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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE**	CREDIT	4
Semester	3	**BOT 1301PT : Paper I- Diversity of Non-Flowering Plants**	HOURS	60

OBJECTIVES:	To familiarize the students with diversity among non flowering plants.

COURSE CONTENT / SYLLABUS

UNIT-I	**Diversity of Algae** General Characters and group characteristics with suitable examples. Occurrence, thallus structure and reproduction in: *Oedogonium, Chara, Ectocarpus, Dictyota, Batrachospermu* and *Polysiphonia*	15 hrs.
UNIT-II	**Diversity of Bryophytes** General Characters and group characteristics with suitable examples Occurrence, thallus structure, Morphology, anatomy and reproduction in: *Marchantia, Pellia, Anthoceros and Polytrichum*	15 hrs.
UNIT-III	**Diversity of Pteridophytes** General characters and group characteristics with suitable examples Morphology, anatomy and reproduction in: *Lycopodium, Isoetes, Marsilea , Osmunda* and *Adiantum*	15 hrs.
UNIT-IV	**Diversity of Gymnosperms** General characteristics and group characteristics with suitable examples Morphology, anatomy and reproduction in: *Zamia, Pinus, Biota* and *Ephedra*	15 hrs.

REFERENCES

1. Smith, G.M. 1972 Cryptogamic Botany Vol I and II
2. Vasishtha, B.R. 1974 Botany for Degree students Vol I Algae
3. Vasishtha, B.R. 1974 Botany for Degree students Vol III Bryophya
4. Vasishtha, P.C. 1974 Botany for Degree students Vol IV Pteridophyta
5. Vasishtha, P.C. 1976 Botany for Degree students Vol V Gymnosperms
6. Bhatnagar, S.P. and Alok Moitra 1996. GymnospermsNew Age Internatnal Publishers
7. Inderdeep Kaur and Prem Lal Uniyal 2019. Text book of Gymnosperms Daya Publishing house

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE**	CREDIT	4
Semester	3	**BOT 1302 PT:Paper II- Cell Biology**	HOURS	60

OBJECTIVES:	To provide basic knowledge of structure and functions of cell and cell organelles.

COURSE CONTENT / SYLLABUS

UNIT-I	**Introduction to Cellular Organization** General structure and constituents of cell; Origin and Evolution of Cells, structure and function of plant cell wall, structure and function of cell membrane, Cell receptors, Signal transduction mechanisms, cell Junction, cytoskeletal elements, organization of the cytoskeleton	15 hrs.
UNIT-II	**Nucleus** Structure and function of Nucleus, Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, Centromere and telomere: types, structure and function.	15 hrs.
UNIT-III	**Cellular Organelles** Structure and function of major organelles: Chloroplasts, Mitochondria, Ribosomes, Lysosomes, Peroxisomes, Endoplasmic reticulum, Golgi apparatus, Vacuoles, transport vesicles.	15 hrs.
UNIT-IV	**Cell Cycle and Cell Death** Cell division (Mitosis, Meiosis); cell cycle and its regulation, Kinetochore and spindle apparatus-structural organization and functions, Mechanism of cell cycle control in Yeast (checkpoints and role of MPF); Plant cell death – types, factors involved and its mechanism	15 hrs.

REFERENCES

1. Earnshaw WC, Johnson GT, 2017. Cell biology. 3rd Ed, Elsevier cop.
2. Karp J, Iwasa J, Marshall W, 2018. Karp's Cell biology. 8th Ed, John Wiley.
3. Lodish HF et al. 2016. Molecular Cell Biology. 8th Ed. W.H. Freeman-Macmillan learning.
4. Primrose SB. 2001. Molecular Biotechnology. Panima.
5. Krebs JE, Goldstein ES, Kilpatrick ST, 2018. Lewin's Genes XII. Jones and Bartlett learning.
6. Bruce Alberts, 2017. Molecular Biology of the Cell. 6th Ed. Garland Science.
7. Gunning B, Steer MW, 1996. Plant cell biology: structure and function. Jones and Bartlett Publishers.
8. Older editions of the books, easily affordable to students may also be referred.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE**	CREDIT	4
Semester	3	**BOT 1303 PL: Paper III- Botany Practical -III**	HOURS	60

