



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
Jnanasagara campus, Bellary-583105

Department of Studies in Botany

SYLLABUS

Master of Science
(IV semester)

With effect from
2021-22



VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Jnana Sagara, Ballari - 583105

Department of Studies in Botany



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

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	21BOT4C11L	Plant Biotechnology	30	70	100	4	-	-	4	3
	DSC12	21BOT4C12L	Pharmacognosy and Phytochemistry	30	70	100	4	-	-	4	3
	DSE3	21BOT4E3AL	A. Weed Biology and Ecology	30	70	100	4	-	-	4	3
		21BOT4E3BL	B. DNA barcoding of land plants								
		21BOT4E3CL	C. Plant Translational Research								
	DSE4	21BOT4E4AL	A. Intellectual Property Rights	30	70	100	4	-	-	4	3
		21BOT4E4BL	B. Conservation Biology and Phytogeography								
		21BOT4E4CL	C. Forest Botany								
	GEC2	21BOT4G2AL	A. Medical Botany	20	30	50	2	-	-	2	1
		21BOT4G2BL	B. Curios and Fascinating Plants								
21BOT4G2CL		C. Floriculture									
DSC11P9	21BOT4C9P	Pharmacognosy, Phytochemistry, and Plant Biotechnology	20	30	50	-	-	4	2	4	
Project	21BOT4C1R	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					

M.Sc. Botany IV Semester

Course: Plant Biotechnology	Course code: 21BOT4C11L
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 History 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, selection of haploids. Applications and limitations. Somatic embryogenesis: Induction maturation and germination, factors affecting somatic embryogenesis. Physiological and biochemical aspects of somatic embryogenesis. Application, artificial/ synthetic seeds.

Unit-4 Production of Secondary metabolites

11 hrs

Types of secondary metabolites, formation, and storage in plants. Techniques of selecting cell lines with increased secondary metabolite levels. Elicitations, hairy roots, and productions of secondary metabolites. Factors determining the accumulation of secondary metabolites.

Biotransformation using plant cell cultures. Bioreactors: concept, types and use in plant cell cultures. Cryopreservation: Techniques and applications

Unit-5 Germplasm conservation and somaclonal variation

11 hrs

In-situ and ex-situ principles and conservation of germplasm. Variations 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.

REFERENCES

1. Birren B.E. et al., Genome Analysis – A Laboratory manual Vol-1 Analyzing DNA. Panama Publishing House (reprinted), New Delhi
2. Bold R.W. and Primrose S.B. Principles of Gene manipulation- An Introduction to Genetic Engineering. Blackwell Scientific Publications. London, Edinburgh, Boston
3. Chawla H.S. (2002) Introduction to Plant Biotechnology. Oxford and IBH Publishing Co. PVT LTD., New Delhi
4. Dixan RA and Ganzales RA (1994) Plant Cell Culture- A practical approach. Oxford University Press, New York.
5. Gambarg OL and Philips (1996) Plant cell, tissue and organ culture Narosa Publishing House, New Delhi
6. Mukudam U., Dawad HG and Ratnaparkhi S (1997) Hairy root culture. Agro Botanica Bikaner, India
7. Razdhan MK (2003) Introduction to plant tissue culture 2nd Edition: Oxford and IBH Publishing Co. New Delhi
8. Reinert J and Balaji YPS (1998) Applied and Fundamental Aspects of PLANT CELL, TISSUE and ORGAN CULTURE. Narosa Publishing House, new Delhi
9. 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

8. Description of the psychomotor skills to be developed and the level of performance required.

M.Sc. Botany IV Semester

Course: Pharmacognosy and Phytochemistry	Course code: 21BOT4C12L
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 hrs	

COURSE OBJECTIVES

1. To know the crude drugs, their uses, and chemical nature
2. know the evaluation techniques for the herbal drugs
3. To learn the modern extraction techniques, characterization, and identification of the 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 Extraction, isolation and purification of phytochemicals

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; Isolation of selected primary and secondary metabolites – amino acids, proteins, and carbohydrate; Phenolics, flavonoids, alkaloids, lipids, oils, terpenes, and saponins; Purification techniques for plant secondary metabolites – solvent-solvent fractionation and chromatography techniques.

