DAV UNIVERSITY, JALANDHAR

Scheme of Courses M.Sc.
M.Sc. (Hons.) Botany

Semester 1

S.No	Paper Code	Course Type	Course Title	L	T	P	Cr
1	BOT521	Core	Algae, Fungi and Phytopathology	4	0	0	4
2	BOT522	Core	Algae, Fungi and Phytopathology Laboratory	0	0	3	2
3	BOT523	Core	Crop Improvement	4	0	0	4
4	BOT524	Core	Crop Improvement Laboratory	0	0	3	2
5	BOT525	Core	Cytogenetics	4	0	0	4
6	BOT526	Core	Cytogenetics Laboratory	0	0	3	2
7	BTY513	Core	Cell Biology	4	0	0	4
8	BTY514	Core	Cell Biology Laboratory	0	0	3	2
	Total						24

L: Lecture T: Tutorial P: Practical Cr: Credits

DAV UNIVERSITY, JALANDHAR

Scheme of Courses M.Sc.
M.Sc. (Hons.) Botany
Semester II

S.No	Paper Code	Course Type	Course Title	L	T	P	Cr
1	BOT531	Core	Archegoniate Biology	4	0	0	4
2	BOT532	Core	Archegoniate Biology Laboratory	0	0	3	2
3	BOT533	Core	Plant Physiology	4	0	0	4
4	BOT534	Core	Plant Physiology Laboratory	0	0	3	2
5	BOT535	Core	Conservation of Natural Resources	4	0	0	4
6	BOT536	Core	Conservation of Natural Resources Laboratory	0	0	3	2
7	BOT537	Core	Field Trip	0	0	1	1
8	Open Elective/Interdisciplinary Course I			4	0	0	4
	Total						23

L: Lecture T: Tutorial P: Practical Cr: Credits

DAV UNIVERSITY, JALANDHAR

Scheme of Courses M.Sc.
M.Sc. (Hons.) Botany
Semester III

S.No	Paper Code	Course Type	Course Title	L	T	P	Cr
1	BOT621	Core	Scientific Writing and Research Methodology	3	1	0	4
2	BOT622	Core	Advanced Plant Systematics	4	0	0	4
3	BOT623	Core	Advanced Plant Systematics Laboratory	0	0	3	2
4	BTY511	Core	Molecular Biology	4	0	0	4
5	BTY512	Core	Molecular Biology Laboratory	0	0	3	2
6	BOT624	Core	Project-I	0	0	2	2
7	Departmental Elective-I			4	0	2	6
	Total						24
Departmental Elective-I (6Cr) (Choose any one theory course and the related laboratory course)							
i.	BOT625	Elective	Economic Botany	4	0	0	4
	BOT626	Elective	Economic Botany Laboratory	0	0	3	2
ii.	BOT627	Elective	Agricultural Ecology-Principles and Applications	4	0	0	4
	BOT628	Elective	Agricultural Ecology-Principles and Applications Laboratory	0	0	3	2

L: Lecture T: Tutorial P: Practical Cr: Credits

DAV UNIVERSITY, JALANDHAR

Scheme of Courses M.Sc.
M.Sc. (Hons.) Botany

Semester IV

S.No	Paper Code	Course Type	Course Title	L	T	P	Cr
1	BOT608	Core	Analytical Techniques	2	1	0	2
2	BOT609	Core	Analytical Techniques Laboratory	0	0	3	1
3	BOT631	Core	Project-II	0	0	8	8
4	Open Elective/Interdisciplinary Course II			4	0	0	4
5	Departmental Elective-II			4	1	2	6
6	Departmental Elective-III			4	0	0	4
	Total						25
Departmental Elective II (6Cr) (Choose any one theory course and the related laboratory course)							
i.	BOT632	Elective	Plant Ecology and Phytogeography	4	1	0	4
	BOT633	Elective	Plant Ecology and Phytogeography Laboratory	0	0	3	2
ii.	BOT634	Elective	Advanced Plant Physiology and Biochemistry	4	1	0	4
	BOT635	Elective	Advanced Plant Physiology and Biochemistry Laboratory	0	0	3	2
Departmental Elective III (4Cr) (Choose any one theory course)							
i.	BOT636	Elective	Forestry	4	0	0	4
ii.	BOT637	Elective	Advances in Plant Breeding	4	0	0	4

L: Lecture T: Tutorial P: Practical Cr: Credits

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester I

Paper: Algae, Fungi and Phytopathology
Code: Theory: BOT521

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:
To acquaint the students about the origin, history, morphology, biology and importance of prokaryotic and eukaryotic algal and fungal organisms.

Teaching Methodology:
It will involve class room lectures, practicals and field visits etc.

Learning outcomes
This will enable the students to learn the evolutionary and recent trends in lower plants.

UNIT-I

Algae: Algal classification, Comparative account of important systems of classification (Fritsch and Lee); Salient features of major divisions (Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta; Phaeophyta and Rhodophyta).

Algal ecology: Ecological importance of Algae, Algal indicators, Algal blooms, Carbon capture by algae, Algal biofouling.

Economic importance of Algae: Algae as food, fodder, biofertilizer, medicine, industrial uses and other useful products. **(15 Lectures)**

UNIT-II

Fungi: Recent trends in classification of fungi; general account of phylum Chytridiomycota, Ascomycota, Deuteromycota, Basidiomycota, Zygomycota and Myxomycota and their classification (major orders).

Fungal associations and their significance: (a) Symbionts - Lichens, Mycorrhiza, Fungus-insect mutualism; (b) Parasites - Common fungal parasites of plants; (c) Saprophytes - Fungal decomposition of organic matter, coprophilous fungi, cellulolytic fungi, lignolytic fungi.

Agricultural significance of Fungi - Mycoparasite, mycoherbicide. **(12 Lectures)**

UNIT-III

Phytopathology: Introduction; Process of infection and pathogenesis: penetration and entry of pathogen into host tissue – mechanical, physiological and enzymatic; Host-parasite interaction, enzymes and toxins in pathogenesis.

Defense mechanism in plants: Pre-existing structural and biochemical defense mechanisms, induced structural and biochemical defense mechanisms, hypersensitive reaction, role of phytoalexins and other phenolic compounds, PR proteins, role of Jasmonic acid and Salicylic acid. **(15 Lectures)**

UNIT-IV

Diseases in plants: Symptoms, etiology and disease cycle.

Wheat- rust, smut; Rice-sheath blight; Cucurbits-Powdery mildew; Sugarcane-red rot; Potato-late and early blight; Crucifers-white rust; dieback disease of grasses.

Plant disease management: Exclusion, eradication and protection. Chemical means of disease control; biological means of disease control; biotechnological approaches to disease resistance: transgenic approaches to disease resistance, engineering chemicals that elicit defense responses in plants. **(14 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Algae, Fungi and Phytopathology Laboratory
Paper code: BOT522

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Study of diversity of fresh water and marine algae - Range of thallus and sex organs in major algal groups.
2. Heterocysts and their frequency in some Cyanophycean genera
3. Study of symptoms of plants infected with *Albugo*; asexual and sexual structures of through sections/tease mounts and permanent slides.
4. *Rhizopus*: Students to culture Black bread mould in the laboratory to study asexual stage from temporary mounts. Sexual stages of mould to be studied from permanent slides.
5. *Puccinia*: Herbarium specimens of Wheat Rusts- (Black, Brown and Yellow) and infected barberry leaves; section/tease mounts of spores on wheat, and permanent slides of both the hosts.

Reference Books

1. Alexopoulos, Constantine John, and Meredith Blackwell. *Introductory Mycology*. 4.th ed. New York [u.a.: Wiley, 1996. Print.
2. Bilgrami, K. S., and Verma, R. N. *Physiology of Fungi*. New Delhi: Vikas Pub. House, 1978. Print.
3. Bold, Harold Charles, and Michael James Wynne. *Introduction to the Algae: Structure and Reproduction*. Englewood Cliffs, N.J.: Prentice-Hall, 1978. Print.
4. Burnett, J. H. *Fundamentals of Mycology*. New York: St. Martin's, 1976. Print**.**
5. Carlile, M. J., and Sarah C. Watkinson. *The Fungi*. 2nd ed. San Diego: Academic, 2001. Print.
6. Chapman, N. J., and Chapman, D.J. *The Algae*. London: ELBS and Macmillan;, 1977. Print.
7. Fritsch, F. E. *The Structure and Reproduction of the Algae. (Vol. I, Vol II)*. Vikas House Pvt. Ltd, 1979. Print.
8. Graham, Linda E., and Lee Warren Wilcox. *Algae*. Upper Saddler River, NJ: Prentice Hall, 2000. Print.
9. Kumar, H. D. *Introductory Phycology*. New Delhi: Affiliated East-West, 1999. Print.
10. Lee, Robert Edward. *Phycology*. Cambridge: Cambridge UP, 2008. Print.
11. Landecker, Elizabeth. *Fundamentals of the Fungi*. Englewood Cliffs, N.J.: Prentice-Hall, 1972. Print.
12. South, G. Robin, and Alan Whittick. *Introduction to Phycology*. Oxford: Blackwell Scientific Publications, 1987. Print.
13. Hoek, C. Van Den, and Mann, D. G. *Algae: An Introduction to Phycology*. Cambridge: Cambridge UP, 1995. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester I
Paper: Crop Improvement
Paper code: BOT523

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To introduce the students about plant breeding, regeneration of plants and genetic variations under artificial conditions.

