the PTC technique
3. Describe how to regenerate plants using the different techniques of PTC
4. Recognize the possible reasons for the failure of a specific plant tissue organ culture
5. Analyze and interpret the in vitro data and draw sensible conclusions from such data

COURSE CONTENTS

Unit-1 Fundamentals of Plant Tissue Culture 11 hrs

Concept of Totipotency and development of tissue culture. Discovery and role of auxins and cytokinins. Requirements for tissue culture: Basic laboratory organization, instruments, and equipment, the general composition of culture medium (major & minor salts, carbon source, vitamins, growth regulators, and other additives). Concept of cellular totipotency: Totipotency of cell differentiation, de-differentiation, callogenesis, organogenesis, hormonal control of callogenesis, and organogenesis

Unit-2 Principles and culture techniques 11 hrs

Clonal propagation: Techniques multiplication by apical axillary and adventitious shoots, rooting, and acclimatization of plants transferred to soils. Organ culture: Meristem culture and production of virus-free plants, leaf, root, ovule, embryo culture and embryo rescue. Haploid culture: Anther and Pollen culture pathways of pollen germination, use of haploids in crop improvement.

Unit-3 Protoplast Culture and Somatic hybridization 11 hrs

Isolation, purification, and culture of protoplasts. Somatic hybridization, cybrids, Applications and limitations of protoplast culture and somatic hybridization. Somatic embryogenesis: Induction maturation and germination, factors affecting somatic embryogenesis. Physiological and biochemical aspects of somatic embryogenesis. Synthetic seeds and its applications.

Unit-4 Production of Secondary metabolites 11 hrs

Types of secondary metabolites, formation, and localization in plants. Factors determining the accumulation of secondary metabolites. Techniques of selecting cell lines with increased secondary metabolite levels. Methods of secondary metabolite production: Elicitations, hairy roots and biotransformation using plant cell cultures. Bioreactors: concept, types and use in plant cell cultures.

Unit-5 Germplasm conservation and somaclonal variation 11 hrs

In-situ and ex-situ principles and conservation of germplasm. Variations in regenerated plants: chromosomal and genetic basis of somaclonal variations applications. Techniques in *in-vitro*

production of salt, drought, and disease-resistant plants. General applications of plant cell, tissue and organ culture. Cryopreservation: Techniques and applications.

REFERENCES

1. Bhojwani SS and Razdan MK (1996) Plant Tissue Culture: Theory and Practice, a Revised Edition. Elsevier, Amsterdam-Lausanne- Newyork-Oxford -Shannon-Tokyo
2. Razdan MK (2019) Introduction to Plant Tissue Culture 3rd Edition
3. Plant Tissue Culture by Kalyan Kumar De, New Central Book Agency, ISBN: 9789352551651
4. Sunghun Park. Plant Tissue Culture: Techniques and Experiments 4th Edition -1 Updated methods for plant tissue cultures
5. Dev Kumar D, Rajesh K, Praneeth Kumar S, Mahesh G (2021) Plant Tissue Culture Techniques. AkiNik Publications.
6. Birren B.E. et al., Genome Analysis – A Laboratory manual Vol-1 Analyzing DNA. Panama Publishing House (reprinted), New Delhi
7. Bold R.W. and Primrose S.B. Principles of Gene manipulation- An Introduction to Genetic Engineering. Blackwell Scientific Publications. London, Edinburg, Boston
8. Chawla H.S. (2002) Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. PVT LTD., New Delhi
9. Dixan RA and Ganzales RA (1994) Plant Cell Culture- A practical approach. Oxford University Press, New York.
10. Gambarg OL and Philips (1996) Plant cell, tissue and organ culture Narosa Publishing House, New Delhi
11. Mukudam U., Dawad HG and Ratnaparkhi S (1997) Hairy root culture. Agro Botanica Bikaner, India
12. Razdhan MK (2003) Introduction to plant tissue culture 2nd Edition: Oxford and IBH Publishing Co. New Delhi
13. Reinert J and Balaji YPS (1998) Applied and Fundamental Aspects of PLANT CELL, TISSUE and ORGAN CULTURE. Narosa Publishing House, new Delhi
14. Vasil IK (1985) Cell culture and somatic cell genetics of plants Vol-II. Academic Press, INC. New York.

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to

1. List the various components of plant tissue culture media e.g., minerals, growth factors, hormones, and what governs the choice of components
2. Recognize the various steps taken to establish and optimize media for particular purposes in particular species
3. Define the various stages of micropropagation including morphogenesis
4. Describe the types of in-vitro cultures. State and write a protocol to establish an unknown species and test its response
5. Acquire the skills needed for sub-culturing in a pathogen-free environment
6. Carryout careful examination of the cells of the culture under sterile conditions
7. Analyze the data obtained and draw careful observations and conclusions

M.Sc. Botany IV Semester

Course: **Plant Breeding and Propagation**	Course code: **24BOT4C12L**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Exam: **70 Marks**
Total contact hours: **56 hrs**	

Course Objectives

1. To increase the yield of crops such as grain, fiber, sugar and oil.
2. To create crops that are resistant to disease and pests.
3. Floral biology in self and cross pollinated species
4. Selection methods in segregating populations and evaluation of breeding material

Unit-I Plant breeding : **12 hours**

Objectives, Definition, need and potentialities for plant multiplication.

Asexual and sexual methods of propagation - advantages and disadvantages. Evolution of major crop plants – wheat & maize; Objectives of plant breeding. Plant breeding techniques - Breeding methods in self-pollinated, cross pollinated, vegetatively propagated and apomictic plants. Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method.

