

Batch 2024-25

Syllabus

2nd Semester

M.Sc. (Botany)

SCHEME A2: M.Sc. Botany (w.e.f. Academic Session 2024-25)Scheme: Semester 2nd

Course Code	Course Title	Course ID	L			T			Total Credits	MARKS						
			L	T	P	(Hrs)	L	T		P	TI	TE	PI	PE	Total	
Core Course(s)																
CC-A04	Plant Taxonomy & Economic Botany		04	00	00	04	00	00	04	30	70	00	00	100		
CC-A05	Biochemistry & Biotechniques		03	00	02	03	00	01	04	25	50	05	20	100		
CC-A06	Molecular Cytogenetics		03	00	02	03	00	01	04	25	50	05	20	100		
Discipline Specific Elective Courses (Select any one course from the following)																
DSE-02	Bioinformatics		02	00	02	02	00	01	03	15	35	05	20	75		
	Advanced Plant Physiology															
Multidisciplinary Course(s)																
MDC-02	One from the Pool		02	00	02	02	00	01	03	15	35	05	20	75		
Ability Enhancement Course(s)																
AEC-02	One from the Pool		02	00	00	02	00	00	02	00	50	00	00	50		
Skill Enhancement Course(s)																
SEC-01	One from the Pool		02	00	00	02	00	00	02	00	50	00	00	50		
Total Credits									22					550		

Note: internship or field training or project of 4-6 weeks during summer vacation @ 4 credits.

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241/BOT/CC204

BOTANY: SEMESTER-II

Course Code	Course ID	Course Title	Credit	Contact Hours/Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
CC-A04	241/BOT/CC204	Plant Taxonomy and Economic Botany	3	3	25	50	75	3 hrs.
		Practical	1	2	5	20	25	4 hrs.

Course Learning Outcomes (CLO)

1. Understand the significance, basic concepts, tools of plant taxonomy
2. Learn about the different systems of classification of angiosperms and relevance of plant taxonomy to other branches.
3. Acquire knowledge about the plant sources of foods, modern and traditional medicines, spices, oil, fibres, dyes, gum and timbers.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	The Species concept, Taxonomic hierarchy, Species, Genus and Family Taxonomic evidence: Morphology, anatomy, palynology. Taxonomic Tools: Herbarium and Floras. Botanical Gardens and herbaria in India; Botanical Survey of India its organization and role.	12
II	Salient Features of the International Code of Nomenclature (ICN). Systems of angiosperm classifications of Benthom and Hooker, Engler and Prantl, Hutchinson, Cronquist, Takhtajan, Dahlgren and Thorne, Relative merits and demerits of these systems.	11
III	Origin of agriculture: World centers of primary diversity of domesticated plants. 28 Origin, botany, cultivation and uses of cereals (wheat, rice), Sugarcane, Potato Oil yielding plants (groundnut, mustard, sunflower)	11
IV	Botany, origin, uses of important fibres (Cotton, Jute), General account of important spices (Ginger, Turmeric, Cinnamon, Clove, Cardamom, Chilies, Pepper, Fennel, Coriander, Cumin, Asafetida, Nutmeg, Mace, and Saffron), General account of important medicinal plants (Aconite, Cinchona, Belladonna, Digitalis, Glycyrrhiza, Rauwolfia, Papaver, Vasaka, Aloe and Ginseng). A brief account of major Indian Medicinal plants (Amla, Neem, Arjun, Harad, Bahera, Isabgol, Ashwagandha, Bhringraj and Senna) General account of important timber, dye, gums and tannin yielding plants	11
V Practical		30