Teaching Methodology:

Class room lectures, practical, models, charts, filed visit, power point presentations.

Learning outcomes

The course will impart theoretical knowledge and practical skills about plant breeding objectives,modes of reproduction and breeding methods for crop improvement. The studies will acquire the knowledge of regeneration power of a cell and how a single cell can be used to grow disease free plants. Further, the subject will make the students to understand that how an acquired character can be transferred from one plant to another for some specific function.

UNIT-I

Plant Breeding: Introduction, objectives of plant breeding, genetic variability, green revolution, Domestication and centers of origin of cultivated plants.

Systems of reproduction in plants: Reproductive systems, Sexual reproduction - Cross and self pollination; asexual reproduction, Incompatibility and Male sterility, pollination control mechanisms.

Hybridization: Role and methods, Back-cross breeding. Heterosis, Inbreeding depression.

Breeding for resistance: Breeding for biotic and abiotic stresses, physical and chemical mutagens; Gamma gardens. **(12 Lectures)**

UNIT-II

Plant Cell and Tissue Culture: Principles of plant tissue culture- historical perspectives, Organization of laboratory media composition and preparation, Different types of culture media Cell culture and cell cloning. Cellular totipotency.

Somatic embryogenesis and synthetic seeds: Induction and controlling factors. Organogenesis

Haploids: Androgenic and gynogenic.

Somatic hybridization: Isolation, culture and fusion of protoplasts, Selection of fusion products; regeneration of hybrids and cybrids.Application in biotechnology

Clonal propagation: Micropropagation. Somaclonal and gametoclonal variation and their applications. **(14 Lectures)**

UNIT-III

Transgenic Plants, recombinant DNA technology, Gene Transfer Methods in Plants (direct gene transfer methods: particle bombardment, electroporation, PEG-mediated); Plant transformation vectors; Cloning vehicles, gene engineering through cutting and joining

DNA molecules, restriction endonucleases, ligases, applications of genetic engineering; floral-dip **(12 Lectures)**

UNIT-IV

Proteomics: Proteome, proteomics, Separation and identification of cellular proteins by 2D gel electrophoresis and mass spectrometry, Protein expression analysis using Protein microarray, protein localization using GFP, proteomics in crop improvement.

Genomics: Genome, genomics. Structural genomics - genome sequencing strategies Functional genomics – genome annotation, gene expression study using microarrays, genomics in crop improvement. **(12 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Crop Improvement Laboratory

Paper code: BOT524

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. To study the fertility in pollen grains of given flowers.
2. To study artificial induction of polyploidy.
3. To study different steps of the process of artificial hybridization.
4. To emasculate different flowers
5. To study seed viability
6. Determination of seed moisture content
7. Laboratory organization and techniques for tissue culture.
8. To study different nutrient media; their preparation and sterilization.
9. To study the technique of encapsulation of shoot meristem/somatic embryos in calcium alginate beads.

Reference Books

1. Allard, R. W. *Principles of Plant Breeding*. John Wiley & Sons, 1981. Print.
2. Chopra, V. L. *Breeding Field Crops.* New Delhi: Oxford and IBH Pub., 2004. Print.
3. Gupta, S. K. *Practical Plant Breeding*. 2nd ed. Jodhpur: Agrobios (India), 2010. Print.
4. Poehlman, John Milton, and Dhirendranath Borthakur. *Breeding Asian Field Crops, with Special Reference to Crops of India*. Calcutta: Oxford & IBH Pub., 1969. Print.
5. Roy, Darbeshwar. *Plant Breeding: Analysis and Exploitation of Variation*. Pangbourne, UK: Alpha Science International, 2000. Print.
6. Bhojwani, S. S., and Razdan, M. K. *Plant Tissue Culture: Theory and Practice*. Amsterdam: Elsevier ;, 1983. Print.
7. Chawla, H. S. *Introduction to Plant Biotechnology*. New Delhi: Oxford & IBH Pvt.Ltd., 2002. Print.
8. Hammond, J., McGarvey, P., and Yusibov, V. *Plant Biotechnology: New Products and Applications*. Berlin: Springer, 2000. Print.
9. Kumar, H.D. *A Text Book of Biotechnology*. Affiliated East West, Pvt., 2010. Print**.**
10. Murray, David R. *Advanced Methods in Plant Breeding and Biotechnology*. Melksham: Redwood Press Pvt. Lmt., 1991. Print.
11. Old, R.W., and Primrose, S.B. *Principles of Gene Manipulation: An Introduction to Genetic Engineering*. Oxford: Blackwell Scientific Publications, 1985. Print.
12. Razdan, M. K. *Introduction to Plant Tissue Culture*. New Delhi: Oxford and IBH Pvt. Ltd., 1983. Print.
13. Rainert, J. and Yeoman, M.M. *Plant Cell and Tissue Culture ; A Laboratory Manual*. Berlin: Springer-Verlag, 1982. Print.
14. Street, H. E. *Plant Tissue and Cell Culture*. London: Blackwell Scientific Publications, 1973. Print.
15. Smith, Roberta H. *Plant Tissue Culture: Techniques and Experiments*. New York: Academic, 2000. Print.
16. Trevan, M.D., Buffey, S., Goulding, K.H., and Stanbury, P. *Biotechnology–The Biological Principles*. New: Delhi: Tata McGraw-Hill Publishing Company Ltd., 1988. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester I
Paper: Cytogenetics
Paper code: BOT525

L	T	P	Credits	Maximum Marks	Minimum marks
4	0	0	4	100	40

Objective:

To acquaint the students about the hereditary basis of life, prokaryotic and eukaryotic genome organization and its functions.

Teaching Methodology:

It will involve class room lectures, practicals, models, and topic related power point presentations.

Learning outcomes

To provide insight into structure and functions of chromosomes, chromosome maping, polyploidy and cytogenetic aspects of crop evolution. To provide a knowledge of the importance of chromosomal variations in structure and number. The study will make the students clear regarding what forms the basis of variations in living organisms.

UNIT-I

Genome: Organization in prokaryotes and eukaryotes, Nuclear DNA content; law of DNA constancy and C-value paradox; *Cot* curves. **(4 Lectures)**

Chromosome: Structure and DNA packaging; Euchromatin and heterochromatin, unique and repetitive DNA; Karyotype analysis and banding patterns. **(8 Lectures)**

UNIT - II

Special chromosome types: Polytene, lampbrush, B and sex chromosomes; Fine structure of gene coding and noncoding sequences, unique and repetitive DNA; pseudogenes, gene families. **(6 Lectures)**

Genomic enzymes: Enzymes involved in DNA replication, polymerases, topoisomerases, methylases, nucleases and restriction endonucleases; replication origin and replication fork, fidelity of replication. **(6 Lectures)**

UNIT - III

Sex determination: Mechanism of sex determination, sex chromatin and dosage compensation, Sex linked inheritance and common genetic disorders. **(6 Lectures)**

Linkage and genetic mapping:

Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order, interference and co-efficient of coincidence. Haploid mapping (*Neurospora*), Mapping in bacteria and bacteriophages. Inheritance of traits in humans; pedigree analysis, determination of human genetic diseases by pedigree analysis, genetic mapping in human pedigrees. **(6 Lectures)**

DAV UNIVERSITY, JALANDHAR

UNIT - IV

Gene mapping methods: Genetic and physical maps of chromosome, mapping with molecular markers and somatic cell hybrids. **(4 Lectures)**

Transposons: Cut and Paste transposons, Replicative transposons and Retrotransposons; Mutations induced by transposons. **(3 Lectures)**

Molecular cytogenetics: Chromosome walking; Chromosome jumping; Applications of molecular cytogenetics. **(2 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Cytogenetics Laboratory
Paper code: BOT526

L	T	P	Credits	Maximum Marks	Minimum marks
0	0	3	2	50	20

1. Workout problems related to linkage, crossing over and gene mapping, human pedigree analysis.
2. Staining and study of polytene chromosomes.
3. Characteristics and behavior of B chromosomes using maize or appropriate material.
4. Preparation and study of karyotype.
5. Mitosis and meiosis in higher plants.
6. Study of aberrant meiosis in *Rhoeo*, *Tradescantia* and *Chrysanthemum*.
7. Calculation of mitotic index and chiasma frequency.
8. Linear differentiation of chromosomes through banding techniques, such as G-banding, C-banding and Q-banding (Photographs/Slides).

Reference Books

1. Brooker R.J. *Genetics*. USA: Addison-Wesley, Longman Publisher, 1999. Print.
2. Brown T.A. Genetics: *A Molecular Approach*. USA: Chapman & Hall, 1999. Print.
3. Brown T.A. *Genomes*. USA: Wiley & Sons, 2001. Print.
4. Glick B.R., and Pasternak, J.J. *Molecular Biotechnology*. USA: American Society for Microbiology, 1998. Print.
5. Griffiths A.J.F., Gelbart, W.M., Miller, J.H., and Lewontin. *Modern Genetic Analysis*. USA: W.H. Freeman & Company, 2002. Print.
7. Karp G. *Cell and Molecular Biology*. USA: Wiley & Sons, 1999. Print.
8. Lewin B. *Genes VII*. UK: Oxford University Press, 2000. Print.
9. Lodish H., Berk, A., Zipursky, L., Matsudaira, P., Baltimore, D., and Darnell, J. *Molecular Cell Biology*. USA: W.H. Freeman & Co., 2005. Print.
10. Malacinski, J., and Friefelder, D. *Essentials of Molecular Biology*. USA: Jones and Bartlett Publ., 1999. Print.
11. Primrose S.B., Twyman, R.M., and Old, R.W. *Principles of Gene Manipulation*. UK: Blackwell Publisher, 2001. Print.
12. Russel, P.J. *Genetics*. California: Addison Wesley Longman, 2006. Print.
13. Snustad, D.P. and Simmons, M.J. *Principles of Genetics*. USA: Wiley and Sons, 2003. Print.