Unit 2 Genetic basis of breeding self- and cross - pollinated crops: Heritability and genetic advance, genotype environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding. **12 hours**

Unit 3 Inbreeding depression: Role of heterosis and hybrid vigour in plant breeding. Self-incompatibility and male sterility in crop plants and their commercial exploitation. Somaclonal variation in crop improvement. Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds. **12 hours**

Unit-4 Concept of plant ideotype and its role in crop improvement; Transgressive breeding. Special breeding techniques- Mutation breeding; Breeding for abiotic and biotic stresses. Cultivar development: Apomixis, polyembryony, polyploidy. Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights. Clonal selection, hybridization. **12 hours**

Unit 5 Propagation- Introduction. Propagation by seeds and vegetative structures, harvesting, storage and viability, germination, dormancy (seed and bud). Propagation by division and separation: Bulbs, pseudobulbs, corms, tubers and rhizomes; runners, stolon, suckers and offsets. Techniques, anatomical and Physiological aspects of rooting of cuttings, Types of cuttings, Grafting, Budding, Layering. **12 hours**

References

1. Plant Breeding Priciples and Methods 12th Edition. B.D.Singh
2. Fundamentals of Genetics by BD Singh
3. Mohanan KV. Essentials of plant breeding. eBook ISBN:9788119364053
4. Poehlman JM and Borthakur D 1969. Breeding Asian Field Crops. Oxford and IBH

5. McDonald MB Jr and Copeland LO. 1997. Seed Production: Prinicples and Practices. Chapman and Hall
6. Musil AF 1967. Identification of Crop and Weed Seeds. Handbook No. 219, USDA, Washington DC.
7. Principles of plant breeding. Robert Wayne Allard. John Wiley and Sons, 10-May-1999-Science. 1-234
8. Chahal. Principles and procedures of Plant Breeding. L.B. Publications.
9. Gopalakrishnan, T.S., Itta Sambasivaiah and Kamalakar Rao. Principles of organic evolution
10. Gupta, P.K. Cytology, Genetics and Evolution. Rastogi publications, Meerut .
11. Khanna, S.S. Genetics, Heridity and Evolution.
12. Sinha and Sinha. Cytogenetics, Plant Breeding and Evolution. Vikas Publications.
13. Joshi, P. Genetic engineering and its applications. Panima Book Distribution, Bangalore.
14. Menetre, S.S. Molecular basis of cytoplasmic male sterility in crop plants. International Book Distribution.
15. Hartmann, Kester, Davies, and Geneve, 2011. Hartmann and Kester's Plant Propagation: Prin-ciples and Practices. Eighth edi-tion. Prentice-Hall, Inc. Publish-ing, Upper Saddle, NJ. ISBN: 978-0-13-501449-3. 5. Principles of Plant Breeding. Robert Wayne Allard. John Wiley and Sons, 10-May-1999 - Science - 254 pages
16. Singh, B. D. (1983). Plant Breeding principles and methods Ludhiana Kalyani Publications. Dew Delhi/Hyderabad
17. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
18. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2ndedition.
19. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishin

Course outcomes

1. Explain various plant propagation structures and their utilization.
2. Understand advantage s and disadvantages of vegetative, asexual and sexual plant propagation
methods
3. Assess the benefits of asexual propagation of certain economically valuable plants using apomictic and adventive polyembryony.

M.Sc. Botany IV Semester

Course: **A. Weed Biology and Ecology**	Course code: **24BOT4E3AL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours – **55 hrs**	

COURSE OBJECTIVES

1. To appreciate the importance of weed biology and ecology in weed control and management. The students will be accomplished with various healing and edible weeds.

COURSE CONTENTS

Unit 1 Weed biology and Ecology 11 hrs

Definition and Objectives of weed science, classification of weeds. The characteristic traits of weedy species. Importance of weed biology in weed control. Weed seed banks. Weed indices. Weed community structure – factors that drive community composition and implications.

Unit 2 Weed invasion and naturalization 11 hrs

Characteristics of invasive, native, non-native, exotic weeds, noxious weeds, and naturalized weeds. Factors determining invasion by weeds- climate, residence time, propagule pressure, dispersal traits, reproductive traits, the role of habitats, and disturbance. Process- Introduction, Colonization, and Naturalization Allelopathy.

Unit 3 Survival mechanisms of weeds 11 hrs

Ability to survive in cultivated soil, Competitive ability, Ability to tolerate unfavourable habitats, Ability to withstand repeated cutting or mowing, the distribution pattern of seeds in the soil, dormancy, and morphological characteristics as a defence against herbivores.

Unit 4 Weed Management 11 hrs

Types of weed management - Chemical, Cultural, Physical, Biological, and Integrated weed management. Recent developments in weed management- Robotics and use of drones and aeroplanes. Herbicides -classification based on chemical, physiological application and selectivity. Mode and mechanism of action of herbicides. Movement of herbicides in plants and soil. Development of herbicides resistance in plants. Harmful effects of weeds.

Unit 5 Weeds for sustainable utilization 11 hrs

Weeds used for healing (*Cynodon dactylon, Boerhavia diffusa, Oxalis corniculata, Argemone Mexicana, Cleome gynandra*), pest repellent, shelter plants, trap crops, weeds for decorative purposes, weeds with essential oils, Edible weeds (*Portulaca oleraceae, Chenopodium album, Rumex cripsus* etc.), weeds used for decorative furnitures (Ex: *Eichhornia crassipes, Lantana camera, Hyptis suaveolens, Ipomoea Carica*, etc.), Weeds as green manure, weeds helpful against soil erosion, weeds as fuel, weeds as indicators of soil nutrients.

REFERENCES

1. Anderson, w. P. 1983. Weed Science: Principles. Second Edition, West Publishing Company, New York.
2. Bewley, J. D., and M. Black. 1982. Physiology and Biochemistry of Seeds in Relation to Germination. (2 volumes.) Springer-Verlag, New York.
3. Harper, J.L. (1977). Population Biology of Plants. Academic Press, San Diago, C.A, pp. 892.
4. Hence R.A. and K. Holly 1990. Weed Control Handbook: Principles, 8th Edition by Blackwell Scientific Publications.
5. Isikawa, S. and Fujii, T. (1961). Photo control and temperature dependence of germination of Rumex seeds. Plant and cell physiology. 2: 51-62.
6. Ivens G.W. 1989. East African Weeds and Their Control: 2nd Edition, Oxford University Press.
7. Jayakumar, R. and Jagannthan, R. (2003). Weed science principles. Kalyani publishers, New Delhi, India. Pp 15-24. [10] Jensen, L.L. (1971). Morphology and photoperiodic responses of yellow sedge. Weed Sci. 19: 210-219.
8. Kavitha Sagar and Rajanna MD . 2015. A Handbook on weeds of Karnataka. Centre for Plant Taxonomic studies. Bengaluru.
9. Patterson, D.T. (1982). Shading response of purple and yellow nut sedges (Cyperus rotundus and C. esculentus). Weed Sci. 30: 25- 30.
10. R. J. Aldrich and R. J. Kremer. 1997. Principles in Weed Management, Iowa State University Press
11. Rao, V.S. (2000). Principles of Weed Science. 2 nd edition. Oxford & IBH Publ. Com; New Delhi. Pp 7-35.
12. Ross M. A. and C. A. Lembi. 1999. Applied Weed Science: 2nd Edition, Prentice Hall.
13. Terry P.J. 1984. A guide to weed control in East African crops Kenya Literature Bureau
14. Weed Biology and control by T. J. Musik (Mc Graw Hill)

COURSE OUTCOMES

1. Students will gain knowledge on weeds and their management.
2. Students will critically evaluate weed management options within ecological,
3. economic, and social constraints and design effective integrated management systems.
4. Students will evaluate beneficial aspects of weeds.
5. **S**tudents will be enhanced with knowledge on survival mechanisms of weeds.
6. **S**tudents will be well acquainted with process of invasion of weeds and their
7. establishment.

