DAV UNIVERSITY JALANDHAR

Course Scheme & Syllabus
For
M.Sc. (Hons.)BOTANY
(Program ID-95)

1st TO 4th SEMESTER
Examinations 2021-2022 Session Onwards

Syllabi Applicable For Admissions in 2021

Total minimum credits required for M.Sc. (Hons.) Botany is 98

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	BOT527	Core	Approaches for Crop Improvement	4	0	0	4
4	BOT528	Core	Approaches for Crop Improvement Laboratory	0	0	3	2
5	BOT529	Core	Genetics and Cytogenetics	4	0	0	4
6	BOT530	Core	Genetics and Cytogenetics Laboratory	0	0	3	2
7	BOT539	Core	Plant Cell Biology and Biochemistry	4	0	0	4
	Total						22

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	BOT540	Core	Evolutionary Biology of plants	4	0	0	4
8	BOT538	Core	Seminar	0	0	0	1
	Open Elective/Interdisciplinary Course I			4	0	0	4
	Total						27

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	BOT629	Core	Plant Molecular Biology	4	0	0	4
5	BOT630	Core	Plant 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.	BOT641	Elective	Plant Resource Utilization	4	0	0	4
	BOT642	Elective	Plant Resource Utilization 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

Schem
e of Courses M.Sc.
M.Sc. (Hons.) Botany

Semester IV

S. No	Paper Code	Course Type	Course Title	L	T	P	Cr
1	BOT645	Core	Plant Ecology and Phytogeography	2	0	0	2
2	BOT646	Core	Plant Ecology and Phytogeography Laboratory	0	0	2	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.	BOT647	Elective	Techniques in Plant analysis	4	0	0	4
	BOT648	Elective	Techniques in Plant analysis Laboratory	0	0	3	2
ii.	BOT649	Elective	Advanced Plant Physiology and Metabolism	4	1	0	4
	BOT650	Elective	Advanced Plant Physiology and Metabolism Laboratory	0	0	3	2
iii	BOT643	Elective	Plant Developmental Biology	4	0	0	4
	BOT644	Elective	Plant Developmental Biology 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

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Algae, Fungi and Phytopathology**
Course Code: **BOT521**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To acquaint the students with the origin, history, morphology, biology and importance of prokaryotic and eukaryotic algal and fungal organisms.

Unit I

Algae: Algal classification, Salient features of major divisions (Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta; Phaeophyta and Rhodophyta; along with their important genera).
Algal ecology: Ecological importance of Algae, Algal indicators, Algal blooms – damage and control, Carbon capture by algae, Algal bio fouling, and Symbiotic association.
Economic importance of Algae: Algae as food, fodder, biofertilizer, medicine, industrial uses and other useful products, algae as indicator of water pollution, bio fuels from algae, algae and global warming. **(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 diseaseresistance: transgenic approaches to disease resistance, engineering chemicals that elicit defense responses in plants. **(14 Lectures)**

Learning Strategies: Class room lectures, practical, field visits, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome: This will enable the students to learn the evolutionary and recent trends in lower plants.
Assessment: Mid Semester Exam (MSE) – 25 Marks

	Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT527 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Approaches for Crop Improvement **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Define algae.
ii. Define fungi.
iii. Define symbiosis.
iv. Define algal bloom.
v. Explain algae and global warming**.**

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain criteria used in Algal classification.
Q.3 Differentiate Chlorophyta and Bacillariophyta.
Q.4 Write a note on Deuteromycota.
Q.5 Write salient features of Pheophyta.
Q.6 Explain general accounts of chytridiomycota.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Write an essay on ecological importance of algae.
Q.8 Write a recent system of classification of Fungi.

DAV University, Jalandhar. **ETE**

(Term-Sample)

Name: ……..... **Regd. No.: …….**

Course Code: BOT521 **Time: 3 Hours**

Course Name: Algae, Fungi and Phytopathology **Maximum Marks: 50**

Section – A (Maximum Marks: 1 x 10 = 10)

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. What are the modern trends in algal classification?
ii. Write a short note on the gametangial copulation.
iii. Give the characteristic features of the phaeophyceae. Why these are called brown algae?
iv. How will you differentiate a conidium, an ascocarp and a basidiospore?
v. Explain phytoalexins.
vi. Define fungal- insect mutualism.
vii. Define mycoparasites.
viii. Define hypersensitive reaction.
ix. Explain PR proteins.
x. Describe host- parasite interaction

Section – B (Maximum Marks: 4 x 6 = 24)

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Describe recent system of classification of algae proposed by F. E. Fritsch.
Q.3 Enumerate the role of Jasmonic acid and Salicylic acid in defense mechanism.
Q.4 Describe the process of infection and pathogenesis.
Q.5 Describe pre-existing structural and biochemical defense mechanism.
Q.6 With the help of labeled diagrams only illustrate the disease cycle in cucurbits powdery mildew.
Q.7 Describe asexual reproduction in *Phytophthora* with diagram.
Q.8 Write a note on economic importance of algae and fungi.
Q.9 What is the causal organism of red rot of sugarcane? Describe the structure and reproduction of this fungus.