DAV UNIVERSITY, JALANDHAR

Botany (Hons. School) Semester II
Paper: Archegoniate Biology
Paper code: BOT531

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To expose the students to evolutionary history, morphology, biology and affinities of bryophytes and pteridophytes.

Teaching Methodology:

Class room lectures, practicals, models, charts, field visit, power point presentations.

Learning outcomes

The studies will be exposed to the evolutionary trends in cryptogams and phanerogams, development of vascular system in plants, ecological significance of bryophytes and pteridophytes.

UNIT-I

Bryophytes: Comparative account of the salient features of (i) Takakiales (ii) Polytrichales (iii) Sphagnales (iv) Andreaeales (v) Jungermanniales (vi) Anthocerotales (vii) Marchantiales.

Uptake of water and nutrients, characteristic features of endohydric, ectohydric and mixohydric Bryophytes **(6 Lectures)**

Substratum Ecology: Epiphytes, Epiphylls, Epiliths, Litter species, Fire mosses, Coprophilous species, Calcicoles and Calcifuges, Halophytes, Epizoic Bryophytes.

(3 Lectures)

Bryogeography and Conservation: Bryophyte endemisms; Indian bryodiversity with particular emphasis to Himalayas; Threatened bryophytes; strategies to conserve diversity at National and Global levels. **(3 Lectures)**

UNIT-II

Pteridophytes: Classification of Pteridophytes with special reference to ferns, Criteria used for the classification of ferns. **(4 Lectures)**

Evolution of stellar structure among Pteridophytes; Spore structure, types and patterns of spore germination in ferns. **(4 Lectures)**

Natural and induced apogamy and apospory in pteridophytes. Heterospory and seed habit.

(4 Lectures)

UNIT-III

Gymnosperms: General characteristic features of Gymnosperms and their affinities with pteridophytes and angiosperms; Evolutionary status of pteridosperms and their angiospermic affinities. Current trends in the classification of Gymnosperms; Distribution of Gymnosperms in India. **(6 Lectures)**

Brief account of families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae, Glossopteridaceae). **(8 Lectures)**

Cytological studies in Gymnosperms. **(1 Lecture)**

UNIT-IV

Ecological and economic significance of Archegoniate:

Ecological significance of Bryophytes - role as pollution indicators; biologically active compounds in Bryophytes, Economic importance of Bryophytes.

Ferns as hyperaccumulators of arsenic, mechanism of uptake, transfer and tolerance and use in phytoremediation

Impact of coniferous forest on human life, Gymnosperms as a source of wood, resins, essential oils, food and drugs. **(12 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Archegoniate Biology Laboratory
Paper code: BOT532

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Morphology and internal organization in Marchantiales, Jungermanniales, Isobryales and Hypnobryales.
2. To compare the structure and behaviour of endohydric and ectohydric mosses.
4. Study of the morphology, anatomy and reproductive structures of some representative fern and fern allies
5. Herbarium preparation of Pteridophytic collection.
6. Wood Anatomy in *Cedrus*, *Ginkgo*, *Ephedra* and *Gnetum*
7. Leaf Anatomy in *Cedrus*, *Abies*, *Picea*, *Pinus*
8. Male and female cones (external morphology) in *Cedrus*, *Abies*, *Thuja* and *Juniperus*.

Reference Books

1. Chopra, Ram Saran. *Taxonomy of Indian Mosses: An Introduction*. New Delhi: Publications & Information Directorate, Council of Scientific & Industrial Research, 1975. Print.
2. Dyer, A. F. *The Experimental Biology of Ferns*. London: Academic Press, 1979. Print.
3. Dyer, A.F., and Duckett, J.G. *The Experimental Biology of Bryophytes*. London: Academic Press, 1984. Print.
4. Gifford, E.M., and Foster, A.S. *Morphology and Evolution of Vascular Plants*. New York: W.H. Freeman and Company, 1989. Print.
5. Goffinet, B., and Shaw, A.J. *Bryophyte Biology*. Cambridge: Cambridge University Press, 2000. Print.
6. Khullar, S.P. *An Illustrated Fern Flora of West Himalayas* (Vols. I and 2), Dehradun: International Book Distributors, 2000. Print.
7. Mehra, P.N., and Gupta, A. *Gametophytes of Himalayan Ferns*. Chandigarh: Mehra P.N., Botany Department, P.U., 1986. Print.
8. Rashid, A. *An Introduction to Pteridophyta*. New Delhi: Vikas Publishers, 1999. Print.
9. Richardson, D.H.S. *Biology of Mosses*. Oxford: Blackwell Scientific Publications, 1981. Print.
10. Schofield, W.B. *Introduction to Bryology*, New York: Macmillan Publishing Company, 1985. Print.
11. Schuster, Rudolf M. *New Manual of Bryology*. Nichinan, Miyazaki: Hattori Botanical Laboratory, 1984. Print.

12. Sporne, K.R. *The morphology of Pteridophytes*, Bombay: B.I. Publications, 1982. Print.
13. Dalimore, W., Jackson, A.B., and Morrison, S.L. *A Handbook of Coniferae including Ginkgoaceae*, London: Edward Arnold and Co., 1966. Print.
14. Meyen, S.V. "Basic Features of Gymnosperms, Systematics and Phylogeny as Evidenced by the Fossil Record." *Botanical Review*: 50 (1984): 1-112. Print.
15. Rothwell, G.W. "The Role of Comparative Morphology and Anatomy in Interpreting the Systematics of Fossil Gymnosperms." *Botanical Review*: 51 (1985): 318-327. Print.
16. Sporne, K.R. *The Morphology of Gymnosperms*, Delhi: B.I. Publications, 1974. Print.
17. Sharma, O.P. and Dixit, S. *Gymnosperms*. Meerut: Pragati Prakashan, 2001. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester II
Paper: Plant Physiology
Code: BOT533

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To acquaint the students about various physiological processes at cellular and organ level in plants.

Teaching Methodology:

Class room lectures, practicals, models, charts, power point presentations.

Learning outcomes

The students will come to know that how a plant cell responds to various biotic and abiotic stresses, defence mechanism in plants, events of seed and fruit development, and the various physiological roles of plant hormones.

UNIT-I

Water and Plant Cells: Water in plant life; Water transport processes; Concept of water potential; Absorption of water by roots and transport through the xylem; Transpiration and factors affecting transpiration; The Soil-Plant-Atmosphere Continuum. **(6 Lectures)**

Mineral Nutrition: Concept of essentiality of mineral elements; Essential nutrients and their deficiency in plants; Absorption of minerals by roots; Transport proteins; Membrane transport process; Role of microbes in nutrient acquisition by plants; Assimilation of mineral nutrients. **(6 Lectures)**

UNIT-II

Photosynthesis: Energy pathways in photosynthesis; Composition and characterization of photosystem-I and -II; molecular basis of electron flow through cyclic, non-cyclic and pseudo-cyclic photophosphorylations, Biochemical events and regulation of CO_2 fixation (C3, C4 and CAM); Mechanism of and regulation of photorespiration; RUBISCO as an example of model enzyme for semi-autonomy at the molecular level. **(7 Lectures)**

Plant Respiration: Detailed mechanism; Glycolysis and TCA cycle Mitochondria as biological oxidators; Chemiosmatic regeneration of ATP; CN- resistant respiration and metabolic inhibitors regulating the respiration. **(5 Lectures)**

UNIT-III

Physiology of seed development, maturation, dormancy and germination: Hormonal regulation of seed development, events associated with seed maturation, factors regulating seed dormancy, mechanisms of mobilization of food reserves during seed germination. **(4 Lectures)**

Fruit development and ripening: Stages of fruit development and their regulation, biochemical and related events during fruit ripening in climacteric and non-climacteric fruits,

physiology and biochemistry of fruit abscission, post-harvest changes, production of transgenic fruits. **(4 Lectures)**

Sensory physiology: Phytochromes and cryptochromes; Localization of phytochrome; Physiological responses of phytochrome with special reference to shade avoidance and circadian rythms; Blue-light mediated responses; Photoperiodism. **(4 Lectures)**

UNIT-IV

Flowering in plants: Control of flowering; Floral organ development; Phase changes during floral development; Role of Photoperiodism and Vernalization in flowering. **(2 Lectures)**

Plant Hormones: Physiological effects and molecular mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscissic acid, jasmonic acid, brassinosteroids, polyamines, salicylic acid. **(8 Lectures)**

Stress physiology: Plant responses to abiotic stresses, mechanisms of abiotic stress tolerance, water deficit and drought tolerance, salinity stress, metal toxicity, freezing and heat stress. **(3 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Plant Physiology Laboratory
Code: BOT534

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Determination of Chlorophyll a and Chlorophyll b ratio in C3 and C4 plants.
2. Spectroscopic determination of Chlorophyll a, Chlorophyll b, Carotenoids and Anthocyanin content under varied environmental conditions.
3. TLC and paper chromatography for separation of chlorophyll pigments.
4. Determination of NR activity.
5. Extraction of plant proteins and determination of their contents.
6. Demonstration of GA production bioassay.
7. Demonstration of internodal elongation bioassay for brassinosteroids
8. Experimental study of seed germination under stressful conditions.