Learning Resources

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1. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row Publishers Inc.
2. Lawrence, G.H.M. 1951. Taxonomy of vascular plants. The Macmillan C., New York.
3. Davis, P.H. and Heywood, V.H. 1965. Principles of Angiosperm Taxonomy. D Van Nostrand Co. , New York.
4. Sivarajan, V.V. 1984. Introduction to Principles of Plant Taxonomy. Oxford IBH Pub. Co., New Delhi.
5. Kochar, S.L. 1981. Economic Botany in the Tropics. Macmillan India Ltd., Delhi.
6. Hill, A.F. 1952. Economic Botany (2nd Ed.) McGraw Hill, New York.
7. Cobby, L.S. and Steele, W.M. 1976. An Introduction to the Botany of Tropical Crops (2nd Ed.) Longmans, London.
8. Simmonds, N.W. 1976. Evolution of Crop Plants Longman, London, New York.
9. SambaMurthy, AVS and Subrahmanyam, N.S. 1989. A Text Book of Economic Botany. Wiley Eastern Ltd., Delhi
10. Judd, W.S.; Campbell. C.S., Kellogg, E.A. and Stevens, P.F. 1999. Plant Systematics A Phylogenetic Approach. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts, U.S.A.
11. Schery, R.W. 1972. Plants for Man. Prentice Hall. Englewood Cliffs, N.J. USA
12. Simpson B. B. M. C. Ogorzaly 2001. Economic botany: plants of our world, 3rd ed. McGraw-Hill, New York, New York, USA.
13. Hancock. J. F. 2004. Plant evolution and the origin of crop species. 2nd edition. CABI Publishing, Cambridge, MA USA.
14. Radford, A. E., W. C. Dickison, J. R. Massey, C. R. Bell. 1976. Vascular Plant Systematics Harper and Row, New York..

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BOTANY: SEMESTER-II

Course Code	Course ID	Course Title	Credit	Contact Hours/Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
CC-A05	241/BOT/CC205	Biochemistry & Biotechniques	3	3	25	50	75	3 hrs.
		Practical	1	2	5	20	25	4 hrs.

Course Learning Outcomes (CLO)

- Students will be able to understand the general reactions of various metabolic pathways.
- It will make the students to understand the structure and classification of biomolecules.
- This paper will provide the basic understanding of various biological techniques.
- The youth will be able to understand the basics of various techniques
- It will make the students to understand the applications of these techniques for animal kindness.

Instructions for Paper-Setter

- Nine questions will be set in all. All questions will carry equal marks.
- Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Amino acids and peptides-classification, chemical reactions and physical, properties, Sugars - classification and reactions, metabolism of carbohydrate, Heterocyclic compounds-and secondary metabolites in living systems -nucleotides, pigments, isoprenoids, Separation techniques for different biomolecules. Bio-energetics and oxidative phosphorylation. Blood clotting – biochemistry, body fluids –pH and acid base balance and their importance in clinical biochemistry, muscle contraction. Techniques in the study of proteins, carbohydrates and lipids.	12
II	Lipids- classification, structure and functions Proteins-protein and protein legand interactions, end group analysis, hierarchy in structure, Ramachandran map. Conformational properties of polynucleotides, Polysaccharides - types, secondary and tertiary structural features, analysis- theoretical and experimental; Protein folding – biophysical and cellular aspects, enzymes coenzymes, in born errors of metabolism.	11
III	Microscopy: Principles and applications of light, phase contrast, fluorescence microscopes, scanning and transmission electron microscopes. Centrifuge technique: Principle, types of centrifuge, density gradient centrifuge in isolation of cell, cell organelles and biomolecules. Chromatography: Principles and applications of gel filtration, ion-exchange, affinity, thin layer, gas chromatography and high pressure liquid chromatography (HPLC) and FPLC. Application of chromatographic technique in biology. Electrophoresis and centrifugation: Principles and applications of agarose and polyacrylamide gel electrophoresis; ultracentrifugation (velocity and buoyant density).	11
IV	Spectroscopy: Fluorescence, UV, visible, Infrared, Atomic absorption spectroscopy, NMR and ESR spectroscopy; Mass spectrometry (LC-MS, GC-MS), X-ray diffraction. Tracer Biology: Principles and applications of tracer techniques in biology; radioactive isotopes and half-life of isotopes; autoradiography. Application of different spectroscopic technique in biology. Nature and types of radiation, preparation of labelling biological sample, detection and measurement of radiation, GM counter, Scintillation counter. Flow cytometry. Safety measurement in handling radioisotopes, ELISA, RIA and non-radiolabelling.	11

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<p style="text-align: center;">V Practical</p>	<ol style="list-style-type: none"> 1. Titration of amino acids 2. Reactions of amino acids, sugars and lipids 3. Isolation of DNA and protein 4. Quantitation of Proteins and Sugars 5. UV, Visible, Fluorescence and IR spectroscopy, Absorption spectra 6. Demonstration of working of different types of microscopes. 7. Demonstration of Chromatography i.e. TLC, HPLC, GC. 8. To demonstrate the separation of proteins with the help of electrophoresis. 9. To study various molecular biology techniques i.e. PCR. 10. To demonstrate the use of spectrophotometer. 11. Purification of protein by column chromatography. 12. Visit of various laboratories in the university, preparation and submission of report. 	<p style="text-align: center;">30</p>
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Learning Resources

1. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.
2. Cooper, T.G. 1977. Tools in Biochemistry. John Wiley, New York, USA.
3. Dryer, R. L. and Lata, G. F. 1989. Experimental Biochemistry. Oxford University Press, New York.
4. Hames, B.D.(Ed.).1998. Gel Electrophoresis of Proteins: A Practical Approach, 8th edition. PAS, Oxford University Press, Oxford, UK.
5. Scott, R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.
6. Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, 4th edition. Cambridge University Press, Cambridge, U
7. A Biologists guide to Principles and Techniques of Practical Biochemistry, K. Wilson and K.H.Goulding, ELBS Edn.
8. Lehninger AL, Nelson DL & Cox MM (1993) Principles of Biochemistry, 2nd edn. New York: Worth.
9. Stryer L (1995) Biochemistry, 4th edn. New York: WH Freeman.
10. Voet D, Voet JG & Pratt CW (1999) Fundamentals of Biochemistry. New York: Wiley.

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241/BOT/CC206

BOTANY: SEMESTER-II

Course Code	Course ID	Course Title	Credit	Contact Hours/Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
CC-A06	241/BOT/CC206	Molecular Cytogenetics	3	3	25	50	75	3 hrs.
		Practical	1	2	5	20	25	4 hrs.

Course Learning Outcomes (CLO)

- Students will be able to study the molecular composition of the chromosomes.
- They will gain the knowledge about mutations and molecular basis of cell cycle and its check points
- The paper deals with nature and mechanism of genomic imprinting.
- Students will gain the knowledge about mutations and detection of mutagens.

Instructions for Paper-Setter

- Nine questions will be set in all. All questions will carry equal marks.
- Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Biology of Chromosomes: Molecular anatomy of eukaryotic chromosomes; Metaphase chromosomes: Centromere, Kinetochore, Nucleolus organizers and rRNA genes, Telomere: structure and Functions, Heterochromatin and euchromatin, Giant Chromosomes: Polytene Chromosomes, Lampbrush Chromosomes	12
II	Sex Chromosomes: Sex determination and the Y Chromosome, Dosage compensation in <i>C. elegans</i> , <i>Drosophila</i> and Humans, Nature and mechanism of genomic imprinting, X-inactivation and imprinting, Sex specific imprinting	11
III	Genes in Pedigrees: Mendelian pedigree pattern, Inheritance of mitochondrial diseases, Complications to the basic pedigree patterns, Non-Mendelian traits. Somatic Cell Genetics: Cell fusion and somatic cell hybrids – agents and mechanism of fusion, Heterokaryon – Cell lines and selection systems and chromosome segregation,	11
IV	Gene Mutations : Spontaneous mutations – Base pair substitution and frame shift mutations Induced mutations – Radiation, chemical and environmental, In-vitro site specific mutagenesis. Detection of mutagens – The Ames test and sister chromatid exchanges, Genetics of Cell Cycle: Genetic regulation of cell division in yeast and eukaryotes, Molecular basis of cellular check points.	11
V Practical	<ol style="list-style-type: none"> Making karyological preparations from testicular material of suitable insects by squash and air drying techniques to study the structure and behaviour of chromosomes during mitosis and meiosis. Study of chiasma frequency and terminalisation co-efficient. Study of mitosis from hepatic caecae of suitable insects or from onion root tips and preparation of karyotype and idiogram. Demonstration of banding techniques (C, G and T). Study of NORs in insect chromosomes. Making preparations from salivary glands of <i>Chironomus</i> larvae / <i>Drosophila</i> larvae to study polytene chromosomes. Effect of temperature on polytene chromosomes. Preparation of human buccal smear to study sex chromatin. Nuclear sexing from polymorphonuclear leucocytes. Identification of meiotic and mitotic stages from permanent slides. 	30

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| | 11. Gel electrophoresis: Practical demonstration.
12. Isolation of genomic DNA.
13. PCR: Introduction and practical demonstration. | |
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Learning Resources