OBJECTIVES:	To practically make students understand the diversity among non flowering plants To unsderstand basic cell structure and its components

COURSE CONTENT / SYLLABUS

1. Morphology and anatomy of vegetative and reproductive parts in:
   - *Oedogonium, Chara, Dictyota, Batrachospermum*
   - *Marchantia, Anthoceros, Polytrichium*
   - *Lycopodium, Isoetes,Marsilea, Adiantum*
   - *Zamia, Pinus, Biota*
2. Plant cell structure in epidermal peel of Onion/Rheo
3. Study of electron micrographs for internal organelles
4. Study of plasmolysis and deplasmolysis
5. Study of Mitosis
6. Staining techniques for plant cell and cell wall
7. Chromosome structure
8. Shapes of chloroplast in plant cells (Members of algae as an example)
9. To study Yeast growth curve

8 Hrs a week

REFERENCES

1. Vasishtha, B.R. 1974 Botany for Degree students Vol I Algae
2. Vasishtha, B.R. 1974 Botany for Degree students Vol III Bryophya
3. Vasishtha, P.C. 1974 Botany for Degree students Vol IV Pteridophyta
4. Vasishtha, P.C. 1976 Botany for Degree students Vol V Gymnosperms
5. Earnshaw WC, Johnson GT, 2017. Cell biology. 3rd Ed, Elsevier cop.
6. Karp J, Iwasa J, Marshall W, 2018. Karp's Cell biology. 8th Ed, John Wiley.
7. Lodish HF et al. 2016. Molecular Cell Biology. 8th Ed. W.H. Freeman-Macmillan learning.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.)

YEAR	2	**Generic Elective I**	CREDIT	3
Semester	3	**BOT 1301ET: Paper I-Plant Systematics and development (Theory)**	HOURS	45

OBJECTIVES:	The students will be able to classify Plants and enable them to prepare herbarium. The students will understand basic structure of flower and understand different developmental processes during micro and megasporogenesis.

COURSE CONTENT / SYLLABUS

UNIT-I	**Basics of Plant Systematics** **Introduction:** Aims and components of systematics; identification, nomenclature and classification, Taxonomic categories **Nomenclature:** Principles and rules of Nomenclature; ranks and names; type method. **Storage and Preseravtion:** Importance of herbarium specimens and their preparation, other methods of storing plant material. Herbaria and Botanical Garden. **Systems of Classification:** Types of classification, Bentham and Hooker's System	15 hrs.
UNIT-II	**Methods in Systematics and Families of Angiosperms** **Polypetalae:** Annonaceae, Malvaceae, Rutaceae, Meliaceae, Fabaceae, Caesalpiniaceae, Mimosaceae. **Gamopetalae:** Asteraceae, Apocynaceae, Solanaceae, Lamiaceae. **Monoclamydae:** Amaranthaceae, Euphorbiaceae (Inclu. Phyllanthaceae). **Monocotyledonae:** Liliaceae, Poaceae.	15 hrs.
UNIT-III	**Developmental biology** Introduction of flowering; flower as a modified determinate shoot. Anther wall: Structure and functions, microsporogenesis,. Microgametogenesis; Pollen wall structure, NPC system; Palynology and scope (a brief account) Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac. Pollination types and significance, path of pollen tube in pistil, double fertilization.	15 hrs.

REFERENCES

1. Plant Developmental biology-Biotechnological Perspective Vol I 2009
2. B.M. Johri and P.S. Srivastava 2001 Reproductive biology of plants
3. S.S. Bhojwani and S.P. Bhatnagar 2008 The Embryology of Angiosperms
4. Gurucharan Singh. Plant Systematics
5. O.P. Sharma. Plant Taxonomy.
6. Judd. Plant Systematics.

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Bachelor of Science (Hons.)

YEAR	2	**Generic Elective I**	CREDIT	1
Semester	3	**BOT 1302EL: Paper II -Plant Systematics and development (Practical)**	HOURS	30

OBJECTIVES:	The students will practically examine the characteristic features and classify Plants and learn to prepare herbarium. Students will practically observe the different parts of the reproductive structures in the plants and variations in them.