Reference Books

1. Bonner, B., and Varner, J.E. *Plant Biochemistry*. London: Academic Press, 1976. Print.
2. Srivastava, L.M. *Plant Growth and Development*. NewYork: Associated Press, 2002. Print.
3. Stryer, L. *Biochemistry*. 5th ed. New York: W.H. Freeman and Co., 1995. Print.
4. Taiz, L., and Zeiger, E. *Plant Physiology*. California: The Benjamin/Cumming Publishing Company, 1998. Print.
5. Voet, D., and Voet, J.G. *Biochemistry*. New York: John Wiley and Sons Inc., 1995. Print.
6. Wilkins, M.B. *Advanced Plant Physiology*. New York: Pitman, 1984. Print.
7. Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. India: I K Internationals, 2005. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester II
Paper: Conservation of Natural Resources
Paper code: BOT535

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To make the students learn about the significance of different natural resources and their conservation strategies.

Teaching Methodology:

Class room lectures, practicals, models, charts, power point presentations.

Learning outcomes

The students will gain the knowledge of significance of biodiversity, different conservation strategies, biosphere reserves etc.

UNIT I

Conservation: Concept; Objectives and aims; definition and classification of resources, basic principles of resource management, problems of resource depletion, preservation, conservation and restoration **(4 Lectures)**

Conservation of Soil: Reasons of soil degradation, Soil erosion and its check; Role of soil micro-organisms; Soil reclamation. **(6 Lectures)**

Conservation of Mineral Resources: Demographic quotient and depletion curves. **(2 Lectures)**

UNIT II

Conservation of Agriculture: Conservation of arable land; Conservation of crop genome; Strategies of conservation of crops. **(4 Lectures)**

Pesticides and herbicides in crop protection; Organic, inorganic and hormonal pesticides and herbicides. **(3 Lectures)**

Environmental hazards of pesticides and insecticides - their impact on life and life support system. **(2 Lectures)**

Role of botanicals in crop protection; Biological management of pests; Integrated weed management. **(3 Lectures)**

UNIT III

Biodiversity and its Conservation: Definition, levels, measurement, threats, strategies for biodiversity conservation. **(6 Lectures)**

Endangered and threatened species: IUCN Categories of Extinction

Concept of National Parks, Wildlife Sanctuaries; Biosphere Reserves

Biodiversity Hotspots' **–** concept; A brief account of Biodiversity hotspots of India; Classification of protected areas as per UN. **(6 Lectures)**

UNIT IV

Conservation of Forests: Joint Forest Management, Plantation Programmes in India – Social, Community, Farm and Urban Forestry; Forest Conservation Act. **(5 Lectures)**

Strategies for conservation of wastelands and deserts **(2 Lectures)**

Conservation of Wildlife: Concept of wildlife; Habitat Improvement; Wildlife Protection Act. **(3 Lectures)**

Conservation of Aquatic System: Need and strategies of conservation of Aquatic systems; Conservation of Wetlands. **(2 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Conservation of Natural Resources Laboratory
Paper code: BOT536

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. To study different types of soil.
2. To undertake a field visit to understand the concept and consequences soil degradation and erosion.
3. To study different types of plantation systems.
4. Enlist herbicides / pesticides commonly used in the region.
5. Enlist plants that are the sources of botanicals.
6. Enlist various botanical pesticides available in the market.

Reference Books

1. Chiras D.D. and Reganold J.P. *Natural Resource Conservation: Management for a Sustainable Future*. Benjamin Cummings/Pearson, 2010. Print.
2. Keddy P.A. *Wetland Ecology: Principles and Conservation* Cambridge University Press. 2010. Print.
3. Oliver, S.O., and Daniel, D.C. *Natural Resource Conservation: Management for a Sustainable Future*. New Jersey: Prentice Hall International, 1990. Print.
4. Rai, G.D. *Non-Conventional Energy Sources*. Delhi: Khanna Publishers, 1993. Print.
5. Ramijhan, S.K. *Agro Industrial by Products and Non-Conventional Feed for Live Stock*. New Delhi: Indian Council for Agriculture Research, 1990. Print.
6. Weddell B.J. *Conserving Living Natural Resources: In the Context of a Changing World.* Cambridge University Press, 2002. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester III
Paper: Scientific Writing and Research Methodology
Code: BOT621

L	T	P	Credits	Max. Marks	Minimum marks
3	1	0	4	100	40

Objective:
To make the students learn how to design an experiment and what are the various research strategies.

Teaching Methodology:
Class room Lectures, practicals, models, charts, power point presentations.

Learning outcomes
This course will impart the comprehensive knowledge of designing a research experiment, how to write a research paper, the relevant ethics, copy right, impact factor etc.

UNIT-I

Biostatistics: Definition and relevance in biological research; Measures of Central Tendency: Arithmetic Mean, median, mode, quartiles and percentiles; Measures of Dispersion: Range, variance, standard deviation, coefficient of variation; Skewness and Kurtosis. **(5 Lectures)**

Inferential Statistics: Hypothesis testing, Errors in Hypothesis Testing- Null Hypothesis, Alternative Hypothesis, Type I and Type II errors, Confidence Limits. Setting up of level of significance. One tailed and Two- tailed tests. **(2 Lectures)**

Correlation and Regression: Correlation coefficient (r), properties, interpretation of r, partial and multiple correlations, linear regression: Fitting of lines of regression, regression coefficient, Bivariate and Multiple Regression. **(5 Lectures)**

UNIT-II

Parametric and Non-Parametric Statistics: Definition, Advantages, Disadvantages, Assumptions; Parametric Tests: Student's t-test, One Way Analysis of Variance, Two Way Analysis of Variance; Non-Parametric Tests: Analysis of Variance, Chi square and Kendall Rank Correlation **(6 Lectures)**

Experimental Set-up: Basic principles and significance of research design; Randomized Block Designs (RBD), completely randomized designs (CRD); Latin square design and Factorial design **(5 Lectures)**

UNIT-III

Data collection, organization and interpretation.

Research articles, research papers, popular research articles and reviews; difference between periodicals; journals; monographs, magazines; proceedings.

How to write a research paper, reference styles, process of submission of a paper; process of proof reading of a research manuscript; process of reviewing.

Important journals in plant sciences. **(15 Lectures)**

UNIT-IV

An introduction to Science citation index; H-index, i10 index, Impact factor calculation, Impact factor of a journal; Eigen factor, Major journal search engines.

Copyright act; Academic frauds; Plagiarism; Softwares to check plagiarism. **(10 Lectures)**

Reference Books

1. Kothari, C.R. *Research Methodology – Methods and Techniques*. 2nd revised ed. New Delhi: New Age International (P) Ltd. Publishers, 2007. Print.
2. McKillup, S. *Statistics Explained. An Introductory Guide for Life Scientists*. Cambridge, UK: Cambridge University Press, 2006. Print.
3. Selvin, S. *Biostatistics – How it Works.* First Impression. New Delhi: Pearson Education Inc., 2007. Print.
4. Agarwal, B.L. *Basic Statistics*. New Delhi: New Age International, 2006. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester III
Paper: Advanced Plant Systematics
Paper code: BOT622

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:
To familiarize the students about the origin, evolution and taxonomy of angiosperms.

Teaching Methodology:
Class room lectures, practicals, models, charts, power point presentations.

Learning outcomes
The students will acquire the knowledge of evolution, their systematic position, nomenclature of an organism/species.

UNIT I

Taxonomic History: Natural systems to cladistics: Natural systems; Phyletic systems; Phenetics; Cladistics. **(4 Lectures)**

Classification: The components of classification; Characters and their states; Sources of characters; Evaluation of characters. **(4 Lectures)**

Systematics: Keys for identification of plants; Evidences from morphology, palyonology, cytotaxonomy, chemotaxonomy, serology, computers and GIS; molecular systematics. **(4 Lectures)**

UNIT II

Botanical Nomenclature: Kinds of names; International Code of Botanical Nomenclature Melbourne Code 2011, Names according to rank; Citation of authors; Priority; Type method; Naming a new species; Legitimacy; Synonyms. **(8 Lectures)**

Molecular Systematics: Generating molecular data: restriction site mapping, gene sequencing **(6 Lectures)**

UNIT III

Phylogenetics: The nature of phylogeny; How we depict phylogeny?; The importance of homology, Polarizing characters of homology; The problem of homoplasy. **(4 Lectures)**

Introduction to the angiosperms: General characteristics; Evolutionary history; Basal angiosperms and Magnoliids; Basal monocots; Petaloid monocots; Commelinids; Basal eudicots and Caryophyllids; Rosids; Asterids. **(8 Lectures)**

UNIT IV

Salient Features and Economic Importance of Dicot Families: Apocyanaceae; Verbenaceae; Chenopodiaceae; Capparidaceae; Caryophyllaceae; Myrtaceae; Apiaceae; Acanthaceae; Moraceae; Rubiaceae. **(10 Lectures)**

Salient Features and Economic Importance of Monocot Families: Amaranthaceae; Musaceae; Cannaceae; Commelinaceae. **(4 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Advanced Plant Systematics Laboratory
Paper code: BOT623