Section – C (Maximum Marks: 8 x 2 = 16)

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Describe any recent system of classification of fungi studied by you and mention important characteristics of the various classes.
Q.11 Draw detailed life cycle diagram of *Puccinia graminis*. Divide the cycle into haploid, dikaryotic and diploid portion. Indicate the barberry and the wheat phase of the cycle.
Q.12 Explain eradication, chemical and biological means of disease control in detail.
Q.13 With the help of suitable diagrams describe the life cycle of white rust and leaf blight spot of rice.

Programme Name:	**M.Sc. (Hons.) Botany**
Course Name:	**Algae, Fungi and Phytopathology Laboratory**
Course Code:	**BOT522**
Total Credits:	**2**
Credit Components:	**L-0; T-0; P-3**
Learning Objectives:	To acquaint the students about various physiological processes at cellular and organ level in plants.

List of Experiments

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.
6. Smut: tease mount of spores on wheat and permanent slides of the host.

Learning Strategies:	Collection and field trips, Practical, models, charts, online demonstrations, group discussions and assignments
Learning Outcome:	This will enable the students to learn the origin, history, morphology, biology and importance of prokaryotic and eukaryotic algal and fungal organisms and phyto pathology.
Assessment:	Continuous Assessment: 20 Marks Practical Exam: 80 Marks
Model Question Paper:	Practical Exam component is divided into the following sub components: • Performance – 24 Marks • Spotting – 16 Marks • Viva-voce – 24 Marks • Record – 8 Marks • Internal Assessment – 8 marks
Text Books:	1. Fritsch, F. E. *The Structure and Reproduction of the Algae.(Vol.I, Vol II)*.Vikas House Pvt. Ltd, 1979. Print. 2. Graham, Linda E., and Lee Warren Wilcox. *Algae*. Upper Saddler River, NJ: Prentice Hall, 2000. Print. 3. Kumar, H. D. *Introductory Phycology*. New Delhi: Affiliated East-West, 1999. Print. 4. Lee, Robert Edward. *Phycology*. Cambridge: Cambridge UP, 2008. Print.
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., andVerma, 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.

Programme Name:	**M.Sc. (Hons.) Botany I Semester**
Course Name:	**Approaches for Crop Improvement**
Course Code:	**BOT527**
Total Credits:	**4**
Credit Components:	**L-4; T-0; P-0**
Learning Objectives:	To introduce the students about plant breeding, regeneration of plants and genetic variations under artificial conditions.

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. Mass and pure line selection.

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

Micro-propagation: application in horticulture and forestry. Cryopreservation and germplasm storage; Anther and pollen culture and their importance; Isolation, culture and fusion of protoplasts

In-vitro production of secondary metabolites from medicinal plant culture; Microbial production of vitamins, organic acids and alcohols. Energy plantations and petro plants. **(6 Lectures)**

History of Genetic modified crops; The gene addition approach to plant genetic engineering; Plants that make their own insecticides; Herbicide resistant crops. **Gene subtraction;** Antisense RNA and the engineering of fruit ripening. **Problems with genetically modified plants;** Safety concerns with selectable markers; The terminator technology; The possibility of harmful effects on the environment. **(7 Lectures)**

Unit IV

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.

Cloning vectors for plants: *Agrobacterium tumefaciens*—nature's smallest genetic Engineer, Using the Ti plasmid to introduce new genes into a plant cell, Production of transformed plants with the Ti plasmid, The Ri plasmid, Limitations of cloning with *Agrobacterium* plasmids,

Cloning genes in plants by direct gene transfer, Direct gene transfer into the nucleus, Transfer of genes into the chloroplast genome, Attempts to use plant viruses as cloning vectors; Caulimo virus vectors, Gemini virus vectors. **(12 Lectures)**

Learning Strategies:	Class room lectures, practical, crop land visits, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome:	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.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT527 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Approaches for Crop Improvement **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Define totipotency.
ii. Define Green revolution.
iii. Define Inbreeding depression.
iv. Define centre of origin.
v. Define Heterosis

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain mass selection.
Q.3 Differentiate self and cross pollinated crops.
Q.4 Explain domestication.
Q.5 Explain Gamma Garden.
Q.6 Explain soma clonal variation.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 What is centre of origin? Explain various centres of origin of cultivated plants.
Q.8 What are haploids? Explain the process of their production in tissue culture.

