

**DAV UNIVERSITY, JALANDHAR**

**D A V UNIVERSITY JALANDHAR**



**Course Scheme  
For  
M.Sc. Botany (Hons.)  
(Program ID-4)**

**1<sup>st</sup> TO 4<sup>th</sup> SEMESTER  
Examinations 2014–2016 Session**

**Syllabi Applicable For Admissions in 2014**

# DAV UNIVERSITY, JALANDHAR

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

### I – IV Semester

#### Examinations 2014 - 2016

#### Semester I

| S. No | Paper Code | Course Title                                 | L         | T        | P         | Cr        | (% weightage) |    |    |     | Total marks |
|-------|------------|--|-----------|----------|-----------|-----------|---------------|----|----|-----|-------------|
|       |            |  |           |          |           |           | A             | B  | C  | D   |             |
| 1     | BOT501     | Biology and Diversity of Algae and Fungi     | 4         | 1        | 0         | 3         | 25            | 25 | 25 | 25  | 75          |
| 2     | BOT503     | Cytogenetics                                 | 4         | 1        | 0         | 3         | 25            | 25 | 25 | 25  | 75          |
| 3     | BOT505     | Forestry                                     | 4         | 0        | 0         | 3         | 25            | 25 | 25 | 25  | 75          |
| 4     | BOT507     | Cell Biology                                 | 4         | 0        | 0         | 4         | 25            | 25 | 25 | 25  | 100         |
| 5     | BOT509     | Plant Biotechnology                          | 4         | 0        | 0         | 4         | 25            | 25 | 25 | 25  | 100         |
| 6     | BOT502     | Biology and Diversity of Algae and Fungi Lab | 0         | 0        | 2         | 1         | -             | -  | -  | 100 | 25          |
| 7     | BOT504     | Cytogenetics Lab                             | 0         | 0        | 2         | 1         | -             | -  | -  | 100 | 25          |
| 8     | BOT506     | Forestry Lab                                 | 0         | 0        | 2         | 1         | -             | -  | -  | 100 | 25          |
| 9     | BOT508     | Cell Biology Lab                             | 0         | 0        | 3         | 2         | -             | -  | -  | 100 | 50          |
| 10    | BOT510     | Plant Biotechnology Lab                      | 0         | 0        | 3         | 2         | -             | -  | -  | 100 | 50          |
|       |            |  | <b>15</b> | <b>5</b> | <b>13</b> | <b>24</b> |               |    |    |     | <b>600</b>  |

A: Continuous Assessment: Based on surprise tests (objective type) & attendance

B: Mid- term test-1: Pre-announce tests (objective+Subjective)

C: Mid-Term Test-2: Pre-announce tests (objective+subjective)

D: End-Exam (Final): Objective type question

E: Total

**L: Lectures, T: Tutorial, P: Practical, Cr: Credits**

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### **Instruction for candidates (Theory Paper)**

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced test will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise test will be taken. Two best out of four objective/MCQ type surprise test will be considered towards final each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The Reference Books indicated as text-book(s) are suggestive However, any other book may be followed.

\* Wherever specific instructions are required these are given at the starting of that particular subject/paper

### **Instruction for candidates (Practical Paper)**

- Total marks of practical will include 20% weightage of Continuous Assessment and 80% end semester exam including Notebook / Viva / Performance/ written test.

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

**Paper: Biology and Diversity of Algae and Fungi**

**Code: Theory: BOT501; Practical: BOT502**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

### **Objective:**

To acquaint the students about the origin, history, morphology, biology and importance of prokaryotic and eukaryotic algal organisms, 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 I:** Salient features; Criteria for classification (pigments, reserve food, flagella, chloroplast, endoplasmic reticular membrane etc.); Comparative account of important systems of classification (Fritsch and Lee); Salient features of major divisions (Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta; Phaeophyta, Dinophyta, Cryptophyta and Rhodophyta).  
**(15 Lectures)**

### **UNIT-II**

**Algae II:** Evolutionary trends in thallus organization in algae; Life cycle patterns in algae; Biological rhythms in algae; Bioluminescence in algae; Algal blooms; Algae for Industrial uses (biofertilizers, algae as food and feed, bioengineering, Agar, Carrageenan and Alginates); Bioactive compounds from algae: Algae in bioengineering, photo-bioreactors and raceway ponds etc.).  
**(12 Lectures)**

### **UNIT-III**

**Fungi I:** Salient features of fungi; recent trends in classification of fungi; general account of phylum Chytridiomycota, Ascomycota, Deuteromycota, Basidiomycota, Zygomycota and Myxomycota and their classification (major orders).  
**(15 Lectures)**

### **UNIT-IV**

**Fungi II:** Heterokaryosis and parasexuality in fungi; Mycorrhizal application in agriculture and plant growth; Applied Mycology (biotechnology, food industry, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins); Secondary metabolites e.g. pharmaceutical preparations, Agriculture e.g. biofertilizers, Mycotoxins; Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology. **(10 Lectures)**

## DAV UNIVERSITY, JALANDHAR

**Paper: Biology and Diversity of Algae and Fungi Lab**

**Paper code: BOT502**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 0 | 0 | 2 | 1       | 25    | 10            |

1. Collections and culture (media preparation, sterilization, inoculation and incubation).
2. Study of diversity of fresh water and marine algae
3. Range of thallus and sex organs in major algal groups.
4. Heterocysts and their frequency in some Cyanophycean genera.
5. Study of *Phaneroplasmodium* from actual specimens and/or photograph. Study of *Physarum* sporangia.
6. Study of symptoms of plants infected with *Albugo*; asexual and sexual structures of through sections/tease mounts and permanent slides.
7. *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.
8. *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. Alexopolous C.J., Mims, C.W., and Blackwell, M. *Introductory Mycology*. John Wiley and Sons: New York, 1996.
2. Bilgrami, K.S. and Verma, R.N. *Physiology of Fungi*. Vikas Publishing House: New Delhi, 1978.
3. Bold H.C. and Wyne, M.J. *Introduction to the Algae: Structure and Reproduction*. Prentice Hall of India, New Delhi, 1978.
4. Burnett J.H. *Fundamentals of Mycology*. Edward Arnold: London, 1976.
5. Carlile M.J., Watkinson, S.C. and Gooday, G.W. *The Fungi*. Academic Press: New York, 2001.
6. Chapman N.J. and Chapman, D.J. *The Algae, ELBS and Macmillan*, New York, 1977.
7. Fritsch F.E. *The Structure and Reproduction of Algae (Vol. I & II)*. Vikas Publishing House Pvt. Ltd.: New Delhi, 1979.
8. Graham L.E., Graham, J.M. and Wilcox, L.W., *Algae*. Prentice Hall: USA, 2000.
9. Kumar H.D. *Introductory Phycology*. East West Press: New Delhi, 1999

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10. Lee R.E. *Phycology*. Cambridge University Press: Cambridge, 2008.
11. Moore L. *Fundamentals of the Fungi*, Prentice Hall, New York, 1972.
12. South G.R., and Whittick, A. *Introduction to Phycology*. Blackwell Scientific Publications: Oxford, 1987.
13. VanDen Hock C. Mann, D.G. and Jahns, H.M. *Algae: An Introduction to Phycology*, Cambridge University Press: Cambridge, 1995.