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Live plants/ Herbarium specimens of the following families will be provided in the class for description and identification (classification based on APG II, 2003):
   a) Basal Angiosperm and Magnoliids: Nymphaeaceae, Magnoliaceae
   b) Basal Monocots: Araceae, Alismataceae
   c) Petaloid monocots: Liliaceae, Smilacaceae, Alliaceae, Orchidaceae
   d) Commelinids: Arecaceae, Poaceae, Cyperaceae
   e) Basal Eudicots and Caryophyllids: Ranunculaceae, Caryophyllaceae
   f) Rosids: Euphorbiaceae, Rosaceae, Fabaceae, Cucurbitaceae
   g) Asterids: Solanaceae, Lamiaceae, Apiaceae, Asteraceae
2. Cladogram construction and analysis

Reference Books

1. Angiosperm Phylogeny Group. "An Update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG II." *Botanical Journal of the Linnaean Society*: 141 (2003): 399-436. Print.
2. Crawford, D.J. *Plant Molecular Systematics*. Cambridge, UK: Cambridge University Press, 2003. Print.
3. Cronquist, A. *An Integrated System of Classification of Flowering Plants*. New York: Columbia University Press, 1981. Print.
4. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., and Donoghue, M.J. Plant *Systematics: A Phylogenetic Approach*. Massachusetts: Sinauer Associates, Inc., 2002. Print.
5. Maheshwari, J.K. *The Flora of Delhi*. New Delhi: CSIR, 1963. Print.
6. Nei, M., and Kumar, S. *Molecular Evolution and Phylogenetics*. New York: Oxford University Press, 2000. Print.
7. Radford, A.E., Dickison, W.C., Massey, J.R., and Bell, C.R. *Vascular Plant Systematics*. New York: Harper and Row, 1974. Print.
8. Semple, C., and Steel, M.A. *Phylogenetics*. Oxford: Oxford University Press, 2003. Print.
9. Simpson, M.G. *Plant Systematics*. Amsterdam: Elsevier, 2006. Print.
10. Stuessy T.F. *Plant Taxonomy: The systematic Evaluation of Comparative Data*. New York: Columbia University Press, 2009. Print.
11. Bierhorst, D.W. *Morphology of Vascular Plants*. New York: The Macmillan and Co., 1971. Print.
12. Cronquist, A. *The Evolution and Classification of Flowering Plants*. Boston: Houghton Miffin, 1968. Print.
13. Naik, V.N. *Taxonomy of Angiosperms*. New Delhi: Tata McGraw Hill, 1984. Print.
14. Pandey, S.N., and S.P. Misra. *Taxonomy of Angiosperms*. India: Ane Reference Books, 2008. Print.

DAV UNIVERSITY, JALANDHAR

Paper: Project-I
Paper code: BOT624

L	T	P	Credits	Max. Marks	Minimum marks
0	0	2	2	50	20

Guidelines for Project Synopsis:

Research experience is as close to a professional problem-solving activity as anything in the curriculum. During the course students will come to know about the general understanding of the common problems and recent advances in research.As a preparatory of project work student/s need to formulate a legible research problem and go through literature search to propose ways to address the problem. A short account of this work need to be presented by the students in written format to the advisors. The students shall submit a synopsis on the research problem, which shall be evaluated by the concerned internal faculty. Student will have to understand the topic and collect literature. Through this, the students will develop habit of reading newer topics, will become inquisitive and develop research aptitude. A verbal presentation aided with media tools should follow the submission of written synopsis.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective-I
Paper: Economic Botany

Paper code: BOT625

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:
To familiarize the students about the botanical names, family to which they belong and economic importance of various herbs, shrubs and trees of daily use.

Learning outcomes
The students will learn the origin, cultivation, high yielding varieties, part used, active principles etc. of some food, oil, drugs, spice, rubber etc yielding plants.

UNIT-I

Concept of centers of origin, their importance with reference to Vavilov's work; World centers of primary diversity and secondary centers of cultivated plants; The Indo-Burmese center; plant introductions. **(4 Lectures)**

Origin, evolution, cultivation and significance of the following:

Psychoactive drugs and Narcotics: Tobacco, Cola, Areca, Coca

Medicinal and aromatic plants: *Cinchona, Digitalis, Rauvolfia, Papaver, Cannabis, Rosa, Cymbopogon, Vetiveria, Santalum* and *Eucalyptus*

Fibers: Cotton, Flax, Jute, Ramie, Hemp, Kapok **(12 Lectures)**

UNIT-II

Spices and condiments*:* Source, collection and uses of Ginger, Turmeric, Cinnamon, Saffaron, Clove, Pepper, Coriander, Cumin, Fennel, Cardamom, Fenugreek, Peppermint, Vanilla, Nutmeg & Mace, Oregano, Thyme, Basil, Celery, and Rosemary. **(15 Lectures)**

Natural Rubber: Para Rubber, tapping and processing, Various substitutes of Para Rubber. **(2 Lectures)**

UNIT-III

Origin, evolution, cultivation and significance of the following:

Beverages: tea, coffee, cocoa

Oil yielding plants: Coconut, mustard and linseed

Food: Wheat, Rice, Soybean, groundnut, gram, mango, citrus and papaya **(15 Lectures)**

UNIT-IV

Bioinsecticides: Source and uses of plant based insecticides-Pyrethrum, Rotenone, herbicides Plants used as avenue trees for shade, pollution control, aesthetics.

Green Revolution*:* Introduction, Wheat breeding, The wheat revolution, Rice varietal improvement, the brown side of green revolution

Plant Introduction activities in India **(12 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Economic Botany Laboratory
Paper code: BOT626

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

The practical course is divided into three units; (1) Laboratory Work; and (2) Field Survey and Scientific Visits.

Laboratory Work

1. Morphology, anatomy, microchemical tests for stored food materials*:* Wheat, rice, maize, chickpea (Bengal gram), potato, sugarcane.
2. **Forage/fodder Crops***:* Study of any *five* important crops of the locality (e.g. sorghum, bajra, berseem, clove, guar, bean, gram, *Ficus* sp.).
3. Morphology, microscopic structure of the oil-yielding tissues, tests for oil and iodine number of vegetables Oils (mustard, groundnut, coconut, sunflower, castor)

Field Survey:

1. Prepare a list of 10 most important sources of firewood and timber in your locality. Give their local names, scientific names and families to which they belong.
2. The students should be taken to a recognized botanical garden or a museum (such as those at the Forest Research Institute, Dehra Dun; National Botanical Research Institute, Lucknow) to a CSIR Laboratory doing research on plants and their utilization and an ICAR Research Institute or a field station dealing with crops.

Reference Books

1. Bole, P.V., and Vaghani, Y. *Field Guide to Common Indian Trees.* Mumbai: Oxford University Press, 1986. Print.
2. Chandel, K.P.S., Shukla, G., and Sharma, N. *Biodiversity in Medicinal and Aromatic Plants In India: Conservation and Utilization.* New Delhi: National Bureau of Plant Genetic Resources, 1996. Print.
3. Cristi, B.R. *Handbook of Plant Science and Agriculture*, Vol. I. *In-situ Conservation*, Florida, U.S.A: CRC Press, Boca Raton, 1999. Print.
4. Council for Scientific & Industrial Research. *The Useful Plants of India*, New Delhi: Publications and Information Directorate, CSIR, 1986. Print.
5. Kocchar, S.L. *Economic Botany of the Tropics*, 2nd ed., New Delhi Macmillan India Ltd., 1998. Print.
6. Swaminathan, M.S., and Kocchar, S.L., (eds.). *Plants and Society*. London: MacMillan Publications Ltd., 1989. Print.
7. Thakur, R.S., Puri, H.S. and Husain, A. *Major Medicinal Plants of India.* Lucknow: Central Institute of Medicinal and Aromatic Plants, 1989. Print.
8. Walter, K.S., and Gillett, H.J. *IUCN Red List of Threatened Plants.* U.K.: World Conservation Union, IUCN, Switzerland, and Cambridge, 1998, 1997. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective-I
Paper: Agricultural ecology –principles and application
Code: BOT627

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To provide an understanding of the basic theories and principles of ecology and to help study various aspects related to ecology

Teaching Methodology:

Class room lectures, practicals, models, charts, power point presentations.

Learning outcomes

This course is designed to present an introduction to current theories and practices in ecology. Students will learn the basic principles of ecology, emphasizing population, community and ecosystem ecology. They will understand ecological concepts.

UNIT I

Introduction to ecology, evolutionary ecology, environmental concepts – laws and limiting factors, ecological models, Significance of habitat, biodiversity, ecological niche **(3 lectures)**

Evolution and Natural Selection

Agents of evolution, types of natural selection, allopatric and sympatric speciation, reproductive isolating mechanisms, Galapogos finches **(7 lectures)**

UNIT II

Autecological concepts - Population Ecology

Characteristics of populations - size and density, dispersion, age structure, natality and mortality. **(3 lectures)**

Population growth - factors affecting population growth, environmental resistance, biotic potential, carrying capacity, positive and negative interaction, migration, subsistence density, security and optional density. Exponential growth, limits of population growth, population dynamics, life history pattern, fertility rate and age structure. Ecological consequence of overpopulation. **(9 lectures)**

UNIT III

Genecology - ecological amplitude, ecads, ecotypes, ecospecies, coenospecies, k-selection and r-selection populations. **(2 lectures)**

Competition and coexistence, intra-specific interactions, inter-specific interactions, scramble and contest competition model, mutualism and commensalism, prey-predator interactions.

(3 lectures)

Synecological concepts - Community ecology

Ecological processes of community formation, ecotone, edge effect. Classification of communities criteria of classification, dynamic system of classification by Clement.

Special plant communities - quantitative, qualitative and synthetic characteristics of plant communities, Sorenson's Index of similarity, coefficient of communities.