COURSE CONTENT / SYLLABUS

	1. Study the structure of anther 2. Study of different types of pollen 3. Male and female gametogenesis 4. Structure of ovule 5. Placentation types 6. Study of monocot and dicot embryo 7. Preparation of herbarium 8. Study of vegetative and floral characters of the families prescribed in the theory. 9. Any other practicals relevant to theory paper which helps in students understanding will be added.	2 Hrs per week

REFERENCES

1.	Plant Developmental biology-Biotechnological Perspective Vol I 2009
2.	B.M. Johri and P.S. Srivastava 2001 Reproductive biology of plants
3.	S.S. Bhojwani and S.P. Bhatnagar 2008 The Embryology of Angiosperms
4.	Gurucharan Singh. Plant Systematics
5.	O.P. Sharma. Plant Taxonomy.
6.	Judd. Plant Systematics.

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ACADEMIC YEAR
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Bachelor of Science (Hons.)

YEAR	2	**Generic Elective 2:**	CREDIT	3
Semester	3	**BOT 1303ET:Paper I: Physiology and Biochemistry of plants (Theory)**	HOURS	45

OBJECTIVES:	To understand the principles and concepts of physiology and biochemistry of plants

COURSE CONTENT / SYLLABUS

UNIT-I	**Transportation of Water and Nutrition** Plant water relationships- Water potential, pathway of water movement, Water and plant cells, Ascent of sap- cohesion-tension theory; Transpiration and factors affection transpiration, Nutrient uptake and translocation in phloem- Macro and micronutrients, Experiments and mutants to study nutritional deficiency in plants, essential elements and chelating agents, Role of ATP, carrier system, proton-ATPase pump and ion flux in nutrient uptake	15 hrs.
UNIT-II	**Photosynthesis and Nitrogen Metabolism** Photosynthesis- Photopigments and its role, Antenna complex and reaction centres, light reactions, carbon reactions, photorespiration, C3, C4, CAM photosynthesis, Respiration, control and regulation of photosynthetic reactions Nitrogen metabolism: Assimilation of nitrate by plants, Biochemistry of dinitrogen fixation in Rhizobium, GS and GOGAT enzyme system	15 hrs.
UNIT-III	**Phytohormones, Movements, Photoresponses and Senescence.** Role of plant hormones: auxin, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, strigolactones, Jasmonic acid, Salicylic acid; Phototropism and Gravitropism; phytochromes and light control of plant development, blue-light responses; Photoperiodism; plant circadian rhythm; vernalization , Senescence and cell death	15 hrs.

REFERENCES

1. Salisbury FB, Ross CW, 2009. Plant physiology. 4th Ed., Cengage learning.
2. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Plant physiology and development. 6th Ed, Oxford University press.
3. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Fundamentals of plant physiology. 1st Ed, Oxford University press.
4. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2nd Ed., Wiley-Blackwell.
5. Voet D, Voet JG, Pratt CW, 2016. Fundamentals of Biochemistry. 5th Ed., Wiley.

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Bachelor of Science (Hons.)

YEAR	2	**Generic Elective 2:**	CREDIT	1
Semester	3	**BOT 1304 EL :Paper II: Physiology and Biochemistry of plants (Practical)**	HOURS	30

OBJECTIVES:	To perform experiments and understand the principles and concepts of physiology and biochemistry of plants

COURSE CONTENT / SYLLABUS

1. Estimation of plant water potential using *Rheo* leaf method
2. Estimation of plant water potential using potato tuber method
3. Demonstration of water transpiration practicals
4. Measurement of rate of photosynthesis by *Hydrilla* method
5. Role of colour of light in rate of photosynthesis
6. Role of light intensity in rate of photosynthesis
7. Variation in leaf anatomy of C3, C4 and CAM plants
8. Structure of root nodule.
9. Any other practicals relevant to theory paper which helps in students understanding will be added.

REFERENCES

1. Salisbury FB, Ross CW, 2009. Plant physiology. 4th Ed., Cengage learning.
2. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Plant physiology and development. 6th Ed, Oxford University press.
3. Taiz L, Zeiger E, Moller Ian, Murphy Angus, 2018. Fundamentals of plant physiology. 1st Ed, Oxford University press.
4. Buchanan Bob et al., 2015. Biochemistry and molecular biology of plants. 2nd Ed., Wiley-Blackwell.
5. Voet D, Voet JG, Pratt CW, 2016. Fundamentals of Biochemistry. 5th Ed., Wiley.