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

**Paper: Cytogenetics**

**Paper code: BOT503**

| L | T | P | Credits | Maximum Marks | Minimum marks |
|---|---|---|---------|---------------|---------------|
| 4 | 0 | 0 | 3       | 75            | 30            |

### **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**

The students will learn how the genetic material is replicated inside the cell and passes from one generation to the next. 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. **(4 Lectures)**

**Genomic enzymes:** Enzymes involved in DNA replication, polymerase, topoisomerase, methylase, nucleases and restriction endonucleases; replication origin and replication fork, fidelity of replication. **(4 Lectures)**

### **UNIT - III**

**Heterozygotes:** Breeding behavior and genetics of structural heterozygotes; Complex translocation heterozygotes; Translocation tester sets; Robertsonian translocations; B-A translocations. **(5 Lectures)**

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

### 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)



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**Paper: Cytogenetics Lab**

**Paper code: BOT504**

| L | T | P | Credits | Maximum Marks | Minimum marks |
|---|---|---|---------|---------------|---------------|
| 0 | 0 | 2 | 1       | 25            | 10            |

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

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

**Paper: Forestry**

**Paper code: BOT505**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

### **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 silviculture.

### **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)**

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## UNIT - IV

**Social and Urban Forestry:** Social forestry- Non-commercial farm forestry, scope and limitations of Non-commercial forestry, community forestry, scope and limitations of community forestry, social land allocation programmes (Taungya system). Economic benefits of social forestry, Urban forestry. **(7 Lectures)**

**Agroforestry:** Concepts, types and significance.

**(3 Lectures)**

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**Paper: Forestry Lab**

**Paper code: BOT506**

|          |          |          |                |              | <b>Minimum</b> |
|----------|----------|----------|----------------|--------------|----------------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> | <b>Marks</b> | <b>marks</b>   |
| 0        | 0        | 2        | 1              | 25           | 12             |

1. To measure diameter at breast height (dbh), diameter over bark (dob) and diameter under bark (dub) and girth of trees.
3. To determine the moisture content, specific gravity and weight density of common timber trees of Punjab.
4. To compare the anatomy of hard wood and soft wood.
5. Students should be taken to nearest natural forests and they should prepare a field report regarding the following points:  
Height above Sea level, Mean annual rain fall and temperature, Soil texture, soil pH, Topography Dominant tree species and the general characters of the forest (Distribution of trees in different storeys, ground flora, nature of leaf fall, average height of dominant tree species etc.) The students will submit the field report.
6. Propagation studies on important common forest trees of Punjab regarding Height and diameter increments (under similar soil conditions) at two months intervals under natural conditions of day length and temperature for young tree saplings of known age and represent the results in a graphic form.
7. Visit to the nearby forest nursery.

### Reference Books

1. Batish, D.R., Kohli, R.K., Jose, S., and Singh, H.P. *Ecological Basis of Agroforestry*. CRC Press: NewYork, 2008.
2. Chaturvedi, A.N. *Forest Mensuration*. International Book Distributors: Dehradun, 1982.
3. Dwivedi, A.P. *A Text Book of Silviculture*. International Book Distributors: Dehradun, 2006.
4. Gopikumar, K., Gopakumar, S., and Anoop, E.V. *Forest Nursery and Tree Husbandry*. International Book Distributors: Dehradun, 2003.
5. Jha, L.K. *Forestry for Rural Development*. APH Publishing Corporation: New Delhi, 1996.
6. Khosla, P.K. and Kohli, R.K. *Social Forestry for Rural Development*. I.S.T.S. Solan, India, 1988.

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7. Kohli, R.K., Arya, K.S., Singh, H.P. and Dhillon, H.S. *Tree Directory of Chandigarh*. DNAES, Chandigarh, India, 1994.
8. Negi, S.S. *Elements of General Silviculture*. International Book Distributors: Dehradun, pp. 269, 2003.
9. Negi S.S. *Hand Book of Forest Ecology and Biology*. International Book Distributors: Dehradun, 2004.
10. Puri, G.S., Mehr-Homji, V.M., Gupta, R.K., and Puri, S. *Forest Ecology Vol. 2*. Oxford & IBH: New Delhi, 1989.
11. Sahni, K.C. *The Book of Indian Trees*. 2<sup>nd</sup> ed. Oxford University Press: Mumbai, 2000.
12. Stoddard, C.H. *Essentials of Forestry Practice*. R.P.C., New York, 1959.

# DAV UNIVERSITY, JALANDHAR

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

**Paper: Cell Biology**

**Paper code: BOT507**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 4       | 100   | 40            |

### **Objective:**

The students will learn the structure, characterization, functioning and regulation of hereditary material.

### **Teaching Methodology:**

Traditional method of class room Lectures, practicals, models, power point presentations.

### **Learning outcomes**

The studies will provide students with the knowledge of synthesis, processing and regulation of DNA and RNA inside the cell.

## **UNIT I**

**Cell:** Structural organization and Components (a brief account) **(2 Lectures)**

**Synthesis and processing of nucleic acids:** Structure and functions of different types of DNA (A,B,Z); Replication; Structure and functions of different types of RNA, formation of initiation complexes; Transcription factors, activators and repressors, RNA polymerase RNA processing (capping, splicing, polyadenylation); RNA editing and RNA transport.