Dynamic community characteristics - cyclic replacement changes and cyclic no-replacement changes. **(7 lectures)**

UNIT IV

Dynamic Ecology - Ecological succession

The concept, definition and reasons of succession. Classification of succession: Changes - autogenic and allogenic, primary and secondary, autotrophic and heterotrophic.

Retrogressive changes or the concept of degradation, concept of climax or stable communities, resilience of communities, ecological balance and survival thresholds, changes in ecosystem properties during succession. **(4 lectures)**

Biosphere and Ecosystem

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, controlling factors); global biogeochemical cycling and ecosystem nutrient cycles.

primary and secondary productivity, food chains, food webs, ecological pyramids, energy flow and nutrient cycles. **(6 lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Agricultural Ecology-Principles and Applications Laboratory
Paper code: BOT628

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Quantitative and qualitative community analysis. Carry out a project on species structure and the frequency, abundance, density of different species and similarity index of different communities in a natural system. Students must be able to explain the structure of vegetation from the given data on the above mentioned characteristics.
2. Phytoplankton counting using Sedgwick Rafter counter.
3. Field visit to natural ecosystem and identification of trophic levels, food webs and food chains, plant diversity (species and community).

Reference books:

1. Sharma, P.D. *Environment and Ecology*. New Delhi: Rastogi Publications. 2009. Print.
2. Odum, E.P. *Fundamentals of Ecology*. 3rd ed. Philadelphia: Saunders, 1971. Print.
3. Conklin, Alfred R., and Rolf Meinholtz. *Field Sampling: Principles and Practices in Environmental Analysis*. New York: Marcel Dekker, 2004. Print.
4. Fahey, Timothy J. *Principles and Standards for Measuring Primary Production*. Oxford: Oxford UP, 2007. Print.
5. Grant, William E., and Todd M. Swannack. *Ecological Modeling: A Common-sense Approach to Theory and Practice*. Malden, MA: Blackwell Pub., 2008. Print.
6. Wilkinson, D.M. *Fundamental Processes in Ecology: An Earth system Approach*. Oxford: Oxford Scholarship Online. 2007. Print.
7. Briggs, D. and Walters, S.M. *Plant Variation and Evolution*. Cambridge: Cambridge University Press. 1997. Print.
8. Futuyma, Douglas J. *Evolutionary Biology*. 3rd ed. Sunderland, Mass.: Sinauer Associates, 1998. Print.
9. Ridley, M. *Evolution*. New York: Blackwell. 2003. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester IV
Paper: Analytical Techniques
Paper code: BOT608

L	T	P	Credits	Max. Marks	Minimum marks
2	0	0	2	50	20

Objective:

To acquaint the students about the various techniques used to analyze a biological system.

Teaching Methodology:

Class room lectures, practicals, models, charts, power point presentations.

Learning outcomes

This course will make the students learn the principles, procedures and uses of various bioanalytical techniques used for plant/animal analysis.

UNIT I

pH and buffer solutions: acids and bases, hydrogen ion concentration, dissociation of acids and bases, Buffer solutions. pH metery – Principles, working and applications, titration curves. **(6 Lectures)**

Microscopy: Principles and applications of Light, Phase Contrast, Fluorescence, Scanning and Transmission Electron Microscopy, Flow cytometry. **(8 Lectures)**

UNIT II

Chromatographic techniques: Principles, procedure and application of Colorimetry, Spectrophotometry Paper Chromatography, Thin Layer Chromatography, Gel filtration, Ion Exchange and Affinity Chromatography, GLC; High Pressure Liquid Chromatography; and Flame Photometry. **(12 Lectures)**

UNIT-III

Centrifugation: Technique and principles; Preparative and analytical centrifugation, High speed centrifuges, rotors, ultracentrifugation, density gradient centrifugation **(5 Lectures)**

Electrophoresis and Isoelectric focusing: Principle, working and applications of Electrophoresis; one and two dimensional gel electrophoresis, Isoelectric focusing gels; Analysis of RNA, DNA and proteins electrophoresis. **(2 Lectures)**

Protein sequencing methods, detection of post translation modification of proteins. **(1 Lecture)**

DNA sequencing: methods, strategies for genome sequencing; Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques. **(3 Lecture)**

UNIT IV

Radiolabeling techniques: Detection and measurement of radioisotopes normally used in biology; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines; Autoradiography. **(10 Lectures)**

Molecular techniques: Random Fragment Length Polymorphism (RFLP); Fluorescence In-Situ Hybridization (FISH), Genomic In-Situ Hybridization (GISH), Fiber-FISH, Q-FISH; Flow FISH: Flow Cytogenetics, Flow karyotyping; Random amplified polymorphic DNA. **(7 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Analytical Techniques laboratory
Paper code: BOT609

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	1	25	10

1. Genomic DNA isolation.
2. DNA and Protein analysis by Gel electrophoresis.
3. To demonstrate Beer's law using different dyes.
4. Preparation of Phosphate Buffers of different pH values.
5. Practicals pertaining to Chromatographic techniques: Column Chromatography (Exclusion and Affinity Chromatography), Paper Chromatography and Thin Layer Chromatography.
6. Practicals pertaining to centrifugation.

Reference Books

1. Plummer, D.T. *An Introduction to Practical Biochemistry*. New Delhi: Tata McGraw Hill Publishing Ltd., 1994. Print.
3. Potter, G.W.H. *Analysis of Biomolecules: An introduction to Principles, Instrumentation and Techniques*. London: Chapman and Hall, 1995. Print.
4. Primrose, S.B., Twyman, R.M., and Old, R.W. *Principles of Gene Manipulation.* UK: Blackwell Publishers, 2001. Print.
5. Sawhney, S.K., and Singh, R. *Introductory Practical Biochemistry.* New Delhi: Narosa Publishing House, 2002.
6. Wilson, K., and Walker, J. *Principles and Techniques of Practical Biochemistry.* Cambridge: Cambridge University Press. 2000. Print.

DAV UNIVERSITY, JALANDHAR

Paper: Project-II
Paper code: BOT631
Project Report

L	T	P	Credits	Max. Marks	Minimum marks
0	0	8	8	200	80

Guidelines for Project:
Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of research project are publishable, the project should be communicated in the form of a research report written by the student.
Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be criticized by the faculty guide and corrected by the student at each stage.
The file is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

In general, the File should be comprehensive and include:
- A short account of the activities that were undertaken as part of the project
- A statement about the extent to which the project has achieved its stated goals.
- Assessment about the outcomes of the experimentation processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

Report Layout
The report should contain the following components:

Title or Cover Page
The title page should contain the following information: Project Title; Student' name; Course; Year; Supervisor' name

Acknowledgements (optional)
Acknowledgement to any advisory or financial assistance received in the course of work may be given

Abstract
A good abstract should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

Table of Contents
Title and subtitles are to correspond exactly with those in the text

Introduction
Here brief introduction to the problem that is the central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modification if any.

Results and Discussion

Present results, discuss and compare these with those from other workers etc. In writing these section, emphasis should be given on what has been performed and was achieved in the course of the work, rather than discuss in detail what is readily available in the text books. Avoid abrupt changes in the contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter should be included in a smooth flow.

Note that in writing the various sections, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in "point" form.

Conclusion

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

Future Prospects

Appendices

The appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

References

This should include papers and books referred to in the body of the report.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective II
Paper: Plant Ecology and Phytogeography
Code: BOT632

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To inspire the students about ecological importance of the environment, natural resources, various problems related to environment and its protection.

Teaching Methodology:

Class room Lectures, practicals, models, charts, field visit, power point presentations.

Learning outcomes

The students will understand the various conservation strategies, man-made environmental issues at local, national and global level and the measures to control their adverse effects at individual and collective level.

UNIT-I

Ecology and Environment: Definition, history and scope of ecology, sub divisions of ecology, ecology vs environmental science. Interdisciplinary nature of environmental science. **(2 Lectures)**

Management and Conservation of Natural Resources: Aims, objectives and principles of conservation; Conservation policies; Conservation strategies at national and international level; Sustainable development and ecological economics. **(10 Lectures)**

Environment Pollution: Definition, Different types of pollutants; Sources of pollutants of **air, water and soil;** Effects of pollutants of air, water and soil; Control of pollution; Detailed account of Indoor pollution. **(7 Lectures)**

UNIT-II

Global Environmental Changes: Global warming; Climate change, reasons, Factors contributing to climate change; consequences of climate change and measures to combat the problem. **(3 Lectures)**

Ozone hole: General account of ozone layer and hole; Factors contributing to ozone hole; Effects and Remedies. **(2 Lectures)**

Environment Protection: International concern and efforts for environmental protection, global plan, Stockholm Summit, priority issues; Earth Summits. **(5 Lectures)**

Resource Economics: Introduction and significance. **(2 Lectures)**

Environment Impact assessment: Introduction and significance. **(1 Lecture)**

UNIT-III

Phytogeography: Definition, principles governing plant distribution, factors affecting plant distribution, theories of distribution, different types of distribution of vegetations on the earth, continuous and discontinuous distribution. **(6 Lectures)**

Climate, vegetation and botanical zones of India, role of precipitation and temperature in determining the major types of vegetation and endemism in India. **(3 Lectures)**

Remote sensing: Definition and data acquisition techniques. Application of remote sensing in vegetation classification, understanding the key environmental issues and ecosystem management. **(3 Lectures)**

UNIT-IV

Environmental biotechnology and solid waste management: Concept of waste, types and sources of solid wastes including e-waste. Bioindicator and biomarkers of environmental health. Bioremediation, Phytoremediation, bioaugmentation, biofilms, biofilters, bioscrubbers and trickling filters. Use of bioreactors in waste management. **(6 Lectures)**

Allelopathy: concept, mechanisms and exploitation in weed management. **(4 Lectures)**

Plant Invasion: Definition, factors (both Intrinsic and extrinsic) affecting invasion, Status and impact of plant invasion on native flora. **(4 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Plant Ecology and Phytogeography Laboratory
Code: BOT633

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. An introduction to various methods of sampling vegetation
2. Determination of density, dominance and cover area and Importance values Index
3. Determination of various ecological indices.
4. Evaluation of dominance and importance value index.
5. Study of similarity and dissimilarity index between two communities.
6. Vegetation analysis – Direct gradient analysis and Ordination and indirect methods
7. Demonstration of impact of pollutants on plants through field studies and laboratory experiments.
8. Demonstration of allelopathy under laboratory and field conditions
9. An assignment on the floral diversity of weeds and other common herbs of the DAV University Campus.