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ACADEMIC YEAR
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Bachelor of Science (Hons.)

YEAR	2	**Foundation:**	CREDIT	2
Semester	3	**BOT 1001 FT: Applied techniques in Botany**	HOURS	30

OBJECTIVES:

COURSE CONTENT / SYLLABUS

UNIT-I	**Cytogenetics and Staining Techniques** Staining procedures, classification and chemistry of stains, staining equipment, reactive dyes and fluorochromes (including genetically engineered protein labelling with GFP and other tags), Cytogenetic techniques with squashed plant materials	15 hrs.
UNIT-II	**Industrial Botany** Microbes and plant cells involved in industrial production, Bioreactors/fermenters, fermentation process , media, fermentation conditions, downstream processing; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilisation, spray drying Role of fungi in Biotechnology. Application in food industry. Biological control: Biofertilisers, Bioherbicides, Bioinsecticides, Bionematicides	15 hrs.

REFERENCES

1. Casida, L. E. J. R. (2016). Industrial Microbiology. New Age International Publisher. 2. Sivakumaar, P.K. (2010).
2. An Introduction to Industrial Microbiology. S Chand publishing.
3. Waites, M.J., Morgan, N.L., Rockey, Higton G. (2001). Industrial Microbiology: An Introduction. Blackwell Science.
4. Okafor, N., Benedict, C. and Okeke. (2017). Modern Industrial Microbiology and Biotechnology. Taylor & Francis.
5. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE:**	CREDIT	4
Semester	4	**BOT 1401 PT : Paper I: Plant Ecology**	HOURS	60

OBJECTIVES:	To familiarise the students with basic principles of ecology and ecosystems.

COURSE CONTENT / SYLLABUS

UNIT-I	**Components of Ecosystem** Introduction, Abiotic components and biotic components, Organisms response to abiotic components, specific adaptations to biotic and abiotic components	15 hrs.
UNIT-II	**Ecosystems** Ecosystem, structure and function; types of ecosystems; Trophic organisation; Energy flow; Nutrient cycling; Cycling of carbon, water and nitrogen; Production and Productivity	15 hrs.
UNIT-III	**Synecology (Community Ecology)** Plant communities, Characteristics; Classification of communities; Succession, process, types; Climax community, Ecotone and edge effect; Habitat and niche	15 hrs.
UNIT-IV	**Autecology (Population Ecology)** Plant population studies, r and k- selection; Ecological speciation (Ecads, ecotypes), Biodiversity and conservation; Global environmental changes (Human population growth, Pollution, Climate change)	15 hrs.

REFERENCES

1. Ecology by Robert E. Ricklefs and Gary L. Miller 4th edition by W. H. Freeman Publications, 1999.
2. Ecology by William D. Bowman, Sally D. Hacker and Michael L. Cain 4th edition by Oxford University Press, USA Publications, 2017.
3. Fundamentals of Ecology by Eugene. P. Odum and Gary W. Barrett 5th edition by BrookCole Publications, 2004.
4. Ecology: The experimental Analysis of Distribution and Abundance by Charles J. Krebs 6th edition by Pearson Education Publications, 2016.
5. Ecology by P. N. Michael 1st edition by CBS Publishers and Distributors, 2016.
6. Ecology by Stanley I. Dodson, Timothy F. H. Allen, Stephen R. Carpenter, Anthony R. Ives, Robert L. Jeanne, James F. Kitchell, Nancy E. Langston and Monica G. Turner by Oxford University Press, 1998.
7. Ecology: Principles and Applications by J. L. Chapman and M. J. Reiss 2nd edition by Cambridge University Press, 1999.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE**	CREDIT	4
Semester	4	**BOT 1402 PT: Paper II: Genetics and Plant breeding**	HOURS	60

OBJECTIVES:	To develop basic understanding of classical and molecular genetics and plant breeding.