**(10 Lectures)**

**Chromosomes:** Gene families; transposons; Eukaryotic and prokaryotic; heterchromosomes; Lampbrush chromosomes; Satellites (a brief account) **(3 Lectures)**

## **UNIT II**

**Membrane transport:** Structure; Electrical properties; Transport of small molecules; Channels; Bulk transport; Active and passive; Endomembrane transport systems; Intracellular vesicular Traffic; Vesicle transport and their functions; Structural organization of and functions of organelle at molecular level; proton pump; Intracellular Compartments and Protein Sorting; Post-translational Uptake of Proteins by Peroxisomes, Mitochondria, and Chloroplasts. **(13 Lectures)**

## **UNIT III**

**Cell communication:** Adhesion, fusion, tight junctions, gap junction; Mechanisms of cell communication. **(3 Lectures)**

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**Cell anchoring:** Anchoring cells to their substratum; Interactions of Cells with Other Cells; Selectins; The Immunoglobulin Superfamily; Cadherins. **(3 Lectures)**

**Cytoskeleton:** Structure and function; Microtubules and microfilaments; Intermediate filaments; Extra cellular matrix; Interactions of Cells with Extracellular Materials; Integrins; Focal Adhesions and Hemidesmosomes. **(5 Lectures)**

### UNIT IV

**Cell cycle:** Cell cycle in vivo; Control of the cell cycle: Role of cyclins; Check points; Cyclin dependent kinases; Genetic regulation of cell cycle. Motor proteins required for mitotic movements. **(4 Lectures)**

**Cell signaling:** Basic Elements of Cell Signaling Systems; Extracellular Messengers and Their Receptors; Signal Transduction: G Protein-Coupled Receptors, Second Messengers; Protein-Tyrosine Phosphorylation; The Ras-MAP Kinase Pathway. **(5 Lectures)**

Cell differentiation and Ageing: Programmed cell death (PCD); Apoptosis. **(3Lectures)**

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**Paper: Cell Biology Lab**

**Paper code: BOT508**

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

1. Extraction and estimation of DNA from plant material.
2. Extraction and estimation of RNA from plant material.
3. Genomic DNA isolation.
4. DNA analysis by gel electrophoresis.
5. Protein isolation and their separation by polyacrylamide gel electrophoresis.
6. To prepare a restriction digest by using different restriction enzymes.

### Reference Books

1. Alberts, B., and Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. *Molecular Biology of the Cell*. Macmillan Publishers Ltd.: New York, 2005.
2. Brown, T.A. *Genomes*. Wiley & Sons: USA, 2001.
3. Cooper, G.M., and Hausman, R.E. *The Cell: A Molecular Approach*. ASM Press, Washington DC and Sinauer Associates Inc., 2006.
4. Gilmartin, P.M., and Bowler, C. *Molecular Plant Biology* (Volume 1 & Volume 2). Oxford University Press: UK, 2002.
5. Karp, G. *Cell and Molecular Biology*. Wiley & Sons: USA, 2002.
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D., and Darnell, J. *Molecular Cell Biology*. Jones and Bartlett Publishers: USA, 2005.
7. Powar, C.B. *Cell Biology*. Himalaya Publishers: India, 2008.
8. Primrose, S.B., Twyman, R.M., and Old, R.W. *Principles of Gene Manipulation*. Blackwell Publishers: UK, 2001.



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

**Paper: Plant Biotechnology**

**Paper code: BOT509**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 4       | 100   | 40            |

### **Objective:**

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

### **Teaching Methodology:**

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

### **Learning outcomes**

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 how an acquired character can be transferred from one plant to another for some specific function.

### **UNIT-I**

**Plant Biotechnology:** Its definition, terminologies, scope and applications. **(3 Lectures)**

**Plant Regeneration:** Definition, pre-conditions, role of plant material, Different types of culture media (Batch; continuous and semi-continuous); effect of culture media and culture conditions, and biotechnological utilization of regeneration potential. **(4 Lectures)**

Single Cell Suspension Culture and Secondary Metabolite Production. **(3 Lectures)**

**Somatic Embryogenesis;** factors affecting somatic embryogenesis and its utility. **(2 Lectures)**

### **UNIT-II**

**Haploid Production:** Definition, androgenesis, Gynogenesis, culture techniques and induction factors, biotechnological utilization of haploid production. **(4 Lectures)**

**Somaclonal variations** and their applications. **(2 Lectures)**

**Somatic Hybridization:** Protoplast fusion, culture and fusion methods; Selection of fusion products; Production of hybrids and cybrids; Application in biotechnology. **(4 Lectures)**

**Germplasm Storage,** Artificial Seeds and their utility in micropropagation. **(2 Lectures)**

### **UNIT-III**

**Genetic Engineering I:** 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

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

### UNIT-IV

**Genetic Engineering II:** Detection, characterization and expression of transformants; (Genetic marker and reporter genes transgene stability and transgene silencing; case studies of transgenic traits in plants; production of abiotic stress, herbicide tolerant plants; marker-free transgenics; environmental, social and legal issues. **(12 Lectures)**

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**Paper: Plant Biotechnology Lab**

**Paper code: BOT510**

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

1. Laboratory organization and techniques for tissue culture.
2. Different nutrient media; their preparation and sterilization.
3. Selection of different explants, surface sterilization and inoculations to initiate cultures.
5. To study different regeneration pathways in explants, under controlled conditions.
6. To study effect of different growth regulators in in vitro cultures.
8. Technique of single cell cultures and suspension culture.
9. Technique of production of haploids.
10. Technique of encapsulation of shoot meristem/somatic embryos in calcium alginate beads.

### Reference Books

1. Bhojwani, S.S., and Razdan, M.K. *Plant Tissue Culture - Theory and Practice*. Elsevier Science Pub. Co. Inc.: New York, 1983.
2. Chawla, H.S. *Introduction to Plant Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd.: New Delhi, 2002.
3. Hammond, J., McGarvey, P., and Yusibov, V. *Plant Biotechnology – New Products and Applications*. Springer-Verlag Berlin, Heidelberg: New York, 2000.
4. Kumar, H.D. *A Text Book on Biotechnology*. Affiliated East West press, Pvt. Ltd.: New Delhi, 1991.
5. Murray, D.R. *Advanced Methods in Plant Breeding and Biotechnology*. Redwood Press Ltd.: Melksham, 1991.
6. Old, R.W., and Primrose, S.B. *Principles of Gene Manipulation: An Introduction to Genetic Engineering*. Blackwell Scientific Publications: Oxford, 1985.
7. Razdan, M.K. *An Introduction to Plant Tissue Culture*. Oxford and IBH Publishing Co. Pvt. Ltd.: New Delhi, 1983.
8. Reinert, J., and Yeoman, M.M. *Plant Cell and Tissue Culture-A Laboratory Manual*. Springer Verlag: Berlin, 1982.
9. Street, H.E. *Plant Tissue and Cell Culture*. Blackwell Scientific Publications: London, 1973.