M.Sc. Botany IV Semester

Course: **B. DNA barcoding of land plants**	Course code: **24BOT4E3BL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES:

The main goal of this course is

1. To introduce students to methods used to study and preserve biodiversity
2. To understand the techniques introduced include DNA sequencing and DNA fingerprinting
3. Demonstrates several important concepts of modern biology
4. Describe and comprehend the genetic background of DNA barcoding and evaluate potential techniques and challenges

COURSE CONTENTS

Unit-1 Introduction to DNA barcoding 11 hrs

History and origin of DNA barcoding, Gene fragments used in DNA barcoding, Criteria for barcoding, Factors affecting species discrimination, Case studies, choosing a DNA barcode, metabarcoding, Barcode applications, Practical difficulties, Algal Barcodes in BOLD. Evaluation of candidate barcodes against criteria and challenges, DNA barcoding for wood identification.

Unit-2 DNA barcoding regions 11 hrs

Barcode markers from Animals, Fungi, Red and Brown Algae, and Green Plants. mtDNA, rbcL, rbcLa, COI genes, nrITS, nrITS2, matK (maturase K), rbcL (ribulose biphosphate carboxylase large subunit), rpoB (RNA polymerase B subunit), rpoC1 (RNA polymerase C subunit), atpF ATP synthase subunit delta, psbK-1 (Photosystem II reaction centre protein k precursor), trnH-psbA, trnL-F, UPA, accD, matK, ndhJ, YCF5.

Unit-3 DNA barcoding process 11 hrs

DNA barcoding process from specimen to the barcode, Sampling, DNA extraction, isolation, amplification, purification of specific genes, sequencing, data analysis, and site of DNA barcodes. Different markers in plant barcoding studies. Genes are used as plant DNA bar codes. DNA barcoding today and tomorrow: High-throughput sequencing, Environmental DNA detection and miniaturization, and mobile devices.

Unit-4 DNA barcoding and Taxonomy 11 hrs

The conceptual link between DNA barcoding and traditional taxonomy. Voucher specimens, Integrated taxonomy, Cryptic species. Factors affecting species discrimination. Factors influencing the discrimination success of plant barcodes. Linnaeus classification versus DNA

barcoding. Strength versus weaknesses and challenges. Impact of intraspecific gene flow on species discrimination success. Case studies: Delimiting cryptic species, DNA barcodes for Phyllanthus species, identification of Dalbergia species.

Unit-5 Barcoding and Bioinformatics 11 hrs

Establishment of a global information system, sequence repositories, and consortia involved in plant DNA barcoding. Databases, reference libraries, Data analysis, construction of phylogeny, new computational methods in DNA barcoding, and software available for barcoding of plants. Impacts of intraspecific gene flow on species discrimination. Applications, limitations, case studies. Data repository and organizations - CBOL (consortium for the barcode of life), CCDB (Canadian Centre for DNA barcoding), ECBOL (European Consortium for the barcode of life), BOLD (Barcode of Life database), iBOL (International Barcode of Life), FishBOL, GrassBOL, TreeBOL.

REFERENCES

1. Subrata Trivedi, Hasibur Rehman, Shalini Saggu, Chellasamy Panneerselvam, Sankar K Ghosh (2020) DNA Barcoding and molecular phylogeny. Springer nature.
2. Subrata Trivedi, Abid Ali Ansari, Sankar K Ghosh, Hasibur Rehman (2016) DNA Barcoding in Marine Perspectives. Assessment and conservation of biodiversity.
3. Mohammad Ajmal Ali (2015) Plant DNA Barcoding and Phylogenetics LAP Lambert Academic Publishing.
4. Sankar Kumar Ghosh (2016) A textbook on DNA barcoding.
5. Ma Carmen Ablan-Lagman and Chona Camille Vice Cruz-Abeledo (2017) DNA barcoding of marine organisms. De la Salle University (DLSU) Publishing House.
6. Nikolaus J Sucher, James R Hennell, Maria C Carls (2012) Plant DNA finger printing and barcoding – Methods and Protocols. Springer Protocols. Humana Press
7. W. Joh Kress and David L Erickson (2012) DNA Barcodes: Methods and Protocols: Springer Protocols. Humana Press
8. Rajkumar Pradosh Mahadani, Ravi Kishore, A Loyanganba Meitei, D R Singh (2016) DNA barcoding of Indian Orchids. ICAR- National Research Centre for Orchids, Pakyong, Sikkim =737106.

COURSE OUTCOMES

1. Familiarize the techniques to identify local species of plants, fungi and invertebrates
2. Critically evaluate studies thar utilized DNA based taxonomy
3. Extract and purify DNA from tissue or processed material
4. Amplify a specific region of the chloroplast, mitochondria or nuclear genome by PCR and analyze PCR products
5. Use the BLAST program to identify sequences in databases.
6. Use multiple sequence alignment and tree-building tools to analyse phylogenetic relationships
7. Using DNA barcodes to identify and classify living things

M.Sc. Botany IV Semester

Course: **C. Plant Translational Research**	Course code: **24BOT4E3CL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours – **55 hrs**	

COURSE OBJECTIVES

- Students will develop an understanding of concepts in translational research, methods, and models for evaluation of research, and findings to translate knowledge into best practice protocols.

COURSE CONTENTS

Unit-1 Translation and Translational Research 11 hrs

Definition and objectives. Differences between basic science, basic research, Clinical research and Translational research. Goal and Importance of translational research. Scientific & Ethical Conduct. Terms used in translational research.