Unit-4 Characterisation of Phytochemicals

11 hrs

Preliminary, qualitative, and quantitative techniques – paper chromatography, thin layer chromatography, column chromatography- HPLC, GC (qualitative and quantitative), colour reactions for amino acids, sugars, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Spectroscopic estimations/gravimetric determination of total sugars, amino acids, proteins, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Characterisation using spectroscopic techniques - UV/VIS, FTIR, DSC (differential scanning calorimeter), NMR, MS, MALDI. XRD – single crystal and powder.

Unit-5 Drug discovery and Development

11 hrs

History of herbs as a source of drugs and drug discovery. Sourcing and archiving natural products for discovery. Evaluating natural products for therapeutic properties. Identifying the biologically active natural products, the lead structure selection process, and structure development with suitable examples from the following source: artemisinin, and andrographolides. Preclinical and clinical studies emphasize on phases of clinical trials, protocol design for lead molecules

REFERENCES

1. Indian medicinal plants by RC Trivedi (2009)
2. Medicinal plants of Indian Himalaya by Samant SS and Dhar U
3. Handbook 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, VOII-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 IV Semester

Course: A. Weed Biology and Ecology	Course code: 21BOT4E3AL
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. Growth characteristics of weeds are broad leaves, grasses, sedges, and rushes. The characteristic traits of weedy species. Importance of weed biology in weed control. Weed seed banks. 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 unfavorable habitats, Ability to withstand repeated cutting or mowing, the distribution pattern of seeds in the soil, dormancy, and morphological characteristics as a defense against herbivores.

Unit 4 Weed Management

11 hrs

Basic principles, scouting, thresholds, critical period of weed control. Integrated Weed Management, Types of weed management - Chemical, Cultural, Physical, Biological, and Integrated weed management. 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 (*Portulacaoleraceae*, *Chenopodium album*, *Rumex crispus* etc.), weeds used for decorative furnitures (Ex: *Eichhornia crassipes*, *Lantana camera*, *Hyptissuaveolens*, *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 Diego, 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 Jagannathan, 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.
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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*. 2nd 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, economic, and social constraints and design effective integrated management systems.
4. Students will evaluate beneficial aspects of weeds.
5. Students will be enhanced with knowledge on survival mechanisms of weeds.
6. Students 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: 21BOT4E3BL
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, ChellasamyPanneerselvam, 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 PradoshMahadani, 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 that 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 analyze phylogenetic relationships
7. Using DNA barcodes to identify and classify living things
8. Explore relationships between species

M.Sc. Botany IV Semester

Course: C. Plant Translational Research	Course code: 21BOT4E3CL
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

Intranslating 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., & Herald, L.R. (2012). Methods and metrics challenges of delivery-system research. *Implementation Science, 7*(15). doi:10.1186/1748-5908-7-15
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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), 175-190 doi:10.1177/0193945917728249

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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: 21BOT4E4AL
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, 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, GATT)

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:

- B.L. Wadera, Patents, trademarks, copyright, Designs and Geographical Judications.
- Brian C. Reid, A Practical Guide to Patent Law, 2nd Edition, 1993
- Brinkhof (Edited), Patent Cases, Wolters Kluwer
- D.P. Mittal (Taxman Publication), Indian Patents Law and Procedure
- Hilary 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 and Phytogeography	Course code: 21BOT4E4BL
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: 21BOT4E4CL
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 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 & Koul AK. 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: 21BOT4G2AL
Teaching hours/week (L-T-P): 2-0-0	No. of credits: 02
Internal assessment: 20 marks	Semester End Examination: 30Marks
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

07 hrs

History and development of Indian Medicine, AYUSH: Ayurveda, Unani, Sidda, Homeopathy. Classification of medicinal plants based upon the plant parts and phytoconstituents. Root drugs- *Aconitum napellus*. Bark drugs – *Cinchona officinalis*. Stem drugs- *Ephedra gerardiana*. Leaf, flower, fruit, seed, and whole plant drugs.

Unit-2 Medicinal plants and health care

07 hrs

Poisonous plants: Algae, Fungi, Pteridophytes, Gymnosperms and Angiosperms. Classification, description, mode of action, symptoms and treatments. Remedial plants for cancer, common diseases of nervous system, circulatory system, respiratory system, urinary system and reproductive system. Psycho active plants. Allergens _ types, drug allergy, phytotherapy for allergic symptoms.