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10. Smith, R.H. *Plant Tissue Culture, Technique and Experiments*. Academic Press: New York, 2000.
11. Trevan, M.D., Buffey, S., Goulding, K.H., and Stanbury, P. *Biotechnology–The Biological Principles*. Tata McGraw-Hill Publishing Company Ltd.: New Delhi, 1988.

# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester II

### Paper: Biology and Diversity of Bryophytes and Pteridophytes

Paper code: BOT511

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

#### 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 I:** Salient features of Bryophytes; Modern system of classification; A brief account on morphological diversity in the gametophyte and sporophyte of (i) Takakiales (ii) Polytrichales (iii) Sphagnales (iv) Andreaeales (v) Jungermanniales (vi) Anthocerotales (vii) Marchantiales. **(12 Lectures)**

### UNIT-II

**Bryophytes II:** Uptake of water and nutrients, characteristic features of endohydric, ectohydric and mixohydric Bryophytes; Gametophytic and sporophytic structures specialized for external conduction, Cells involved in internal conduction. **(6 Lectures)**

**Drought tolerance, desiccation and rehydration.** **(4 Lectures)**

**Substratum Ecology:** Epiphytes, Epiphylls, Epiliths Litter species Fire mosses, Coprophilous species, Calcicoles and Calcifuges, Halophytes, Epizoic Bryophytes. **(2 Lectures)**

**Bryogeography and Conservation:** Bryophyte endemisms; Indian bryodiversity with particular emphasis to Himalayas; Threatened bryophytes; strategies to conserve Bryodiversity at National and Global levels. **(2 Lectures)**

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## UNIT-III

**Pteridophytes I:** (a) Origin and evolution of Pteridophytes; Diversity and distribution of Pteridophytes in India; Economic importance of Pteridophytes. **(5 Lectures)**

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

(c) Evolution of stellar structure among Pteridophytes; Spore structure, types and patterns of spore germination in ferns. **(3 Lectures)**

## UNIT-IV

**Pteridophytes II:** (a) Structure, types and development of fern prothalli. **(2 Lectures)**

(b) Natural and induced apogamy and apospory in pteridophytes. Heterospory and seed habit. **(3 Lectures)**

(c) Role of polyploidy in the evolution of ferns. **(3 Lectures)**

(d) Ferns as hyperaccumulators of arsenic, mechanism of uptake, transfer and tolerance and use in phytoremediation **(4 Lectures)**

# DAV UNIVERSITY, JALANDHAR

## Paper: Biology and Diversity of Bryophytes and Pteridophytes Lab

Paper code: BOT512

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 0 | 0 | 2 | 1       | 25    | 10            |

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. Morphological features of spores of some fern.
6. Ecology and taxonomical notes on the species of fern Genera like like *Selaginella*, *Equisetum*, *Pteris*, *Adiantum*, *Asplenium*, *Cheilanthes*, *Marsilea*, *Salvinia*, *Azolla* etc.
7. Herbarium preparation of Pteridophytic collection.

### Reference Books

1. Chopra, R.S. *Taxonomy of Indian Mosses*. CSIR: New Delhi, 1975.
2. Dyer, A.F. *The Experimental Biology of Ferns*. Academic Press: London, 1979.
3. Dyer, A.F., and Duckett, J.G. *The Experimental Biology of Bryophytes*. Academic Press: London, 1984.
4. Gifford, E.M., and Foster, A.S. *Morphology and Evolution of Vascular Plants*. W.H. Freeman and Company: New York, 1989.
5. Goffinet, B., and Shaw, A.J. *Bryophyte Biology*. Cambridge University Press: Cambridge, 2000.
6. Khullar, S.P. *An Illustrated Fern Flora of West Himalayas* (Vols. I and 2), International Book Distributors: Dehradun, 2000.
7. Mehra, P.N., and Gupta, A. *Gametophytes of Himalayan Ferns*. Mehra P.N., Botany Department, P.U.: Chandigarh, 1986.
8. Rashid, A. *An Introduction to Pteridophyta*. Vikas Publishers: New Delhi, 1999.
9. Richardson, D.H.S. *Biology of Mosses*. Blackwell Scientific Publications: Oxford, 1981.

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10. Schofield, W.B. *Introduction to Bryology*, Macmillan Publishing Company: New York, 1985.
11. Schuster, R.M. *New Manual of Bryology*, (Vols. I & II), Jour. Hattori. Bot. Lab., Nichinan: Japan, 1984.
12. Sporne, K.R. *The morphology of Pteridophytes*, B.I. Publications: Bombay, 1982.



# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester II

### Paper: Biology and Diversity of Gymnosperms and Angiosperms

Code: BOT513

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

#### Objective:

To make the students familiar to distribution, structure and reproduction in gymnosperms and evolution of angiosperms.

#### Teaching Methodology:

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

#### Learning outcomes

The studies will be learnt the development of seed habit, origin and evolution of angiosperms and their affinities and differences with gymnosperms.

#### UNIT-I

General characteristic features of Gymnosperms and their affinities with pteridophytes and angiosperms; Evolutionary status of pteridosperms and their angiospermic affinities.

(2 Lectures)

Current trends in the classification of Gymnosperms; Distribution of Gymnosperms in India.

(2 Lectures)

Structure and reproduction of Cycadales; Ginkgoales, Coniferales, Ephedrales, Welwitschiales, Gnetales.

(12 Lectures)

Cytological studies in Gymnosperms.

(1 Lecture)

Economic importance of Gymnosperms.

(1 Lecture)

#### UNIT-II

Evolution of pollination and mechanisms and embryogeny of gymnosperms. (4 Lectures)

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

(12 Lectures)

#### UNIT-III

The Origin of Angiosperms: Origin, evolution and inter-relationship of monocots and dicots.