Unit-2 Phases of Translational research- T1-T4SS 11 hrs

Categories of translational research –identification, observation and understanding. T1- T1: Development and validation of animal models, preclinical drug studies, development of clinically relevant technologies, and phase 1 and 2 clinical studies (a"bench to bedside" research).T2: Phase 3 clinical trials (including comparative effectiveness trials), phase 4 clinical research, and development of clinical guidelines ("bedside to practice" research).T3: Research focused on implementation and dissemination of phase 3 and 4 clinical research results (dissemination and implementation research). T4: Research focused on outcomes and effectiveness in populations, including assessment of benefit to communities through public health policies and programs, as well as the adoption of proven interventions' best practices in communities (diffusion research), and cost-benefit analyses

Unit-3 Stages of translational research 11 hrs

Stage 1- basic research, stage II- preclinical research, stage III-Clinical research, stage IV – Clinical implementation, stage V-public health. mixed methods study designs- BERD series- QUANT data, QUAL data, Explanatory sequential, convergent, Data integration, Data transformation.

Unit-4 Translational research and nursing: Uses of TR nursing 11 hrs

In translating descriptive theories into patient assessment tools, in explanatory theories into comprehensive assessment tools, and in predictive theories into intervention protocols. **Phases of translational research in Nursing.** Phase I **(**PICOT), Phase II (the FAME), Phase III (Pragmatic adequacy), and Phase IV (Evaluation). Challenges and criticisms of practicing

translational research. Impact on society. Advantages of translational research. TR facilities in life sciences.

Unit-5 Study Designs in Translational Research 11 hrs

Study Designs in Translational Research and Dissemination and Implementation Research- i) Randomized designs; step wedged design and Randomized encouragement trial. Ii) Quasi-experimental designs or nonrandomized designs with or without controls- Pre-post, Interrupted time series, Multiple Baseline, Regression discontinuity design. Iii) Natural experiment. Applications of translational research.

REFERENCES

1. Aarons, G.A., Ehrhart, M.G., Farahnak, L.R., & Sklar, M. (2014). Aligning leadership across systems and organizations to develop a strategic climate for evidence-based practice implementation. *Annual Review of Public Health, 35*, 255–274. doi:10.1146/annurev-publhealth-032013-182447
2. Alexander, J.A., & Hearld, L.R. (2012). Methods and metrics challenges of delivery-system research. *Implementation Science, 7*(15). doi:10.1186/1748-5908-7-15
3. Armstrong, R., Waters, E., Dobbins, M., Anderson, L., Moore, L., Petticrew, M., … Swinburn, B. (2013). Knowledge transition strategies to improve the use of evidence in public health decision making in local government: Intervention design and implementation plan. *Implementation Science*, *8*(1), 121–131. doi:10.1186/1748-5908-8-121
4. Birken, S.A., DiMartino, L.D., Kirk, M.A., Lee, S.Y.D., McClelland, M., & Albert, N.M. (2016). Elaborating on theory with middle managers' experience implementing healthcare innovations in practice. *Implementation Science*, *11*(2). doi:10.1186/s13012-015-0362-6
5. Birken, S.A., Powell, B.J., Presseau, J., Kirk, M.A., Lorencatto, F., Gould, N.J., … Damschroder, L.J. (2017). Combined use of the Consolidated Framework for Implementation Research (CFIR) and the Theoretical Domains Framework (TDF): A systematic review. *Implementation Science, 12*(2). doi:10.1186/s13012-016-0534-z
6. Helfrich, C.D., Damschroder, L.J., Hagedorn, H.J., Daggett, G.S., Sahay, A., Ritchie, M., … Stetler, C.B. (2010). A critical synthesis of literature on the promoting action on research implementation in health services (PARIHS) framework. *Implementation Science, 5*(82). doi:10.1186/1748-5908-5-82
7. Hendriks, A.-M., Jansen, M.W.J., Gubbels, J.S., De Vries, N.K., Paulussen, T., & Kremers, S.P.J. (2013). Proposing a conceptual framework for integrated local public health policy, applied to childhood obesity—The behavior change ball. *Implementation Science, 8*, 46–62. doi:10.1186/1748-5908-8-46
8. Henly, S., McCarthy, D., Wyman, J., Heitkemper, M., Redeker, N., Titler, M.G., … Dunbar-Jacob, J. (2015). Emerging areas of science: Recommendations for nursing science education from the Council for the Advancement of Nursing Science Idea Festival. *Nursing Outlook*. *63*(4), 398–407. doi:10.1016/j.outlook.2015.04.007
9. Horsley, J.A. (1983) *Using research to improve nursing practice: A guide*. Austin, TX: Pro-Ed.
10. IOM (Institute of Medicine). (2013a). *Establishing transdisciplinary professionalism for improving health outcomes: Workshop summary.* Washington, D.C.: The National

Academies Press. Retrieved from http://dept-wp.nmsu.edu/geriatriceducation/files/2014/03/Workshop-Summary.pdf
11. Shever, L.L., Titler, M.G., Mackin, M.L., & Kueny, A. (2011). Fall prevention practices in adult medical-surgical nursing units described by nurse managers. *Western Journal of Nursing Research, 33*(3), 385–397. doi:10.1177/0193945910379217
12. Shuman, C.J., Ploutz-Snyder, R., & Titler, M.G. (2018). Development and testing of the NM EBP Competency Scale. *Western Journal of Nursing Research, 40*(2), 175-190doi:10.1177/0193945917728249
13. Wilson, D.S., Montie, M., Conlon, P., Reynolds, M.A., Ripley, R., & Titler, M.G. (2016). Nurses' perceptions of implementing fall prevention interventions to mitigate patient-specific fall risk factors. *Western Journal of Nursing Research, 38*(8), 1012–1034. doi:10.1177/0193945916644995
14. Wong, C.A., & Giallonardo, L.M. (2013). Authentic leadership and nurse-assessed adverse patient outcomes. *Journal of Nursing Management, 21*(5), 740–752. doi:10.1111/jonm.12075
15. Yamada, J., Squires, J.E., Estabrooks, C.A., Victor, S., Stevens, B., & CIHR Team in Children's Pain. (2017). The role of organizational context in moderating the effect of research use on pain outcomes in hospitalized children: A cross sectional study. *BMC Health Services Research, 17*(1), 68. doi:10.1186/s12913-017-2029-2

COURSE OUTCOMES

1. Students get an understanding on accelerating the process of moving the findings from bench research to the bedside as interventions.
2. Students get acquainted with information regarding collaboration between researchers working in different settings at different phases of translation.
3. Students will understand and utilize the potential knowledge and expertise of personnel from different disciplines to focus on a common goal.