COURSE CONTENT / SYLLABUS

UNIT-I	**Introduction to Genetics** Early concepts of inheritance; Mendelian and Non-Mendelian inheritance, multiple Allelism; Sex determination, Differentiation and sex-linkage, Sex-influenced and sex limited traits; linkage, recombination and genetic mapping.	15 hrs.
UNIT-II	**Cytogenetics and Population Genetics** Numerical changes in chromosomes: Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of Aneuploidy, Polyploidy; Speciation and evolution through polyploidy. Structural changes in chromosomes: Types, meiotic behaviour of Deletion, Duplication, Translocation, and Inversion, male sterility and genetic incompatibility; Population Genetics: Populations and gene pool, Genetic variation and evolution; Genotypic and gene frequencies; Evolutionary change and the Hardy-Weinberg law; applications of the Hardy-Weinberg law; Migration; random genetic drift; Founder effect and bottlenecks**.**	15 hrs.
UNIT-III	**Plant Breeding** Plant breeding: introduction and objectives, breeding systems- modes of reproduction in crop plants, important achievements and undesirable consequence of plant breeding. Methods of crop improvement: Introduction- centres of origin and domestication of crop plants, plant genetics resources; acclimatization, selection methods- for self pollinated, cross pollinated and vegetatively propagated crops, hybridization- procedure, advantages and limitations. Mass selections and Pure line selection, Back cross method.	15 hrs.
UNIT-IV	**Methods In Plant Breeding** Heterosis and hybrid seed production, Male sterility and its use in plant breeding; Inbreeding and inbreeding depression, effect of outcrossing- a very brief idea; Molecular Breeding (use of DNA markers in plant breeding).	15 hrs.

REFERENCES

1. Klug WS & Cummings MR. 2003 Concepts of Genetics. Peterson Education
2. Lewin B. 2008. Genes IX. Jones & Bartlett Publ.
3. Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co.
4. Strickberger MW.1990. Genetics. Collier MacMillan.
5. Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs.
6. Uppal S, Yadav R, Subhadra& Saharan RP. 2005. Practical Manual on Basic and Applied Genetics. Dept. of Genetics, CCS HAU Hisar.
7. B.D. Singh, 1995. Plant breeding. 5th Ed, Kalyani Publishers.
8. JM Poehlman, 2005. Breeding field crops. Blackwell publishers.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.) Botany

YEAR	2	**CORE**	CREDIT	4
Semester	4	**BOT 1403 PL: Paper III: Botany Practical-IV**	HOURS	60

OBJECTIVES:	To develop basic understanding of classical and molecular genetics and plant breeding.

COURSE CONTENT / SYLLABUS

	1. Plant ecological adaptations – Hydrophytes, Xerophytes and Halophytes 2. Quadrate study 3. Tree biomass estimation 4. Physical, chemical and biological characters of soil 5. Problems on monogenic and digenic inheritance 6. Problems pertaining to genetic interactions 7. Problems of sex-linkage 8. Problems of genetic recombination mapping 9. Squash of root tips for studying cell division 10. Squash of flower buds for meiotic studies 11. Emasculation of flowers **12.** Any other practicals relevant to theory papers which aids in improving student understanding can be added.	8 Hrs a week

REFERENCES

1.	Klug WS & Cummings MR. 2003 Concepts of Genetics. Peterson Education
2.	Lewin B. 2008. Genes IX. Jones & Bartlett Publ.
3.	Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co.
4.	Strickberger MW.1990. Genetics. Collier MacMillan.
5.	Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs.
6.	Uppal S, Yadav R, Subhadra& Saharan RP. 2005. Practical Manual on Basic and Applied Genetics. Dept. of Genetics, CCS HAU Hisar.
7.	B.D. Singh, 1995. Plant breeding. 5th Ed, Kalyani Publishers.
8.	JM Poehlman, 2005. Breeding field crops. Blackwell publishers.
9	Ecology by Robert E. Ricklefs and Gary L. Miller 4th edition by W. H. Freeman Publications, 1999.
10	Ecology by William D. Bowman, Sally D. Hacker and Michael L. Cain 4th edition by Oxford University Press, USA Publications, 2017.
11	Fundamentals of Ecology by Eugene. P. Odum and Gary W. Barrett 5th edition by BrookCole Publications, 2004.
12	Ecology: The experimental Analysis of Distribution and Abundance by Charles J. Krebs 6th edition by Pearson Education Publications, 2016.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.)