(3 Lectures)

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**General Evolutionary Trends in Angiosperms:** Habits and habitats, leaf structure, inflorescence and flowers. **(7 Lectures)**

**Introduction to different floral terms.** **(2 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: Biology and Diversity of Gymnosperms and Angiosperms Lab**

**Code: BOT514**

| <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> | <b>Marks</b> | <b>Minimum marks</b> |
|----------|----------|----------|----------------|--------------|----------------------|
| 0        | 0        | 2        | 1              | 25           | 10                   |

1. Wood Anatomy in *Cedrus*, *Ginkgo*, *Ephedra* and *Gnetum*
2. Leaf Anatomy in *Cedrus*, *Abies*, *Picea*, *Pinus*
3. Male and female cones (external morphology) in *Cedrus*, *Abies*, *Thuja* and *Juniperus*.

## Reference Books

1. Beck, C.E. *Gymnosperm Phylogeny*. Bot. Rev., 51: 176-294, 1985.
2. Bhatnagar, S.P. and Moitra, A. *Gymnosperms*. New Age International Limited: New Delhi, 1996.
3. Bierhorst, D.W. *Morphology of Vascular Plants*. The Macmillan and Co.: New York, 1971.
4. Dalimore, W., Jackson, A.B., and Morrison, S.L. *A Handbook of Coniferae including Ginkgoaceae*, Edward Arnold and Co.: London, 1966.
5. Meyen, S.V. *Basic Features of Gymnosperms, Systematics and Phylogeny as Evidenced by the Fossil Record*. Botanical Review: 50: 1-112, 1984.
6. Rothwell, G.W. *The Role of Comparative Morphology and Anatomy in Interpreting the Systematics of Fossil Gymnosperms*. Botanical Review: 51: 318-327, 1985.
7. Sporne, K.R. *The Morphology of Gymnosperms*, B.I. Publications: Delhi, 1974.
8. Sharma, O.P. and Dixit, S. *Gymnosperms*. Pragati Prakashan: Meerut, 2001.
9. Cronquist, A. *The Evolution and Classification of Flowering Plants*. Houghton Mifflin: Boston, 1968.
10. Naik, V.N. *Taxonomy of Angiosperms*. Tata McGraw Hill: New Delhi, 1984.
11. Pandey, S.N., and S.P. Misra. *Taxonomy of Angiosperms*. Ane Reference Books: India, 2008.

# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester II

**Paper: Conservation of Natural Resources**

**Paper code: BOT515**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

### **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**

Concept; Objectives and aims; Policies of conservation, strategies of conservation; Renewable and non-renewable resources. **(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)**

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## UNIT III

**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)

## UNIT IV

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

**Endangered and threatened species:** IUCN Categories of Extinction (2 Lectures)

Concept of National Parks, Wildlife Sanctuaries; Biosphere Reserves (2 Lectures)

*Biodiversity Hotspots* – concept; A brief account of Biodiversity hotspots of India; Classification of protected areas as per UN. (2 Lectures)

## DAV UNIVERSITY, JALANDHAR

**Paper: Conservation of Natural Resources Lab**

**Paper code: BOT517**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 0 | 0 | 2 | 1       | 25    | 10            |

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. Oliver, S.O., and Daniel, D.C. *Natural Resource Conservation: Management for a Sustainable Future*. Prentice Hall International: New Jersey, 1990.
2. Rai, G.D. *Non-Conventional Energy Sources*. Khanna Publishers: Delhi, 1993.
3. Ramijhan, S.K. *Agro Industrial by Products and Non-Conventional Feed for Live Stock*. Indian Council for Agriculture Research: New Delhi, 1990.

# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester II

**Paper: Plant Physiology**

**Code: BOT517**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 1 | 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 the how a plant cell responds to various biotic and abiotic stresses, defense mechanism in plants, events of seed and fruit development, and the various physiological roles of plant hormones.

## **UNIT-I**

**Membranes:** Recent concepts of structure and composition of membrane; Transport across cell membrane (various classes of pumps, ion channels and carrier proteins); Regulation of solute transport; Mechanism of sorting and their significance; Electrical properties of membranes.

**(3 Lectures)**

**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<sub>2</sub> fixation (C<sub>3</sub>, C<sub>4</sub> and CAM); Mechanism of and regulation of photorespiration; RUBISCO as an example of model enzyme for semi-autonomy at the molecular level.

**(7 Lectures)**

## **UNIT-II**

**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)**

**Oxidative and nitrosative stress and antioxidative strategies:** Nitrosative and oxidative stress - causes and effects, nitric oxide biosynthesis and metabolism, NO mediated signaling, markers of nitrosative stress, NO crosstalk with other hormones, antioxidant mechanisms.

**(5 Lectures)**

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**Secondary metabolites and their biotechnological aspects:** Natural products (secondary metabolites), their range and ecophysiological functions. Overview of terpenoidal, alkaloidal, and phenolic metabolites, their biosynthesis and functions. **(3 Lectures)**

### UNIT-III

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

**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. **(6 Lectures)**

### UNIT-IV

**Sensory physiology:** Phytochromes and cryptochromes; Biochemical and biophysical mechanisms of sense of touch, electric self-defense, taste, light, explosion, sleeping and rhythms; neurotransmitters in plants. **(3 Lectures)**

**Plant Hormones:** Physiological effects and molecular mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscissic acid, jasmonic acid, brassinosteroids, polyamines, salicylic acid. **(10 Lectures)**



## DAV UNIVERSITY, JALANDHAR

**Paper: Plant Physiology Lab**

**Code: BOT518**

| L | T | P | Credits | 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
3. Anthocyanin content under varied environmental conditions.
4. Effect of environment factors on seed germination.
5. Experimental study of hormonal effects in plant material
6. Experimental study of stress physiology.

### Reference Books

1. Bonner, B., and Varner, J.E. *Plant Biochemistry*. Academic Press: London, 1976.
2. Srivastava, A.K. *Plant Growth and Development*. Associated Press: New York, 2002.
3. Stryer, L. *Biochemistry*. 5<sup>th</sup> edition. W.H. Freeman and Co.: New York, 1995.
4. Taiz, L., and Zeiger, E. *Plant Physiology*. The Benjamin/Cumming Publishing Company: California, 1998.
5. Voet, D., and Voet, J.G. *Biochemistry*. John Wiley and Sons Inc.: New York, 1995.
6. Wilkins, M.B. *Advanced Plant Physiology*. Pitman: New York, 1984.