M.Sc. Botany IV Semester

Course: **A. Intellectual Property Rights**	Course code: **24BOT4E4AL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: **30 marks**	Semester End Examination: **70 Marks**
Total contact hours: **55**	

COURSE OBJECTIVES

- To provide comprehensive knowledge to the students regarding the general principles of IPR, Concepts, and Theories, Indian position of the Patent Law (1970), Indian position of the Trademark Act, 1999, g the effect of IPR, especially on patents on emerging issues like public health, climate, Domain Name Disputes and Cybersquatting, Biopiracy, etc. and the ways to tackle this problem.

Unit-1 Principles of IPR **11 hrs**

Introduction to Intellectual Property Rights Concept and Theories Kinds of Intellectual Property Rights Economic analysis of Intellectual Property Rights Need for Private Rights versus Public Interests Advantages and Disadvantages of IPR. Criticisms of Intellectual Property Rights. TRIPS and other Treaties (WIPO,WTO, GATTS)

Unit-2 Patent Law and practices **11 hrs**

Introduction to Patents, Concepts, Novelty, Utility Inventiveness/Non-obviousness. Patent Act 1970 - amendments of 1999, 2000, 2002, and 2005. Patentable subject matter, Patentability criteria, non-patentable inventions pharmaceutical products and process; patent protection; Software Patents; Patenting of Microorganism. Procedure for granting a patent and obtaining patents.

Unit-3 Copyright law and practices **11 hrs**

Copyright and Neighbouring Rights, Leading International Instruments, Berne Convention, Universal Copyright Convention, International Copyright under Copyright Act, 1957. Conditions for grant of copyright. Copyright Registrar and Copyright Board-Power and Procedure Copyright Societies

Unit-4 Trademark law and practices **11 hrs**

Introduction to Trademarks Need for Protection. Kinds of trademarks, Procedure of registration of trademark. Infringement of trademark. Remedies for infringement and passing off Civil remedies Criminal remedies

Unit-5 Emerging issues and challenges **11 hrs**

Public health and Intellectual Property Rights Case study—Novartis Pharmaceuticals Bayer Pharmaceuticals. IPR and Climate change Patents and Biotechnology. Traditional knowledge and IPR, Bio piracy, Domain Name Disputes and Cyber squatting

REFERENCES:

1. B.L. Wadera, Patents, trademarks, copyright, Designs and Geographical Judications.
2. Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
3. Brinkhof (Edited), Patent Cases, Wolters Kluwer
4. D.P. Mittal (Taxman Publication), Indian Patents Law and Procedure
5. Hilarry Pearson and Clifford Miller, Commercial Exploitation of Intellectual Property
6. Merges, Patent Law and Policy: Cases and Materials, 1996
7. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
8. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
9. P. Narayanan (Eastern Law House), Intellectual Property Law

COURSE OUTCOMES

1. Students will be well acquainted with various aspects of IPR-its importance, role in Copyrights, etc.
2. Students will analyze some case studies provided.
3. Students will get knowledge in emerging issues like public health, climate, Domain Name Disputes and Cybersquatting.
4. Students will gain knowledge regarding the Indian position of the Trademark Act, 1999.
5. Students will understand Criticisms of Intellectual Property Rights, International Regime Relating to IPR

M.Sc. Botany IV Semester

Course: **B. Conservation Biology**	Course code: **24BOT4E4BL**
L-T-P per week **4-0.0**	No of credits: **04**
Internal Assessment: **30 marks**	Semester end Examination: **70 marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES

1. Recognize in-situ and ex-situ conservation of various medicinal plants
2. Create awareness for the utilization of herbal medicines for home remedies
3. To promote conservation strategies recommended by various agencies
4. To understand the medicinal values of various parts of the medicinal plants

COURSE CONTENTS

Unit-1 Introduction to conservation biology 11 hrs

The history and distinctions of conservation biology, the emergence of global conservation (developing and developed nations). Importance of conservation: In response to expanding anthropogenic demands, in response to global climate changes, multidimensional aspects of conservation biology, biogeographic classification.

Unit-2 Conservation challenges in the twenty-first century 11 hrs

Urbanization, creating a knowledge society, conflict management and decision making, management of introduced species. Evaluation of priorities for conservation of habitats and species- species quality, IUCN, guidelines for red-list categories and criteria (version 7.0), red list of Indian flora and fauna, selection criteria for protection habitats – hot spots, conservation indices.

Unit-3 Climate and climate change 11 hrs

Climate and climate change. Nature of climate change: observed and projected changes in climate (atmospheric changes in Greenhouse gases and aerosols, earth's surface temperature and precipitation, climate variability and extreme climatic events, snow cover, sea and river ice, glaciers and sea levels, implications of rapidly rising CO2. Intergovernmental panel on climate change (IPCC): definition of impacts, adaptation, and mitigation, climate change policy of India

Unit-4 Global biological impacts of climate change 11 hrs

Predicted biological impacts, and observed biological impacts on species and ecosystems. Projected impacts of changes in mean climate and extreme climate events on terrestrial (including aquatic) and marine ecosystems, climate change, and gender equality, projected impacts on traditional and indigenous people

Unit-5 Conservation planning and climate change 11 hrs

The bioclimatic envelope model for individual species, climate change- integrated strategies for conservation, predictions on future responses of ongoing climate change on biodiversity, potential adaptation options and their consequences on ecosystems and biodiversity, REDD+, synergies between sustainable use of biodiversity and climate change.

REFERENCES

1. Groom MJ, Meffe GR and Carroll CR (2006) Principles of conservation biology. Sinauer Associates Inc., USA
2. Primack R (2006) Essentials of conservation biology. Sinauer associates Inc. USA
3. Hambler C (2004) Conservation. Cambridge University Press.
4. Van Dyke F (2008) Conservation Biology Foundations, concepts, applications 2nd edition springer.