Unit-3 Pharmacognosy and Drug evaluation

07 hrs

Pharmacognosy – collection and processing of medicinal plants. Guidelines for harvesting, processing and marketing of medicinal plants, preparation of crude drugs, drug adulteration. Methods of drugs evaluation-morphological and organoleptic anatomical features

Unit-4 Herbal Garden and cultivation

07 hrs

Herbal gardens – Introduction and scope, principles, and process involved: plant growing methods, propagation techniques, cultivation of medicinal plants. *Ocimumtenuifolrum*, *Aloe vera*, and *Papaversomniferum*.

Unit-5 Traditional health care system and Ethnobotany

07 hrs

Local traditional healthcare system: herbal home remedies of South India, Herbal formulations,

Infusions and decoctions, oil extractions, ointments, lotions. Ethnobotany of South India. Role of Ethnobotany in modern medicine. Medico-ethnobotanical sources in India. Significance of the following plants in ethno-botanical practices (along with their habitat and morphology) *Azadirachta indica*, *Pongamia pinnata*, *Tribulus terrestris*.

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 Introduction 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: 21BOT4G2BL
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 Extraordinary plants and plants with unique functions **07 hrs**

General Sherman, *Arabidopsis*, *Alpine snowbell*, *Welwitschia*, *Podostemads*, *Mosses*, *Conifers*, *Cacti*, *Seaweeds*, *Orchids*, *Cordyceps*. Insectivorous plants – *Dionaea*, *Nepenthes*, *Drosera*, *Utricularia*, *Codariocalyxmotorius*. Dancing grass (*Desmodiumgyrans*), *Mirabilis*, *Baobab* (*Adansonia*), *Selaginella lepidophylla*, *Skunk Cabbage*, Parasitic plants.

Unit-2 Unique morphology and strange pollination mechanisms **07 hrs**

Amorphophallus, *Rafflesia arnoldii*, *Cleistocactus*, *Dracaena*, *Hydnora*, *Victoria amazonica*, *Populus tremuloides*, Buttercup plant ages, and size. *Lomatia tasmanica*, *Pinus sylvestris*, *Sequoiadendron*, *Sequoia*, *Semipervirens*, *Euphorbia abesa*, *Wolffia*, *Ficus*, *Palms*, *Acacia*, *Neem*, Plants in worship, Myths. Plants mimicking insects, birds, animals.

Unit-3 Defence strategies of plants **07 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-4 Discovery of medicinal plants **07 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-5 Religious and sacred plants **07 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: 21BOT4G2CL
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

07 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

07 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 CO₂ on growth and flowering.

Unit-3 Flower production

07 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

Unit-4 Cut flower standards and grades

07 hrs

Harvest indices, harvesting techniques, post-harvest handling. Methods of delaying flower opening, pre-cooling, pulsing, packing. Storage and transportation, marketing, export potential, institutional support. Agri export zones

Unit-5 Importance of floriculture in India

07 hrs

Economic point of view, Aesthetic point of view, and Social point of view. Scope to enter floriculture in India. Problems for floriculture Industry in India

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 – Fundamentals 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 Biotechnology, Pharmacognosy and Phytochemistry	Course code: 21BOT4C9P
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
2. Preparation of Murashige and Skoog's, Gamborg's B5, Nitsch and White's media
3. Sterilization of media, tissues, and other accessories
4. Isolation of protoplast, culture, and fusion
5. Mounting of Embryo from chilli/ cucumber seeds
6. Artificial seed synthesis
7. Clonal propagation – Shoot tip and axillary bud culture
8. Embryo and ovary culture
9. Anther and pollen culture
10. Morphology, histology, and powder characteristics and extraction and detection of cinchona cinnamon, senna, clove, fennel, and coriander
11. Distillation of volatile oils and detection of phytoconstituents by TLC
12. Preparation of extracts of herbs by successive solvent extraction method to record the percentage yield
13. Detection of phytoconstituents such as alkaloids
14. Thin layer chromatography and identification of phytoconstituents
15. Paper chromatography and identification of phytoconstituents
16. Isolation of curcumin from turmeric
17. Determination of swelling index, foaming index, ash values, extractive values, volatile oil, hemolytic activity, bitter value, leaf constant

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, NostrantRenhold
3. Recent advances in Phytochemistry – Vol I to IV, ScikelRuneckles 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 Bajaj 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

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

M.Sc. Botany IV Semester

Course: Research Project	Course code: 21BOT4C1R
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.