YEAR	2	**Generic Elective 1:**	CREDIT	3
Semester	4	**BOT 1401 ET :Paper I: Plant Ecology and Adaptive Biology (Theory)**	HOURS	45

OBJECTIVES:	To familiarise the students with basic principles of ecology and ecosystems

COURSE CONTENT / SYLLABUS

UNIT-I	**Ecosystem** Concept and structure of Ecosystem, Food chain, Food web, Ecological Pyramids, Energy flow, Production, Ecological efficiencies, Biogeochemical cycles: carbon, nitrogen and phosphorous, Ecological instruments	15 hrs.
UNIT-II	**Adaptive Biology** Ecological classification of plants: Hydrophytes, Mesophytes, Xerophytes and epiphytes, Insectivorous plants, Environmental factors: climate, edaphic. Biotic factors influencing plant growth, Air, water and land pollution, causes and control measures.	15 hrs.
UNIT-III	**Ecophysiology** Introduction to Ecophysiology, Definition, Light intensity, Temperature, Water, Co2 Concentration, Wind and Flooding. Factors affecting Ecophysiology of plants, Plant responses in relation to climate change.	15 hrs.

REFERENCES

1. Smith 2014 Elements of Ecology
2. Misra, R. 2018 Indian manual of plant Ecology
3. Eugene Odum 2017 Fundamentals of Ecology
4. Anil Kumar De 2018 environmental chemistry
5. R.S. Ambasht 2017 15th ed. A textbook of plant ecology
6. Khitoliya R.K. 2006 Environmental pollution
7. P.D. Sharma 2011 Ecology and Environment

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Bachelor of Science (Hons.)

YEAR	2	**Generic Elective 1:**	CREDIT	I
Semester	4	**BOT 1401 EL :Paper II: Plant Ecology and Adaptive Biology (Practical)**	HOURS	30

OBJECTIVES:	To familiarise the students with basic principles of ecology and ecosystems

COURSE CONTENT / SYLLABUS

	1. Plant ecological adaptations – Hydrophytes, Xerophytes and Halophytes 2. Quadrate study 3. Tree biomass estimation 4. Physical, chemical and biological characters of soil 5. Physical, chemical and biological characters of soil 6. Insectivorous plants 7. Ecological instruments 8. Any other practicals relevant to theory paper which helps in students understanding will be added.	2 Hrs per Week

REFERENCES

1.	Smith 2014 Elements of Ecology
2.	Misra, R. 2018 Indian manual of plant Ecology
3.	Eugene Odum 2017 Fundamentals of Ecology
4.	Anil Kumar De 2018 environmental chemistry
5.	R.S. Ambasht 2017 15th ed. A textbook of plant ecology
6.	Khitoliya R.K. 2006 Environmental pollution
7.	P.D. Sharma 2011 Ecology and Environment

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Bachelor of Science (Hons.)

YEAR	2	**Generic Elective 2:**	CREDIT	3
Semester	4	**BOT 1403 ET: Paper I: Genetic engineering and Plant biotechnology (Theory)**	HOURS	45

OBJECTIVES:	To familiarize the students with the fundamentals of Recombinant DNA technology, cell and tissue culture techniques and their applications in Plant Biotechnology.

COURSE CONTENT / SYLLABUS

UNIT-I	**Recombinant DNA Technology** Recombinant DNA technology, Restriction enzymes, Vectors, Gene cloning, Direct and indirect method of gene transfer, Transgenic and Cisgenic approaches for plant improvement; RNAi gene knockouts and overexpression, Gene editing tools:CRISPR-CAS9, Zinc finger nucleases, TALENs; screening; selection markers (nptII, hpt, bar, gox) and reporter genes- GUS, GFP, Luciferase, Agrobacterium	15 hrs.
UNIT-II	**Genetic Modified Organisms** Achievements in crop biotechnology, environment and industry (suitable example)- pest resistant plants (Bt cotton), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality (flavrSavrtomato, golden rice, Amflora potatoes, Arctic apples), role of transgenic in pollution degradation (super-bug), leaching of minerals, production of industrial enzymes, edible vaccine, improved ornamental plants.	15 hrs.
UNIT-III	**Plant Tissue Culture** Concepts of Plant cell and tissue culture, Scope and importance, Totipotency and Morphogenesis, Plant tissue Culture media, regeneration of plants from differentiated tissues, organogenesis, and somatic embryogenesis, and synthetic seeds Micropropagation and its stages, factors affecting micropropagation, Protoplast culture, somatic hybrids and cybrids, Applications in crop improvement.	15 hrs.