1. Atherly, A.C., J.R. Girton and J.F. McDonald. The Science of Genetics. Saunders College Publishing, Harcourt Brace College Publishers, NY.
2. Brooker, R.J. Genetics : Analysis and Principles. Benjamin/Cummings, Longman Inc.
3. Fairbanks, D.J. and W.R. Anderson. Genetics – The Continuity of Life. Brook/Cole Publishing Company ITP, NY, Toronto.
4. Gardner, E.J., M.J. Simmons and D.P. Snustad. Principles of Genetics. John Wiley and Sons. Inc., NY.
5. Griffiths, A.J.F., J.H. Miller, D.T. Suzuki, R.C. Lewontin and W.M. Gelbart. An Introduction to Genetic Analysis. W.H. Freeman and company, NY.
6. Lewin, B. Genes. VI. Oxford University Press, Oxford, New York, Tokyo.
7. Snustad, D.P. and M.J. Simmons. Principles of Genetics. John Wiley and Sons. Inc., NY.
8. Watson, J.D., N.H. Hopkins, J.W. Roberts, J.A. Steitz and A.M. Weiner. Molecular Biology of Genes. The Benjamin/Cummings Publishing Company Inc., Tokyo.
9. Tom Strachan & Read, A.P. Human Molecular Genetics 3rd edition, Garland Publishing 2004, London.

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241/BOT/DS202

BOTANY: SEMESTER-II

Course Code	Course ID	Course Title	Credit	Contact Hours/Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
DSE-02	241/BOT/DS202	Bioinformatics	2	2	15	35	50	3 hrs.
		Practical	1	2	5	20	25	4 hrs.

Course Learning Outcomes (CLO)

- The youth will be able to understand the basics of various techniques
- It will make the students to understand the applications of these techniques for animal kindness

Instructions for Paper-Setter

- Nine questions will be set in all. All questions will carry equal marks.
- Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Computers: An overview of computers, microcomputers, VDUs and printer; What is programming? Algorithms; Languages and packages: Introduction to MS Office, MS Access, introduction to SQL (structured query language) Handling arrays, procedures. Colour, sound and graphics; Use of standard packages.	7
II	Introduction to PERL: Scalar variables, strings and numbers, Assignment statements, Arrays, Hashes, Operators, Input from file, Standard Input, Conditional and logical operators, loops, I/O, Input from file named in command line, Regular expression, Pattern matching, Pattern modifiers. Applications of PERL in Bioinformatics: Storing DNA sequence, DNA to RNA transcription, Finding motifs, Counting nucleotides, Generating random numbers, simulating DNA mutation, generating random DNA, Analyzing DNA	7
III	Biological Sequence Databases: Overview of various primary and secondary databases that deal with protein and nucleic acid sequences. Databases to be covered in detail are GenBank, EMBL, DDBJ, Swiss Prot, PIR, and MIPS for primary sequences. Preliminary ideas of query and analysis of sequence information. Sequence Comparison Methods: Method for the comparison of two sequences viz., Dot matrix plots, Needleman Wunsch & Smith Waterman algorithms. Analysis of computational complexities and the relative merits and demerits of each method. Theory of scoring matrices and their use for sequence comparison.	8
IV	Database Search Algorithms: Methods for searching sequence databases like FASTA and BLAST algorithms. Statistical analysis and evaluation of BLAST results. Pattern Recognition Methods in Sequence Analysis: Concept of a sequence pattern, regular expression based patterns. The use of pattern databases like PROSITE and PRINTS. Concept of position specific weight matrices and their use in sequence analysis. Theory of profiles and their use with special reference to PSIBLAST. Markov chains and Markov models and their use in gene finding. Concept of HMMS, the Forward backward and the Viterbi algorithm. The Baum Welch algorithm for training a HMM. Use of profile HMM for protein family classification.	8
	<ol style="list-style-type: none"> Retrieve Nucleotide sequences from NCBI serve. Retrieve Protein sequences from PDB. Analysis of sequences Similarity using BLAST/pBLAST/nrBLAST To predict protein secondary structures by using iPred. 	