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## M.Sc. Botany (Hons. School) Semester II

Paper Code: ZOO 514

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 4 | 1 | 0 | 4       | 100   |

**Course Objective:** The main objective of the course is to give applications of Statistical Methodology in life sciences to summarize and analyse the data, and modeling of real life data through standard distributions.

### UNIT-A

17 hours

- Biostatistics- Definition and relevance in biological research.
- Descriptive Statistics: Meaning, Objectives,
- Organization of data, Population, sample, variable, parameter, primary and secondary data, screening and representation of data, frequency distribution, tabulation, bar diagram, histograms, pie diagram
- Measures of Central Tendency: Arithmetic Mean, median, mode, quartiles and percentiles
- Measures of Dispersion: Range, variance, standard deviation, coefficient of variation;
- Skewness and Kurtosis

### UNIT-B

18 hours

- 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, Probability and distributions- definition of probability (frequency approach), independent events. Addition and multiplication rules, conditional probability, examples- bernoulli, binomial, poisson and normal distributions; bivariate data- scatter plot,
- 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.

### UNIT-C

**15  
hours**

- 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: Mann Whitney U test, Wilcoxon Signed Rank Sum Test, Kruskal Wallis Analysis of Variance, Chi square and Kendall Rank Correlation

### UNIT-D

**10  
hours**

- Use of Statistical softwares in analysis and interpretation of biological data with special emphasis on SPSS.

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### Reference Reference Books

1. Dunn, O.J: Basic Statistics: A primer for the Biomedical Sciences. (1964, 1977) by John Wiley
2. Bancroft, Holdon: Introduction to Bio-Statistics (1962) P.B. Hoebar Inc., New York.
3. Daniel, Wayne W.: Bio-statistics: A Foundation for Analysis in the Health Sciences. John Wiley (2005).

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**Course Title: Biostatistics Lab**  
**Course Code: Zoo 518**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 0 | 0 | 1 | 2       | 50    |

- Recording of data by using any material such as fish or molluscs or insect.
- Calculation of standard deviation on the basis of recorded data.
- Calculation of correlation coefficient (between X & Y variables) on the basis of material provided.
- Setting up of regression equation and the calculation of the value of Y of unknown X on the basis of equation  $Y = a+bX$ .
- Analysis of data and construction of graphs using statistical packages.

# DAV UNIVERSITY, JALANDHAR

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

**Course Title: Molecular Biology**

**Course Code: BTY502**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 4 | 1 | 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). Cell signaling: signal transduction pathways and their regulation. **10 hours**
5. Genome sequencing: Genome sizes, organelle genomes, genomic libraries, YAC, BAC libraries, and strategies for sequencing genome, packaging, transfection and

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recovery of clones, application of sequence information for identification of defective genes. **8 hours**

6. Photoregulation and phytochrome regulation of nuclear and chloroplastic gene expression. Molecular mechanism of nitrogen fixation. Molecular biology of various stresses, viz. abiotic stresses like drought, salt, heavy metals and temperature; 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**

### Reference Books:

1. Molecular cell biology (2008) by Harvey F. Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher (W.H.Freeman).
2. Genes IX (2008) by Benjamin Lewin (Jones and Bartlett Publishers).
3. Molecular cloning: A laboratory manual (2000) by J. Sambrook, E.F.Fritish and T. Maniatis (Cold Spring Harbor Laboratory Press,New York).

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**Course Title: Molecular Biology-LAB**

**Course Code:BTY506**

| 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.
- Quantitation of nucleic acids and proteins.
- Gel electrophoresis:
  - Nucleic acid
  - Protein

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

**Course Title: Computational Biology & Bioinformatics**

**Course Code:BTY602**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 4 | 0 | 0 | 3       | 75    |

1. Introduction to Computational Biology: Nature and scope of Computational Biology and Bioinformatics, Basic Algorithms in Computational Biology, Introduction to sequence alignment. Analysis of the whole genome sequencing data: Processing and assembly of whole genome sequence data, Base-calling (PHRED), Vector and E-coli masking. Assembly using PHRAP, CAP3, Assessment of final data quality (Coverage, PHRAP score International guidelines for data quality) Types of Misassemblies and their solution. **10 hours**
2. Analysis and submission of EST and GSS data: Processing and quality trimming of nascent sequences; Preparation of submission files; Clustering of ESTs (overview of clustering procedure, pros and cons of clustering). **6 hours**
3. Whole Genome annotation strategies: Basic overview of whole genome annotation strategies, strategies for Human and Arabidopsis genomes. Introduction to DNA and Protein sequencing, Human Genome Project. **6 hours**
4. Bioinformatics databases, Type of databases, Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, GeneBank, DDBJ; Secondary nucleotide sequence databases. **5 hours**
5. Protein structure prediction: Protein Secondary Structure Prediction: Secondary Structure Prediction for Globular Proteins, Transmembrane Proteins, Coiled Coil Prediction. **3 hours**
6. Protein Tertiary Structure Prediction: Methods, Homology Modeling, Threading and Fold Recognition, Ab Initio Protein Structural Prediction, CASP. **3 hours**
7. Sequence motif databases -Pfam, PROSITE, Protein structure databases, Protein Data Bank-SCOP, CATH, KEGG, ChEMBL, Sequence, structure and function relationship. **5 hours**
8. Applications of bioinformatics: Bioinformatics in pharmaceutical industries, Bioinformatics in immunology, Bioinformatics in agriculture, Bioinformatics in forestry, Geoinformatics, Legal, ethical and commercial ramifications of bioinformatics, Biosensing. **7 hours**



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**Course Title: Computational Biology & Bioinformatics-LAB**

**Course Code: BTY606**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 0 | 0 | 2 | 1       | 25    |

- Detailed study of NCBI Homepage.
- To perform BLAST for Nucleotide Sequence
- BLAST for a protein sequence
- To perform multiple sequence alignment via CLUSTAL
- Phylogenetic analysis
- To display PDB structure using Rasmol
- Comparative study of the two formats: Gene Bank/ Genepept and FASTA
- Analysis of Prosite pattern
- Motif search database study
- Prediction of protein structure

# DAV UNIVERSITY, JALANDHAR

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

**Paper: Scientific Writing and Research Methodology**

**Code: BOT601**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 3 | 1 | 0 | 2       | 50    | 20            |

### **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**

Basic principles and significance of research design

Experimental set-up

Randomized Block Designs (RBD), completely randomized designs (CRD); Latin square design and Factorial design **(5 Lectures)**

#### **UNIT-II**

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. **(8 Lectures)**

#### **UNIT-III**

Process of proof reading of a research manuscript.