COURSE OUTCOMES

The student will obtain knowledge and understanding of

1. Ecological and evolutionary processes that are important for conservation of biodiversity- important approaches and practices in biodiversity conservation and management
2. Planning management of biodiversity and biological resources in the light of ecological and evolutionary dynamics.
3. Explain the basic concepts of ecology and evolution and how they underpin and apply to the science of conservation biology
4. Understand and explain the scientific process as related to conservation biology, including the relevance of theories and how hypotheses are tested

M.Sc. Botany IV Semester

Course: **C. Forest Botany**	Course code: **24BOT4E4CL**
Teaching hours/week (L-T-P): **4-0-0**	No. of credits: **04**
Internal assessment: 3**0 marks**	Semester End Examination: 7**0 Marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES

- Students will develop their critical analysis of the importance of forests their types and reasons for deterioration of forests and restoration prescriptions. Analyze information and think critically (e.g. consider the basic environmental requirements of indicator plants/trees and apply this knowledge in classifying and describing forest ecosystems).

COURSE CONTENTS

Unit 1 Forest Biome and Biometry 11 hrs

Types and characteristics of forests in India- Temperate (types), Tropical (types), and Boreal (types). Measurement of tree parameters. Estimation of volume, growth, and yield of individual tree and forest stand. Forest inventory, Sampling methods adopted in forestry, Use of GPS in forest inventory. Measurement stand density. Simulation techniques.

Unit 2 Forest Ecology 11 hrs

Structure composition, the function of forests. Abiotic factors and interactions. Biotic factors and interactions. Understory ecology, tree regeneration Factors affecting forest structure and composition, the effects of environmental gradients on plant species distribution, and the dynamics of vegetation communities over time.

Unit 3 Wood Science & technology 11 hrs

Types of wood, Preservation of wood, wood products & utilization. Forest mensuration. wood seasoning, wood clarity. Industrial Utilization of wood extracts- natural rubber, resin, and turpentine from pines, tannins, gums, resins, pharmacologically active metabolites, and future directions for their utilization. Dendrology.

Unit 4 Forest management- principles, scope 11 hrs

Definition and Scope of wood management: Scope- (i) Control of composition and structure (ii) distribution and marketing of produce (iii) administration of forest property. Task of management of forests- (i) Control of composition and structure of growing stock (ii) harvesting and marketing of forest produce and (iii) admission of forest property. Site quality evaluation and importance. Stand density, classical approaches to yield regulation in forest management, salient features and strategies, Forest valuation and appraisal in regulated forests.

Unit 5 Forest Policy 11 hrs

What is forest policy? Need for a forest policy. National forest policy 1988- aims and objectives. Relevance and scope; National Forest Policy – 1894, 1952 and 1988; Forest laws; Indian Forest Act –1927, Forest Conservation Act 1980, Wildlife Protect Act 1972 Important Forest Rules and Guidelines.

REFERENCES:

1. Dwivedi AP. 1993. A Text Book of Silviculture. International Book Distributors, Dehradun
2. Chaturvedi AN & Khanna LS. 1994. Forest Mensuration. International Book Distributor.
3. Khanna LS. 1996. Principle and Practice of Silviculture. International Book Distributors.
4. Kimmins JP. 1976. Forest Ecology. MacMillan.
5. Nautiyal S & KoulAK. 1999. Forest Biodiversity and its Conservation Practices in India. Oriental Enterprise.
6. Ram Parkash 1983. Forest Surveying. International Book Distr.
7. Ramakrishnan PS. 1992. Shifting Agriculture and Sustainable Development. Man and Biosphere Series. The Parthenon Publ. Group.
8. Sharpe GW, Hendee CW & Sharpe WE. 1986. Introduction to Forestry. McGraw-Hill.
9. Simmons CE. 1980. A Manual of Forest Mensuration. Bishen Singh Mahender Pal Singh, Dehradun.
10. Smith DM, Larson BC, Ketty MJ & Ashton PMS. 1997. The Practices of Silviculture-Applied Forest Ecology. John Wiley & Sons.
11. Trotter H. 1982. Manual of Indian Forest Utilization. FRI & College, Dehradun. Wadoo MS. 1992. Utilization of Forest Resources. IDRIS Publ.

COURSE OUTCOMES:

1. Students will be able to understand a importance of forests for ecological balance and healthy human life.
2. Develop informed hypotheses about the fole of biotic processes in regulation of forest community structure and function.
3. Students will be able to understand dendrology, tribology, anthropology and their roles in forest balancing.
4. Students will be able to understand forest management and various policies and legislations.
5. Various forest products and their commercial utility will be well acquainted.

M.Sc. Botany IV Semester

Course: **A. Medical Botany**	Course code: **24BOT4G2AL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours: **35 hrs**	

COURSE OBJECTIVES

To enable the students

1. To understand the various systems of treatment and herbal drugs
2. To understand the effect of various phytoconstituents to cure various ailments
3. To learn the preparative methodologies of various drug formulations to control diseases and symptoms
4. To study the Indian system of traditional medicine
5. To study the drug development from medicinal plants
6. To understand the traditional systems of medicines like Ayurveda, Siddha and Unani
7. To know the pharmacological actions of crude drugs
8. To gain knowledge on pharmacognosy of medicinal plants
9. To familiarize cultivation technologies of medicinal plants

COURSE CONTENTS

Unit-1 History and classification of medicinal plants 12 hrs

Introduction & scope of medicinal Botany. History and development of Indian Medicine, Concept and principles of Ayurveda, Unani, Sidda, Homeopathy. Classification of medicinal plants based upon the plant parts and phytoconstituents. Root drugs- *Withania somnifera.* Bark drugs – *Cinchona officinalis*. Stem drugs- *Ephedra gerardiana*. Leaf drugs-Mentha arvensis, Flower bud- *Syzygium aromaticum*, fruit-*Punica granatum*, seed- *Terminalia chebula*, and whole plant drugs- *Coriandrum sativum*.

Unit-2 Medicinal plant constituents and health care 11 hrs

Plant secondary metabolites of medicinal importance – Alkaloids, glycosides, mucilages and sterols (brief account). Sources and uses of morphine, atropine, codeine and ephedrine in modern medicine. Algae, Fungi, Pteridophytes, Gymnosperms and Angiosperms as sources of secondary metabolites. Some common herbal practices used to cure – fever, worms, diarrhea, cough, cold, arthritis and rheumatism, stone in urinary tract and fungal infections.