REFERENCES

1. Primrose SB. 2001. Molecular Biotechnology. Panima.
2. Primrose SB, Twyman R, 2009. Principles of gene manipulation and genomics. 7th Ed, Wiley.
3. Sambrook et al., 2014. Molecular cloning: a laboratory manual part 1 to 3. 4th Ed., Cold spring harbor laboratory press.
4. Singh BD, 2011. Plant biotechnology. 2nd Ed, Kalyani publishers.
5. Bhojwani SS, Soh WY, 2003. Agrobiotechnology and plant tissue culture. Science publishers.
6. Thorpe Trevor et al., 2013. Plant tissue culture: Techniques and experiments. 3rd Ed, Academic press.

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YEAR	2	**Generic Elective 2:**	CREDIT	1
Semester	4	**BOT 1404 EL : Paper II: Genetic engineering and Plant biotechnology (Practical)**	HOURS	30

OBJECTIVES:	To familiarize the students with the fundamentals of Recombinant DNA technology, cell and tissue culture techniques and their applications in Plant Biotechnology.

COURSE CONTENT / SYLLABUS

	1. Molecular biology Lab visit (within University campus) 2. DNA isolation – genomic and plasmid 3. Gel pictures of Genomic and Plasmid DNA prep 4. Models of restriction enzymes and its calculations 5. Models and problems of restriction sites on plasmid DNA 6. Problems of Genetic engineering and rDNA technology 7. Plant tissue culture basics and media **8.** Demonstration of varieties of culture techniques	2 Hrs per week

REFERENCES

1.	Primrose SB. 2001. Molecular Biotechnology. Panima.
2.	Primrose SB, Twyman R, 2009. Principles of gene manipulation and genomics. 7th Ed, Wiley.
3.	Sambrook et al., 2014. Molecular cloning: a laboratory manual part 1 to 3. 4th Ed., Cold spring harbor laboratory press.
4.	Singh BD, 2011. Plant biotechnology. 2nd Ed, Kalyani publishers.
5.	Bhojwani SS, Soh WY, 2003. Agrobiotechnology and plant tissue culture. Science publishers.
6.	Thorpe Trevor et al., 2013. Plant tissue culture: Techniques and experiments. 3rd Ed, Academic press.

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ACADEMIC YEAR
2020-2021

Bachelor of Science (Hons.)

YEAR	2	**Foundation:**	CREDIT	2
Semester	4	**BOT 1002 FT: Plant Identification Techniques**	HOURS	30

OBJECTIVES:	Students will learn the different techniques of identifying all groups of plants.

COURSE CONTENT / SYLLABUS

UNIT-I	**Collection and Preservation of Plants.** Specimen Collection: how to collect plant, what organs should be collected which helps in identification, precaution taken during collection. Specimen preservation: Herbarium preparation (Dry collection), wet collection, preservation of algae, fungi bryophyte, Pteridophyte, Gymnosperms and Angiosperms.	15 hrs.
UNIT-II	**Description and Identification** Describing plants: Floral Morphology in detail. Inflorescence-Types of Cymose and Racemose in detail. Floral- Bracts, Bracteole, Calyx, Corolla, Androecium, Gynoecium. Fruit- Types and Seed. Identification: Identification of higher taxa till family with help of local avialiable plants and floras.	15 hrs.

REFERENCES

1. Singh G. (2010). Plant Systematics: An Integrated Approach.
2. Judd *et all*., (2004) *Plant Systematics: a Phylogenetic Approach*
3. Cooke, T. (1903). Flora of Bombay Presidency Vols. I, II &III. *Botanical Survey of India, Culcutta*.
4. Lawrence G.H.M. Taxonomy of Vascular Plants.