Process of reviewing.

Process of submission of a paper.

Important journals in plant sciences. **(6 Lectures)**

#### **UNIT-IV**

An introduction to Science citation index; H-index, Impact factor of a journal; Eigen factor Copyright act; Academic frauds; Plagiarism; Softwares to check plagiarism. **(5 Lectures)**

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### Reference Books

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

# DAV UNIVERSITY, JALANDHAR

**Paper: Economic Botany**

**Paper code: BOT602**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 1 | 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.

## **Teaching Methodology:**

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

## **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:**

- a) Psychoactive drugs and Narcotics
- b) Medicinal and aromatic plants
- c) Fibers and pulps

**(12 Lectures)**

### **UNIT-II**

**Spices and condiments:** Source, collection and uses of Ginger, Turmeric, Cinnamon, Saffron, 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:**

- d) Beverages
- e) Oil yielding plants
- f) Food, fodder / forage

**(15 Lectures)**

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## UNIT-IV

**Insecticides:** Source and uses of plant based insecticides.

Plants used as avenue trees for shade, pollution control, aesthetics.

Masticatories and Fumitories

**Green Revolution:** Benefits and adverse consequences.

**(12 Lectures)**

## DAV UNIVERSITY, JALANDHAR

**Paper: Economic Botany Lab**

**Paper code: BOT603**

| L | T | P | Credits | 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*. Oxford University Press: Mumbai, 1986.
2. Chandel, K.P.S., Shukla, G., and Sharma, N. *Biodiversity in Medicinal and Aromatic Plants In India: Conservation and Utilization*. National Bureau of Plant Genetic Resources: New Delhi, 1996.
3. Cristi, B.R. *Handbook of Plant Science and Agriculture, Vol. I. In-situ Conservation*, CRC Press, Boca Raton: Florida, U.S.A, 1999.
4. Council for Scientific & Industrial Research. *The Useful Plants of India*, Publications and Information Directorate, CSIR: New Delhi, 1986.
5. Kocchar, S.L. *Economic Botany of the Tropics*, 2<sup>nd</sup> edition, Macmillan India Ltd.: Delhi, 1998.

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6. Swaminathan, M.S., and Kocchar, S.L., (eds.). *Plants and Society*. MacMillan Publications Ltd.: London, 1989.
7. Thakur, R.S., Puri, H.S. and Husain, A. *Major Medicinal Plants of India*. Central Institute of Medicinal and Aromatic Plants: Lucknow, 1989.
8. Walter, K.S., and Gillett, H.J. 1997 *IUCN Red List of Threatened Plants*. World Conservation Union, IUCN, Switzerland, and Cambridge: U.K., 1998, 1997.

# DAV UNIVERSITY, JALANDHAR

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

Paper: Advanced Plant Systematics

Paper code: BOT604

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 0 | 0 | 3       | 75    | 30            |

## 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, Names according to rank; Citation of authors; Priority; Type method; Naming a new species; Legitimacy; Synonyms. **(4 Lectures)**

### UNIT III

**Molecular Systematics:** Generating molecular data: restriction site mapping, gene sequencing; Analysis of molecular data: alignment of sequences, methods of phylogeny reconstruction. **(4 Lectures)**

**Phylogenetics:** The nature of phylogeny; How we depict phylogeny?; The importance of homology, Polarizing characters of homology; The problem of homoplasy. **(3 Lectures)**

### UNIT IV

**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)**



# DAV UNIVERSITY, JALANDHAR

**Paper: Advanced Plant Systematics Lab**

**Paper code: BOT605**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 0 | 0 | 2 | 1       | 25    | 10            |

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 Linnean Society, 141: 399-436, 2003.
2. Crawford, D.J. *Plant Molecular Systematics*. Cambridge University Press: Cambridge, UK, 2003.
3. Cronquist, A. *An Integrated System of Classification of Flowering Plants*. Columbia University Press: New York, 1981.
4. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., and Donoghue, M.J. *Plant Systematics: A Phylogenetic Approach*. Sinauer Associates, Inc.: Massachusetts, 2002.
5. Maheshwari, J.K. *The Flora of Delhi*. CSIR: New Delhi, 1963.
6. Nei, M., and Kumar, S. *Molecular Evolution and Phylogenetics*. Oxford University Press: New York, 2000.
7. Radford, A.E., Dickison, W.C., Massey, J.R., and Bell, C.R. *Vascular Plant Systematics*. Harper and Row: New York, 1974.
8. Semple, C., and Steel, M.A. *Phylogenetics*. Oxford University Press: Oxford, 2003.
9. Simpson, M.G. *Plant Systematics*. Elsevier: Amsterdam, 2006.
10. Stuessy T.F. *Plant Taxonomy: The systematic Evaluation of Comparative Data*. Columbia University Press: New York, 2009.

# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester IV

**Course Title: Genomics, Proteomics and**

**Metabolomics**

**Course Code:BTY652**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 4 | 1 | 0 | 4       | 100   |

**Course Objective:** The aim of the course is to provide students practical and bioinformatical skills in genomics, transcriptomics, proteomics and metabolomics, knowledge and the notion about how the methods are applied in real-life scientific research.

1. Introduction to -omes and -omics. Gene, Genome and Genomics. **2 hour**
2. Whole genome analysis: Preparation of genomic library in vectors, ordered cosmid libraries, BAC libraries, shotgun libraries. Genome analysis for global patterns of gene expression using fluorescent-labelled cDNA or end-labelled RNA probes. **6 hours**
3. FISH, Sequencing: Conventional sequencing (Sanger, Maxam and Gilbert methods), automated sequencing, analysis of sequence information FISH. Analysis of single nucleotide polymorphism using DNA chips. **4 hours**
4. Transcriptomics. Microarray, EST, SAGE. Bioinformatical methods in transcriptomics.  
Application of transcriptomics. Genome sequencing projects (technology of sequencing and assembly, bioinformatics of genome annotation, current status of genome sequencing projects) Genomic browsers and databases Orthology prediction (comparative genomics), Search for transcription factor binding sites (TFBS), Computational prediction of miRNA target genes *De novo* prediction of regulatory motifs in genome, Single nucleotide polymorphisms (SNP) in medical genetics and basic research. **10 hours**
5. Next generation sequencing using new technologies. Alignment of pairs of sequences of DNA and proteins. Multiple sequence alignment. Searching databases for similar sequences. Phylogeny: Different approaches to tree construction. Analyze sequences and its role in understanding the evolution of organisms and genes. **6 hours**