Unit-3 Pharmacognosy and Drug evaluation 12 hrs

Pharmacognosy – Introduction to phytomedicines and herbal raw materials – local health traditions, ethnomedicines. Medicinal uses of the following herbs in curing various ailments:

Tulsi, Ginger, Fenugreek, Indian Gooseberry and Ashoka. Collection and processing of medicinal plants. preparation of crude drugs, drug adulteration. Physical, chemical and biological methods of drug evaluations

REFERENCES

1. Roseline A (2011) Pharmacognosy. MJP Publishers, Chennai
2. Maheshwari JK (2000) Ethnobotany and medicinal plants of Indian Subcontinent, Scientific Publishers, India
3. Jain SK (1981) Glimpses of Ethnobotany. Oxford & IBH, New Delhi
4. Kumar NC (1993) An Introdction to Medical Botany, Emkay Publications, New Delhi.
5. Nadkarni (1981) Materia Medica, Popular Prakashan Publication, New Delhi.

COURSE OUTCOMES

1. Different systems of Indian medicine, drugs from plant parts, and their remedial properties
2. Pharmacognosy, drug preparation, adulteration, drug evaluation
3. Prospective medicinal plant cultivation methods and formulas
4. Traditional healthcare systems and tribal medicines
5. Acquire knowledge on the therapeutic uses of plant drugs
6. Understand the traditional and modern systems of medicine
7. Relates physiological action of various plant drugs
8. Recognize crude drugs used in traditional system of medicine
9. Understand the therapeutic potential of crude drugs
10. Apply the knowledge in the cultivation practices of medicinal plants
11. Implement knowledge in identifying novel drug leads against allopathic medicine

M.Sc. Botany IV Semester

Course: **B. Curios and Fascinating plants**	Course code: **24BOT4G2BL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours: **35 hrs**	

COURSE OBJECTIVES

1. The course aims to have an understanding of strange plants with respect to their habitat morphology
2. To study special pollination and insectivorous plants
3. To study the sacred and religious plants
4. To understand the discovery of medicinal plants

COURSE CONTENTS

Unit-1 Defence strategies of plants **12 hrs**

Lithops species, Dracunculus vulgaris, Himalayan Blackberry, Hippophae, Poisonous plants, Giant hogweed, angel Trumpet, Amanita, Death camas, Gympie-Gympie, Tree nettle, Spurge hogweed, Red tide algae, Invasive plants

Unit-2 Discovery of medicinal plants **11 hrs**

Short stories. Plants and their products as medicines: pain relieving plants – aspirin from willow to wonder drug, quinone, artemisin, cancer fighting flowers. Mind altering drugs- Opium, Cannabis, Datura, Salvia, Betel nut,

Unit-3 Religious and sacred plants **12 hrs**

Ficus religiosa, *Nyctanthus arbor-tristis*, *Aegle marmelos*, *Piper betel*, *Nelumbo nucifera*, *Saraca indica*, , *Phyllanthus emblica*, *Ocimum tenuiflorum, Curcuma longa*, *Santalum album*, *Cocos nucifera, Salvia officinalis, Cinnamum camphora*

REFERENCES

1. Raven PH., Evert RF., Eichhorn SE (2005) Biology of plants (7th ed.), New York: WH Freeman and Company
2. Sakai A and Larcher W (Eds) 1987. Frost survival of plants. Springer-Verlag, New York NY 321pp
3. Kochhar SL (2016) Economic Botany: A comprehensive study. Cambridge University press.
4. Trewavas A (2003) Aspects of plant intelligence. Annals of Botany 92(1):1-20
5. Prance GT (2001) Discovering the plant world. Taxon 50(2,4):345-359

6. Acharya D and Shrivastava A (2008) Indigenous Herbal Medicines: Tribal formulations and traditional herbal practices, Jaipur, India: Avishkar Publishers
7. Anderson EF (2001) The Cactus family. Pentland, Oregon: Timber Press
8. Bold HC (1977) The Plant Kingdom (4th ed) Englewood Cliffs, NJ:Prentice-Hall
9. Capon B (2005) Botany for Gardeners (2nd ed) Portland OR Timber Publishing

COURSE OUTCOMES

1. What are the strategies of plants to survive in extreme conditions
2. What are morphological modifications, adaptation on plants with unique features
3. Understand the unique mode of nutrition of insectivorous plants
4. To categorize the plants with respect to their type dye yielding from the different organs of the plants
5. Understand the principal characteristics of gum and resins

M.Sc. Botany IV Semester

Course: **C. Floriculture**	Course code: **24BOT4G2CL**
Teaching hours/week (L-T-P): **2-0-0**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Examination: **30 Marks**
Total contact hours: **35 hrs**	

COURSE OBJECTIVE

1. To impart basic knowledge about the importance and production technology of cut flowers grown in India
2. Apply an integrated nutrient management system (INMS) in the field
3. Identify and select different propagation methods, handling of seed, bulbs, cut flowers, nursery plants and pot plants.
4. Identify and apply method of vegetative propagation and its management
5. Identify commercial flowers and their packaging
6. Identify the diseases and apply the pesticides as per the requirement
7. Plan and execute survey for landscaping and various types of indoor gardening
8. Carryout protected cultivation of flower

COURSE CONTENTS

Unit-1 Floriculture and its scope in global trade 12 hrs

Global scenario of cut flower production. Varietal wealth and diversity, area under cut flowers and production problems in India – Patent rights, nursery management, media for nursery, special nursery practices

Unit-2 Basic requirements and cultivation 11 hrs

Growing environment, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, the influence of environmental parameters, light temperature, moisture, humidity and CO_2 on growth and flowering.

Unit-3 Flower production 12 hrs

Water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production and exhibition purposes

REFERENCES

Arora JS 2006. Introductory Ornamental Horticulture. Kalyani

Bhattacharjee SK. 2006. Advances in Ornamental Horticulture. Vols I-VI. Pointer Publ.

Bose TK and Yadav LP . 1989 Commercial Flowers, Naya Prokash

Bose TK, Maiti RG Dhua RS and Das P 1999. Floriculture and Landscaping. Naya Prokash.