DAV University, Jalandhar. **ETE**

(Term-Sample)

Name: ……..... **Regd. No.: ……**

Course Code: BOT527 **Time: 3 Hours**

Course Name: Approaches for Crop Improvement **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Write a note on objectives of plant breeding.
ii. Define genetic variability.
iii. Explain incompatibility.
iv. Define inbreeding depression.
v. Explain gamma garden.
vi. Explain somaclonal and gametoclonal variation.
vii. Differentiate hybrids and cybrids.
viii. Define terminator technology.
ix. Explain floral-dip.
x. Define herbicide resistant crops

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Define secondary metabolites and In-vitro production of secondary metabolites.
Q.3 Enumerate the role of Antisense RNA in the engineering of fruit ripening.
Q.4 Define the process of isolation, culture and fusion of protoplast.
Q.5 Explain anther and pollen culture and their importance.
Q.6 Describe the process of sexual reproduction in plants.
Q.7 Write a note on synthetic seeds and somatic embryos.
Q.8 Describe Caulimo and Gemini viruses as natural vectors.
Q.9 Explain particle bombardment.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q. 10 Explain direct and indirect gene transfer methods in plants by using suitable diagrams.
Q. 11 What are plant transformation vectors? How they introduce foreign genes into host plants, explain.
Q. 12 What is hybridization? Explain role and methods of hybridization for mass and pure line selection.
Q. 13 Explain in detail domestication, selection and centre of origin of cultivated plants proposed by Vavilov.

Programme Name: **M.Sc. (Hons.) Botany I Semester**
Course Name: **Approaches for Crop Improvement Laboratory**
Course Code: **BOT528**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To acquaint the students about various breeding processes at different levels and techniques used in plant breeding and tissue culture practices.

List of Experiments

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 techniques of encapsulation of shoot meristem /somatic embryos in calcium alginate beads.

Learning Strategies: Practical, models, field trips, charts, online demonstrations, group discussions and assignments,

Learning Outcome: The students will come to know about artificial induction of polyploidy, techniques for tissue culture, the process of artificial hybridization and study different nutrient media.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text 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., 2001. Print.
3. Chopra, V. L. *Breeding Field Crops.* New Delhi: Oxford and IBH Pub., 2004. Print.
4. Gupta, S. K. *Practical Plant Breeding*. 2nd ed. Jodhpur: Agrobios (India), 2010. Print.

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., 2001. Print.
3. Chopra, V. L. *Breeding Field Crops.* New Delhi: Oxford and IBH Pub., 2004. Print.

4. Gupta, S. K. *Practical Plant Breeding*. 2nd ed. Jodhpur: Agrobios (India), 2010. Print.
5. Poehlman, John Milton, and Dhirendranath Borthakur. *Breeding Asian Field Crops, with Special Reference to Crops of India*. Calcutta: Oxford & IBH Pub., 1969. Print.
6. Roy, Darbeshwar. *Plant Breeding: Analysis and Exploitation of Variation*. Pangbourne, UK: Alpha Science International, 2000. Print.
7. Bhojwani, S. S., and Razdan, M. K. *Plant Tissue Culture: Theory and Practice*. Amsterdam: Elsevier ;, 1983. Print.
8. Chawla, H. S. *Introduction to Plant Biotechnology*. New Delhi: Oxford & IBH Pvt.Ltd., 2002. Print.
9. Hammond, J., McGarvey, P., and Yusibov, V. *Plant Biotechnology: New Products and Applications*. Berlin: Springer, 2000. Print.
10. Kumar, H.D. *A Text Book of Biotechnology*.Affiliated East West, Pvt., 2010. Print**.**
11. Murray, David R. *Advanced Methods in Plant Breeding and Biotechnology*. Melksham: Redwood Press Pvt.Lmt., 1991. Print.
12. Old, R.W., and Primrose, S.B. *Principles of Gene Manipulation: An Introduction to Genetic Engineering*. Oxford: Blackwell Scientific Publications, 1985. Print.
13. Razdan, M. K. *Introduction to Plant Tissue Culture*. New Delhi: Oxford and IBH Pvt. Ltd., 1983. Print.
14. Rainert, J. and Yeoman, M.M. *Plant Cell and Tissue Culture ; A Laboratory Manual*. Berlin: Springer-Verlag, 1982. Print.
15. Street, H. E. *Plant Tissue and Cell Culture*. London: Blackwell Scientific Publications, 1973. Print
16. Smith, Roberta H. *Plant Tissue Culture: Techniques and Experiments*. New York: Academic, 2000. Print.
17. 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.

Websites and Audio Video lectures:

CROP WILD RELATIVES GLOBAL PORTAL
www.cropwildrelatives.org

Programme Name: **M.Sc. (Hons.) Botany I Semester**
Course Name: **Genetics and Cytogenetics**
Course Code: **BOT529**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To acquaint the students about the hereditary basis of life, prokaryotic and eukaryotic genome organization and its functions.