Reference Books

1. Altieri, M.A., and Liebman, M. *Weed Management in Agrocosystems: Ecological Approaches*. Florida, USA: CRC Press, 1988. Print.
2. Botkin, D. and Keller, E. *Environmental Science*. New York, USA: John Wiley Publishers, 1995. Print.
3. Enger, E.D., and Smith, B.F. *Environmental Science*. Iowa, U.S.A.: WCB, Publishers, 1992. Print.
4. Hunter, M.L. *Maintaining Biodiversity in Forest Ecosystems*. Cambridge: Cambridge University Press, 1999. Print.
5. Newman, E.I. *Applied Ecology*. UK: Blackwell Scientific Publishers, 1994. Print.
6. Odum, E.P. *Fundamentals of Ecology*. USA: Saunders Toppan, 1971. Print.
7. Ramakrishanan, P.S. *Ecology of Biological Invasion in the Tropics*. New Delhi: International Scientific Publications, 1991. Print.
8. Raven, P.H., Berg, L.R., and Hassenzahl, D.M. *Environment*. 7th ed. USA: Wiley, Hoboken, 2010. Print.
9. Shibu, J., Singh, H.P., Batish, D.R. and Kohli, R.K. *Invasive Plant Ecology*. New York, USA: CRC Press, Taylor and Francis Group, Boca Raton, 2013. Print.
10. Singh, H.P., Batish, D.R., and Kohli, R.K. *Handbook of Sustainable Weed management*. New York, USA: Food Products Press, 2006. Print.
11. Singh, J.S., Singh, S.P., and Gupta, S.R. *Ecology, Environment and Resource Conservation*. New Delhi: Anamaya Publishers, 2006. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective II

Paper: Advanced Plant Physiology and Biochemistry

Code: BOT634

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To acquaint the students about molecular regulation of various physiological processes at genome level in plants.

Teaching Methodology:

Class room lectures, practical, models, charts, power point presentations.

Learning outcomes

The students will have a comprehensive knowledge about the Physiological and biochemical regulation of the processes that are necessary for sustenance of life on earth.

UNIT-I

Energetics: Photosynthesis-organization and arrangement of PS-I and PS-II; regulatory action of uncoupling agents of photophosphorylation; molecular regulation of RUBISCO action; genetics of RUBISCO subunit assembly and organization in plants; physiological and ecological aspects of photosynthesis; RUBISCO remodelling. **(5 Lectures)**

Respiration – regulation of key respiratory enzymes with particular emphasis on phosphofructo kinase, glyceraldehydes-3-phosphate dehydrogenase and pyruvate dehydrogenase; mechanism of action of inhibitors of oxidative phosphorylation; arrangement and organization of ATP synthase complex. **(4 Lectures)**

UNIT-II

Nitrogen metabolism: Process of biological nitrogen fixation; nodule formation-role of NOD genes and nodulins; NIF genes; molecular biology of nitrogenase complex; regulation of nitrogen fixation; nitrogen assimilation in higher plants. **(5 Lectures)**

Secondary metabolism: Biosynthesis and roles of alkaloids, flavonoids, steroids, terpenoids, lignin and carotenes; commercial and economic importance of secondary metabolites; role of secondary metabolites in plant defence. **(5 Lectures)**

Source-sink relationship: Translocation in the phloem; Phloem loading; Phloem unloading; Regulation of source to sink relationship; Sink strength. **(2 Lectures)**

UNIT-III

Metabolism: Lipid catabolism and membrane generation *de novo*; catabolism and breakdown of proteins; function of glycerolipids as membrane constituents and carbon stores. **(6 Lectures)**

Blue-light responses: Stomatal movement; morphogenesis; circadian rythms; regulation of plant movements. **(2 Lectures)**

Plant genomes: Role of chloroplast and mitochondrial genomes; retrograde signalling. **(4 Lectures)**

DAV UNIVERSITY, JALANDHAR

UNIT-IV

Plant Stress Biology: Plant responses to abiotic stresses, mechanisms of abiotic stress tolerance, water deficit and drought tolerance, salinity stress, metal toxicity, freezing and heat stress; Plant stress signalling; NO mediated signaling, markers of nitrosative stress, NO crosstalk with other hormones, antioxidant mechanisms. **(12 Lectures)**

DAV UNIVERSITY, JALANDHAR

Paper: Advanced Plant Physiology and Biochemistry Laboratory
Code: BOT635

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

1. Isolation of lipids from green gram cotyledons.
2. Production and Isolation of gibberellic acid from *Fusarium moniliformae* and demonstration of its activity in pea seedling bioassay.
3. To grow plants under salt and drought stress and demonstration of different stress enzymes like catalase, superoxide dismutase, peroxidise.
4. Qualitative estimation of alkaloids from suitable plant material.
5. Isolation of mitochondria from suitable plant material.

Reference Books

1. Srivastava, L.M. *Plant Growth and Development*. NewYork: Associated Press, 2002. Print.
2. Stryer, L. *Biochemistry*. 5th ed. New York: W.H. Freeman and Co., 1995. Print.
3. Taiz, L., and Zeiger, E. *Plant Physiology*. California: The Benjamin/Cumming Publishing Company, 1998. Print.
4. Voet, D., and Voet, J.G. *Biochemistry*. New York: John Wiley and Sons Inc., 1995. Print.
5. Wilkins, M.B. *Advanced Plant Physiology*. New York: Pitman, 1984. Print.
6. Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. India: I K Internationals, 2005. Print.
7. Heldt, H.W. *Plant Biochemistry*. California: Elsevier, 2005. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective III
Paper: Forestry
Paper code: BOT636

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To expose the students about the practice of growing trees, their legal and social protection, plantation of trees for different purposes etc.

Teaching Methodology:

Traditional method of class room lectures, forest visits, and performing practicals related forestry.

Learning outcomes

The studies will provide students with the knowledge of importance and conservation of forests.

UNIT-I

Common forestry Practices and Forest dynamics: Forest regeneration, tending, thinning, pruning and harvesting. Various interactions within forest communities, disturbances and succession, Gap dynamics **(8 Lectures)**

UNIT - II

Forest Protection: Protection, causes and control of forest fires; Major diseases of forest plants. **(2 Lecture)**

Forest Laws and Forest Conservation: Salient features of the Indian Forest Act 1972 (preliminary, reserved forests, protected forests), different methods employed for conservation of forests. **(2 Lectures)**

Ecosystem Services: Definition, General account; Different types; Significance. **(1 Lecture)**

UNIT - III

Forests Types: Climate of India, different climatic regions of India; Central characters and distribution of the different forest types of India. **(4 Lectures)**

Forest Effects: General effects of forests on climate, control of runoff, effects on snow, soil erosion, wild life, pollution control, nutrient cycling, social values and ecotourism, economic values, floods, green belts and control of temperature. **(9 Lectures)**

UNIT - IV

Social Forestry: Social forestry- social land allocation programmes (Taungya system). Economic benefits of social forestry.

Agroforestry: Role in- soil conservation, soil restoration, conservation of biodiversity.

Watershed Management: Physiographic features, infiltration, soil water storage, pore spaces, available water, evapotranspiration.

Climate change and Forestry: Definition of climate change, impact of climate change on forests, adaptation of trees to climate change.

(12 Lectures)

Reference Books

1. Batish, D.R., Kohli, R.K., Jose, S., and Singh, H.P. *Ecological Basis of Agroforestry*. NewYork: CRC Press, 2008. Print.
2. Chaturvedi, A.N. *Forest Mensuration*. Dehradun: International Book Distributors, 1982. Print.
3. Dwivedi, A.P. *A Text Book of Silviculture*. Dehradun: International Book Distributors, 2006. Print.
4. Gopikumar, K., Gopakumar, S., and Anoop, E.V. *Forest Nursery and Tree Husbandry*. Dehradun: International Book Distributors, 2003. Print.
5. Jha, L.K. *Forestry for Rural Development*. New Delhi: APH Publishing Corporation, 1996. Print.
6. Khosla, P. K., and Kohli, R.K. *Social Forestry for Rural Development*. Solan: Indian Society of Tree Scientists ;, 1988. Print.
7. Kohli, R.K., Arya, K.S., Singh, H.P. and Dhillon, H.S. *Tree Directory of Chandigarh*. New Delhi: Lovedale Educational, 1994. Print.
8. Negi, S.S. *Elements of General Silviculture*. Dehradun: International Book Distributors, pp. 269, 2003. Print.
9. Negi S.S. *Hand Book of Forest Ecology and Biology*. Dehradun: International Book Distributors, 2004. Print.
10. Puri, G.S., Mehr-Homji, V.M., Gupta, R.K., and Puri, S. *Forest Ecology Vol. 2*. New Delhi: Oxford & IBH, 1989. Print.
11. Sahni, K.C. *The Book of Indian Trees.* 2nd ed. Mumbai: Oxford University Press, 2000. Print.
12. Stoddard, C.H. *Essentials of Forestry Practice*. New York: Wiley, 1959. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School)- Departmental Elective III
Paper: Advances in Plant Breeding
Code: BOT637

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Objective:

To make the students learn about various breeding techniques that are used to develop new genotypes of important crop plants.