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6. **Proteomics.** Aims, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein microarrays. Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry, yeast 2-hybrid system. Protein-protein interactions: experimental and computational methods, databases.  
**8 hours**
7. Types of data and databases, quality of annotation. Protein structure prediction. The proteome. High throughput proteomics and its use to the biologists. **4 hours**
8. Novel approaches to protein expression analysis: Scope of functional proteomics. Proteome analysis: 2DE based strategy. Alternatives to 2DE for protein expression analysis. **5 hours**
9. Application of proteome analysis to drug development and toxicology: Basic principle and making use of the data. **4 hours**
10. Protein-DNA interactions. Cancer profiling using DNA microarrays. Proteomics as tool for plant genetics and breeding. **5 hours**
11. Introduction to metabolomics. Technologies in metabolomics. Nutrigenomics. Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry in metabolomics. Metabolic pathways resources: KEGG, Biocarta. Nutrigenomics and metabolic health. Solved problems and future challenges. **6 hours**

### Reference Books:

1. A primer of genome science (2009) by Gibson G. and Muse S. V., (Sinauer Associates, Inc. Sunderland, MA).
2. Knowledge discovery in proteomics (2006) by Igor Jurisica, Dennis Wigle (Chapman & Hall / CRC).
3. Proteomics: From protein sequence to function (2002) edited by Pennington SR, Dunn M. J. (Viva Reference Books Pvt. Ltd).
4. Informatics in proteomics (2005) edited by Srivastava Sudhir (Taylor & Francis Group / CRC).
5. Genomics and proteomics engineering in medicine and biology (2007) edited by Akay M. (Wiley-Interscience John Wiley & Sons, Inc. Publication, USA).
6. Essentials of genomics and bioinformatics (2002) by Christoph W. Sensen (Wiley-VCH, Weinheim).
7. Current protocols in bioinformatics (2004) by Baxevanis A.D., Davison, D.B., Page, R.D.M. & Petsko, G.A (John Wiley & Sons, Inc. Publications, New York).

## DAV UNIVERSITY, JALANDHAR

**Course Title: Genomics, Proteomics and Metabolomics-  
LAB**

| L | T | P | Credits | Marks |
|---|---|---|---------|-------|
| 0 | 0 | 3 | 2       | 50    |

**Course Code: BTY656**

- Site directed mutagenesis. Deleting a DNA sequence from a plasmid and introduction into *E. coli*.
- Functional validation of gene expression.
- Analysis of mutants using Southern blot and PCR analysis.
- Introduction to DNA sequencing.

# DAV UNIVERSITY, JALANDHAR

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

**Paper: Plant Ecology and Phytogeography**

**Code: BOT606**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 1 | 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**

**Management and Conservation of Natural Resources:** Aims, objectives and principles of conservation; Conservation policies; Conservation strategies at national and international level; Types of resources; Conservation of plant genetic diversity; 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)**

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## UNIT-III

Biosphere Reserves and Biodiversity hotspots: The concept, major functions and current status in India and world; speciation and extinction; endemism; IUCN Red List of threatened species; Major threatened plants of India. **(12 Lectures)**

**Phytogeography:** General principles, Biogeographic regions of India; Major vegetation of India; Role of precipitation and temperature in determining the major types of vegetation and endemism in India. **(3 Lectures)**

## UNIT-IV

**Weed Ecology & Management:** The impact, use and ecological role of weeds in agroecosystems, weed characteristics related to success, Major-weeds of the world; Ecological approach to weed management. **(7 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 Lab**

**Code: BOT607**

| L | T | P | Credits | 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 Agroecosystems: Ecological Approaches*. CRC Press: Florida, USA, 1988.
2. Botkin, D. and Keller, E. *Environmental Science*. John Wiley Publishers: New York, USA, 1995.
3. Enger, E.D., and Smith, B.F. *Environmental Science*. WCB, Publishers: Iowa, U.S.A., 1992.
4. Hunter, M.L. *Maintaining Biodiversity in Forest Ecosystems*. Cambridge University Press: Cambridge, 1999.
5. Newman, E.I. *Applied Ecology*. Blackwell Scientific Publishers: UK, 1994.
6. Odum, E.P. *Fundamentals of Ecology*. Saunders Toppan, USA, 1971.
7. Ramakrishanan, P.S. *Ecology of Biological Invasion in the Tropics*. International Scientific Publications, New Delhi, 1991.
8. Raven, P.H., Berg, L.R., and Hassenzahl, D.M. *Environment*. 7<sup>th</sup> edition. Wiley, Hoboken, USA, 2010.
9. Shibu, J., Singh, H.P., Batish, D.R. and Kohli, R.K. *Invasive Plant Ecology*. CRC Press, Taylor and Francis Group, Boca Raton, New York, USA, 2013.

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10. Singh, H.P., Batish, D.R., and Kohli, R.K. *Handbook of Sustainable Weed management*. Food Products Press: New York, USA, 2006.
11. Singh, J.S., Singh, S.P., and Gupta, S.R. *Ecology, Environment and Resource Conservation*. Anamaya Publishers, New Delhi, 2006.



# DAV UNIVERSITY, JALANDHAR

## M.Sc. Botany (Hons. School) Semester IV

**Paper: Analytical Techniques**

**Paper code: BOT608**

| L | T | P | Credits | Marks | Minimum marks |
|---|---|---|---------|-------|---------------|
| 4 | 1 | 0 | 4       | 100   | 40            |

### **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 metery – Principles and applications.

**(1 Lecture)**

Principles and applications of Light, Phase Contrast, Fluorescence, Scanning and Transmission Electron Microscopy.

**(6 Lectures)**

### **UNIT II**

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.

**(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)**

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## 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 lab**

**Paper code: BOT609**

|          |          |          |                |              | <b>Minimum</b> |
|----------|----------|----------|----------------|--------------|----------------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> | <b>Marks</b> | <b>marks</b>   |
| 0        | 0        | 3        | 2              | 50           | 20             |

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