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V Practical	5. Perform phylogenetic analysis using PHYLIP. 6. Perform multiple sequence alignment by using ClustalW. 7. Primer design 8. Computational modeling of genomic, transcriptomic and proteomic	30
Learning Resources		
<ol style="list-style-type: none"> 1. Jin Xiong (2006) Essential Bioinformatics. Cambridge publisher 2. Zhumur Ghosh and Bibekanand Mallick (2008) Bioinformatics: Principles and Applications. Oxford University Press publisher 3. Orpita Bosu and Simminder Kaur Thukral (2007). Bioinformatics. Oxford University Press publisher 4. M. Lesk (2002) Introduction to Bioinformatics. Oxford University Press publisher 5. Fundamental Concepts of Bioinformatics, Dan E. Krane, Michael L. Raymer, Michael L. Raymer, Elaine Nicpon Marieb, 2002, Benjamin/Cummings 6. P. Rastogi and N. Mendiritta (2013) Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery. Prentice-Hall of India Pvt. Ltd; 4th Revised edition 7. Mount and David W (2004) Bioinformatics: sequence and genome analysis. Cshl Press, 2nd edition 8. Harisha S (2007) Fundamentals of Bioinformatics. I K International Publishing House Pvt. Ltd 9. Dan E. Krane (2003) Fundamentals concepts of bioinformatics. Dorling Kindersley (RS); First edition 10. David Edwards and Jason Stajich (2009) Bioinformatics: Tools and Applications. Published by Springer 		

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241/BOT/DS203

BOTANY: SEMESTER-II

Course Code	Course ID	Course Title	Credit	Contact Hours/Week	Internal Assessment marks	End Term Marks	Max. Marks	Exam Duration
DSE-02	241/BOT/DS203	Advanced Plant Physiology	2	2	15	35	50	3 hrs.
		Practical	1	2	5	20	25	4 hrs.

Course Learning Outcomes (CLO)

1. The students will be able to understand the physiological and biochemical basis of drought stress and its manifestation in plant productivity.
2. The students will be well acquainted with the mechanisms of salt and temperature stresses.
3. The learners will acquire the indepth knowledge of process of photosynthesis and the translocations of photosynthates from source to sinks.
4. The students will enhance their knowledge regarding mechanism of respiratory cycle in plants and the methods of estimation of respiration.

Instructions for Paper-Setter

1. Nine questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type covering the entire syllabus, will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each Unit I to IV. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Water stress: Drought, its definition and quantification, water deficit and plant growth, physiological and biochemical functions, responses injury affected by drought, Adaptive strategies for drought resistance. Osmotic adjustment, osmoprotectants. Water logging/ oxygen deficiency and its effects on plant growth.	8
II	Salt and temperature stress: Unit-II Salt stress; Saline and alkaline soils, salt stress injury, mechanism of salt stress and halophytes. 38 Temperature stress; high temperature stress, heat shock proteins, chilling and frost injury and mechanism of tolerance.	8
III	Photosynthesis: The four major complexes of thylakoids. The path of carbon in photosynthesis (C3, C4 and CAM plants) Rubisco, structure and its association with the mechanism of carboxylation and oxygenation of RUBP. Effect of environmental factors on photosynthetic rates. Translocation of photosynthates and its importance in sink growth.	7
IV	Respiration: Cyanide insensitive respiration: Mechanism and significance. Comparison between normal electron transport chain and alternate oxidase pathway of respiration. Glycolic acid metabolism and photorespiration. Glyoxylate cycle. Respiration in intact plants and tissues.	7
V Practical		30

Learning Resources

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1. Bonner, J. And Varner, J.E. (1976) Plant Biochemistry, Academic Press, New York and London (Third Edition).
2. Buchanan, B.B., Gruissem, w. And Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
3. Cooper, T.G. (1977). Electrophoresis. In : The Tools of Biochemistry. John Wiley and Sons., New York.
4. Dey, P.M. and Harborne, J.B. (1997), First Indian edition, 2000). Plant Biochemistry. Academic Press, Harcourt Asia Pvt. Ltd.
5. Noggle, G.r. and Fritz, G.J. (1983). Introductory Plant Physiology. Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition (Seventh reprint, 1992).
6. Salisbury, F.B. and Ross, G.W. (1992). Plant Physiology. Fourth Edition, Wadsworth Publishing Co. Belmont, California, USA.
7. Sawhney, S.K. and Singh, Randhir. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
8. Solmos, T. (1977). Cyanide resistant respiration in higher plants. In : Ann. Rev. Pl. Physiol. 28: 279-297.

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S.P. Harborne