Teaching Methodology:

Class room Lectures, models, charts, power point presentations.

Learning outcomes

This course will impart the knowledge of plant reproductive processes and these processes can be used for the creation of new and improved genotypes.

UNIT-I

Heritability: Definitions; Methods of estimation; Factors influencing heritability.

Genotype X Environment interaction: Models; implications in testing programme; stability of genotype performance.

Parent selection in Breeding Programme: Criteria for selecting parents; Type of crosses and strategies; Sources of parent germplasm. (**10 Lectures)**

UNIT-II

Breeding Methodology: Pedigree method; Bulk method; Single-seed descent method; Backcross method; Production of doubled haploids

Mixture, Blends, and Composites; Early Generation Testing; Selection Index - Multiple Trait Selection; Linkage and Plant Breeding **(15 Lectures)**

UNIT-III

Intrapopualtion Improvement: Selection theory; Hardy-Weinberg law; Normal distribution; Components of variation; Genetic advance

Mass selection-Genetic gain theory; Gardner's Grid system; Half-sib family selection; Ear-to-row selection; Modified ear-to-row selection; Genetic gain theory; Half-sib recurrent selection (or test cross); Testers; S1 progeny recurrent selection; S2 family selection; Full-sib family recurrent selection; Genetic gain theory **(12 Lectures)**

UNIT-IV

Interpopulation Improvement: Reciprocal recurrent selection; Reciprocal recurrent selection based on test cross of half-sib families; Reciprocal recurrent selection based on half-sib progenies of prolific plants; Reciprocal full-sib recurrent selection

Hybrid Development: Inbreeding; Methods of inbreeding; Inbreeding depression; Types of hybrid; Factors in comparing hybrid types; Calculating number of possible hybrids; Prediction of double and 3-way hybrid yields from single cross data; Topcross testers for inbred line development; Type of testers; Stage of testing **(12 Lectures)**

Reference Books

1. Singh, B.D. *Plant Breeding: Principles and Methods*. New Delhi: Kalyni Publishers, 2013. Print.
2. Chahal, G. S., and S. S. Gosal. *Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches*. Boca Raton, Fla.: CRC, 2002. Print.
3. Roy, Darbeshwar. *Plant Breeding: A Biometrical Approach*. Oxford: Alpha Science International, 2012. Print.
4. Allard, R.W. *Principles of Plant Breeding*. New York: Wiley India Pvt. Ltd., 2010. Print.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester I
Paper: Cell Biology
Paper code: BTY513

L	T	P	Credits	Max. Marks	Minimum marks
4	0	0	4	100	40

Course Objective: The object of the present course is to develop basic knowledge in cell biology to make students understand the structure and function of the cellular and sub cellular components of cells and tissues with the help of recent techniques. The course will help students to get an understanding of cell function at the molecular level including the fundamentals of biology. They will become aware of the complexity and harmony of the cell.

1. **History of cell biology:** Development of cell theory, Diversity of cell size and shape: General organization and diversity of prokaryotic and eukaryotic cells. Origin of cells: Assembly of macromolecules (proteins and nucleic acid), mechanism of assembly, evolutionary steps in the origin of cells (Chemical evolution).**9 hours**
2. **Microscopic techniques for study of cells:** Bright field, Fluorescence, Phase contrast, DIC, dark field, Polarization, Confocal. Electron Microscopy: TEM, SEM, AFM, STEM, Preparation of samples for EM. Applications of Light Microscopy and EM in cell biology. **6 hours**
3. **Sub cellular fractionation:** Fractionation and marker enzymes and functional integrity, FACS, separation techniques for membrane proteins. Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility). **6 hours**
4. **Membrane structure and function:** Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. **5 hours**
5. **Cell Trafficking :** Targeting proteins to endoplasmic reticulum, signal recognition particle, signal recognition particle receptor, protein folding and processing in ER protein export from ER; Protein sorting and export from Golgi Apparatus; SNARE hypothesis; Protein import into Mitochondria, mitochondrial genome; Import and sorting of chloroplast protein. Cellular energy transactions: Role of mitochondria and chloroplasts. **8 hours**
6. **Cell division and Cell cycle & its regulation:** Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. Molecular events and model systems; the role of the cyclins and cyclin-dependent kinases, cell cycle checkpoints, methods for synchronizing the cell cycle in cell populations. **3 hours**
7. **Cellular responses to environmental signals in plants and animals:** Mechanism of signal transduction. Cell signaling - Modes of cell signaling, steroid hormone receptors, plant hormones, G-protein coupled receptors; regulation of signaling

pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemotaxis and quorum sensing, c- AMP pathway of signal transduction ; c GMP, phospholipids and calcium ions, Ras, Raf , MAP kinase pathway , JAK –STAT pathway , Apoptosis –role of caspases. **4 hours**

8. **Cell motility:** Cilia, flagella of eukaryotes and prokaryotes, their molecular mechanism. 4 **hours**

Books:

1. Celis, J.E. *Cell biology: A laboratory handbook Vol 1, 2, 3*. UK: Academic Press, 2006. Print.
2. Stryer, L. *Biochemistry*, 4th ed. New York: W.H. Freeman and Co., 1995. Print.
3. Nelson, D.L. and Cox, M.M. *Lehninger Principles of Biochemistry*, 3rd ed. New York: Worth Publishers, 2000. Print.
4. Damal, J., Lodish, H. and Baltimore, D. *Molecular Cell Biology*, 2nd ed. New York: Scientific American Books, 1990. Print.

DAV UNIVERSITY, JALANDHAR

Paper: Cell Biology Laboratory
Paper code: BTY514

L	T	P	Credits	Max. Marks	Minimum marks
0	0	3	2	50	20

- Microscopy: Bright field.
- Instrumental methods for cell biology-centrifugation, chromatography.
- Preparation of permanent slides of cell division.
- Vital staining for visualizing cell organelles.

DAV UNIVERSITY, JALANDHAR

M.Sc. Botany (Hons. School) Semester III

Course Title: Molecular Biology

Course Code: BTY511

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: A comprehensive knowledge of molecular aspects of biological function at the molecular level, particular emphasis on the structure and regulation of genes, as well as, the structure and synthesis of proteins and applications of these concepts in human medicine and health, agriculture, study evolution and other areas.

1. Introduction to molecular biology, basic techniques in molecular biology. DNA and its various forms, super coiling of DNA, DNA melting, repetitive sequences, cot and rot curves, C value paradox, DNA protein interaction, DNA super coiling. Prokaryotic & eukaryotic DNA replication, enzymes and accessory proteins involved in DNA replication, replication origin & replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, gene amplification, mobile genetic elements, homologous and site specific recombination. **12 hours**
2. Prokaryotic and eukaryotic transcription, RNA polymerase, transcription factors, regulatory elements, transcriptional activator, repressor & mechanism of transcription regulation, post-transcriptional processing of mRNA, rRNA & tRNA. **12 hours**
3. Protein synthesis and processing: Ribosome structure, genetic code, prokaryotic & eukaryotic translation, the translation machinery, mechanism and regulation of translation & translation proof-reading, translational inhibitors, Post- translational modification of proteins and intracellular protein targeting, import into nucleus, mitochondria and peroxisome. **10 hours**
4. Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing). **10 hours**
5. Genome sequencing: Genome sizes, organelle genomes, genomic libraries, YAC, BAC libraries, and strategies for sequencing genome, packaging, transfection and recovery of clones, application of sequence information for identification of defective genes. **8 hours**
6. Molecular biology of various stresses, viz. abiotic stresses like drought, salt, heavy metals and tempreture; and biotic stresses like bacterial, fungal and viral disease. Signal transduction and its molecular basis, molecular mechanism of plant hormone action mitochondrial control of fertility, structure, organization and regulation of nuclear gene concerning storage proteins and starch synthesis. **8 hours**

Books:

1. Lodish, H.F., Berk, A., Kaiser, A.C., Krieger, M., Scott, M.P., and Bretscher, A. *Molecular cell biology*. New York: W.H.Freeman, 2008. Print.
2. Lewin, Benjamin. *Genes IX*. Sudbury, Mass.: Jones and Bartlett Publishers, 2008. Print.
3. Sambrook, J., Fritish, E.F., and Maniatis, T. *Molecular cloning: A laboratory manual*. New York: Cold Spring Harbor Laboratory Press, 2000. Print.

DAV UNIVERSITY, JALANDHAR

Course Title: Molecular Biology-LAB
Course Code: BTY512

L	T	P	Credits	Marks
0	0	3	2	50

- Isolation of genomic DNA from bacteria.
- Isolation of genomic DNA from plant.
- Isolation of total RNA from tissue.
- Demonstration of DNA protein interaction.
- Quantification of nucleic acids and proteins.
- Gel electrophoresis:
    - Nucleic acid
    - Protein