Chadha KL and Chaudhury B (1992) Ornamental Horticulture in India. ICAR

Chadha KL (1995) Advances in Horticulture. Vol XII. Malhotra Publ. House. 52

Lauria A and Ries VH 2001. Floriculture – Fundamnetals and Practices, Agrobios

Prasad S and Kumar U 2003. Commercial Floriculture in India, Allied Publ

Reddy S, Janakiram B, Balaji T, Kulkarni S and Misra RL (2007) Hightech Floriculture, Indian Society of Ornamental Horticulture, New Delhi.

COURSE OUTCOMES

1. The student will be able to practice production technology of cut flowers, loose flowers and principle of growing commercial flowers
2. Student will become eligible to manage a commercial floriculture unit
3. Discuss the historical development and current characteristics of the world floricultural industry
4. Apply the essential methods and technologies used in the production of cut flower, cut foliage and tender pot plant crops
5. Evaluate in detail the production of at least five named model cut flower, cut foliage and pot plant crops
6. Evaluate the post-harvest physiology of floricultural products and requirements of care to optimize product shelf life from harvest to consumer.

M.Sc. Botany IV Semester

Course: **Plant Tissue Culture, Plant breeding and propagation**	Course code: **24BOT4C9P**
Teaching hours/week (L-T-P): **0-0-2**	No. of credits: **02**
Internal assessment: **20 marks**	Semester End Exam: **30 Marks**
Total contact hours: **55 hrs**	

COURSE OBJECTIVES

The subject aims to provide students with the necessary skills for

1. Learning principles and techniques of various types of planar chromatography such as PC, TLC, and HPTLC
2. Understanding the principles and techniques of various types of column chromatography such as HPLC, GC, etc.
3. Structure elucidation of pure isolated phytoconstituents – Theory and problem solving using spectral analysis such as UV, IR, Mass spectroscopy, NMR, etc. which can be used for characterization of bioactive phytoconstituents from herbal sources.

EXPERIMENTS

1. Requirements for plant tissue culture laboratory and Instruments
2. Preparation of Murashige and Skoog's, Gamborg's B5, Nitsch and White's media and Sterilization of media, tissues, and other accessories
3. Isolation of protoplasts from onion
4. Mounting and culture of Embryo and endosperm from chillis, Cucumber and Tridax
5. Artificial seed synthesis
6. Clonal propagation – Shoot tip and axillary bud culture
7. Propagation through apomictic
8. Hybridisation techniques: selfing, emasculation and crossing
9. Propagation by cuttings.
10. Propagation by layering
11. Propagation by grafting.
12. Propagation by budding

REFERENCES

1. Text book of Pharmacognosy by G.E. Treese and W.C.Evans, 15th edition, WB Saunders Edinburg, New York
2. Phytochemistry – Vol I to IV by Miller Jan, Nostrant Renhold
3. Recent advances in Phytochemistry – Vol I to IV, Scikel Runeckles Appleton century crofts
4. Pharmacognosy and Phytochemistry of medicinal plants by Jean Bruneton, Rechique and documentation- Lavoiser, 1995
5. Pharmacognosy and Phytochemistry by Vinod D. Rangari Part I and II
6. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhale
7. Harborne JB (1998) Phytochemical methods. Springer (India) Ltd. New Delhi

8. Bhojwani SS and Razdan MK (1983) Plant tissue culture – Theory and Practice, Elsevier, London
9. Reinert J and Bajajj YPS (1989) Plant cell, tissue and organ culture, Narosa Publishing House, New Delhi
10. Jakoby WB and Pastan (1979) Cell Culture – Methods in Enzymology, Academic Press, London, 1979
11. Reinert J and Yeoman MM (1982) Plant cell and Tissue Culture – A laboratory manual, Narosa Publishing House, New Delhi
12. Principle and practices of Plant propagation. Hartman HT and Kester DE.

COURSE OUTCOMES

At the end of the course, students can able to

1. Assess the chemistry and quality of plant products (e.g., herbs, spices) by analyzing their sensory, physical, and chemical properties (addresses program goal 1, technical proficiency)
2. Place the importance of medicinal plants and plant products within an economic context.
3. Acquire knowledge about skills used in plant tissue culture techniques
4. List of chemicals, media, and equipment required for plant tissue culture lab
5. Learn breeding procedures in self and cross pollinated crops
6. Understand exploitation of heterosis utilizing male sterility and other methods
7. Know about the various population improvement programmes
8. Learn about hybrid breeding and propagation techniques
9. Learn about floral biology.
10. Study about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement.

M.Sc. Botany IV Semester

Course: Research Project	Course code: **24BOT4C1R**
L-T-P per week **0-0-4**	No of credits – **04**
Internal Assessment: **30 marks**	Semester end Dissertation and viva-voce: **70 marks**
Total contact hours: **55**	

The purpose of this course is to help students organize ideas, material, and objectives for their dissertation and to begin the development of communication skills, and to prepare the students to present their topic of research and explain its importance to their fellow classmates and teachers.

COURSE OBJECTIVES

1. To know the practical problems in various fields of Botany
2. To understand to collect the related data in the selected fields
3. To give students skills for critical reading of research literature and for developing a research proposal for a master's thesis project
4. To apply suitable skill to solve the selected problems through proper execution

COURSE DETAILS

1. Each student has to undertake a project / dissertation work under the guidance of department faculty
2. The outcome will be intellectual property of the student and faculty guide which cannot be published without written permission of the faculty guide
3. The project report may be presented in following sub-heads
    a. Contents
    b. Acknowledgements
    c. Introduction
    d. Review of Literature
    e. Materials and methods
    f. Results and discussion
    g. References
    h. Appendices
4. Titles and subtitles in running text to be in 16 and 14 font size. The text to be presented in 12 font size with 1-1.5 spacing
5. Students have to submit the final project report at the end of the semester which will be evaluated followed by a seminar presentation and viva-voce examination.

COURSE OUTCOMES

Students should be able to demonstrate the following abilities:

1. Formulate a scientific question
2. Present a scientific approach to solving the problem
3. Analyzing the importance of project while collecting the necessary data

4. Evaluating variations between the theories and the experiments
5. Interpret, discuss and communicate scientific results in written form
6. Executing appropriate methods to get the correct interpretation to present the results
7. Learn how to present and explain their research findings to the audience effectively

CBCS Question Paper Pattern for PG Semester End Examination

with Effect from the AY 2024-25

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**

Time: 3 Hours **Max.**

Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 14 Marks

Note :Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 14 Marks

Note: Question No.7*, shall be from Unit IV and V*,the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

****