Unit I

Mendelian genetics: Dominance, segregation, independent assortment, extension of Mendelian principles: codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, lethal genes, test cross and back cross. **(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. **(6 Lectures)**

Unit II

Mutation: Types and causes, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants **(4 Lectures)**

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, Aneuploidy, nullisomy, monosomy, trisomy, tetrasomy, euploidy, monoploidy and haploidy, polyploidy **(4 Lectures)**

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

Unit III

Genome: Organization in prokaryotes and eukaryotes, Nuclear DNA content; law of DNA constancy and C-value paradox; Cot curves, DNA-DNA hybridization, Junk DNA, expressed gene in many copies, Globin gene family, human genome project, quantitative genetics **(6 Lectures)**

Chromosome: Euchromatin and heterochromatin, unique and repetitive DNA; Karyotype analysis and banding patterns, Types of chromosomes **(8 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)**

Quantitative Genetics: Polygenic inheritance, heritability and measurements, QTL mapping. **(3 Lectures)**

Learning Strategies: Class room lectures, practical, crop land visits, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: To provide insight into structure and functions of chromosomes, chromosome mapping, 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.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar.

Term-18192/1819T (Backlog)

MSE

March 2019

Name: …… **Regd. No.: …….**

Course Code: BOT 529

Course Name: Genetics and Cytogenetics

Roll No.: …….

Time: 1 Hour 30 Minutes

Maximum Marks: 25

……

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Describe following terms.

a. Dominance

b. Segregation

c. Linkage

d. Letual genes

e. Penetrance

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain Stern's hypothesis.

Q.3 Explain multiple cross over.

Q.4 Explain test cross and back cross.

Q.5 Explain types of mutations.

Q.6 Differentiate between monoploidy and haploidy.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Explain in details mapping in bacteria and bacteriophage.

Q.8 Explain numerical alterations of chromatozones.

DAV University, Jalandhar.

(Term-18191)

ETE

December, 2018

Name: …… **Regd. No.: ……**

Course Code: BOT 529

Course Name: Genetics and Cytogenetics

Time: 3 Hours

…… **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Describe briefly

i. Coefficient of coincidence

ii. Gain of function

iii. Somatic cell hybrids

iv. nullisomy

v. Cot curve

vi. Repititive DNA

vii. Human genome project

viii. Map distance

ix. Genome imprinting

x. Pleiotropy

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 What is sex determination? Describe briefly various mechanism of sex determination found in plants.

Q.3 How can statistical tools can be used to describe and analyze quantitative traits?

Q.4 Why Neurospora is used as modal organism in genetics? Explain haploid mapping in Neurospora.

Q.5 Write the steps of chromosome walking. How chromosome walking is different from chromosome jumping?

Q.6 Describe any two molecular markers used in gene mapping.

Q.7 What is karyotype analysis? Explain types of chromosome.

Q.8 Describe the significance of cot curves, DNA-DNA hybridization.

Q.9 Explain genetic and physical maps of chromosome.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Differentiate between a) Euchromatin and Heterochromatin.

b) Tetrasomy and Trisomy.

c) Germinal and Somatic mutations.

d) Organisation in prokaryotes and eukaryotes.

Q.11 What are Cut and Paste transposons? Explain mutation induced by Transposons.

Q.12 What are causes of lethal, conditional and Biochemical mutations?

Q.13 Explain mapping in Bacteria and Bacteriophage.

Programme Name: **M.Sc. (Hons.) Botany I Semester**
Course Name: **Genetics and Cytogenetics Laboratory**
Course Code: **BOT530**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To acquaint the students about the hereditary basis of life, prokaryotic and eukaryotic genome organization and its functions.

List of Experiments

1. Workout problems related to linkage, crossing over and gene mapping, human pedigree analysis.
2. Study of permanent mounts of different stages of mitosis from onion root tips.
3. Studies of different cell organelles.
4. Study of mitosis and meiosis in higher plants.
5. Study of aberrant mitosis from 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, Cbanding and Q-banding (Photographs/Slides).
9. Preparation of standard curve of carbohydrates. Carbohydrate estimation by different methods
10. Preparation of standard curve of protiens and protiens estimation by different methods.
11. Lipid isolation from plant samples.
12. Paper and Thin layer chromatography for identification of amino acids in plant samples.

Learning Strategies: Practical, models, field trips, charts, online demonstrations, group discussions and assignments,

Learning Outcome: 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.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text 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.

Reference Books:

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.

Programme Name: **M.Sc. (Hons.) Botany I Semester**
Course Name: **Plant Cell Biology and Biochemistry**
Course Code: **BOT539**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: Make students well versed with cell structure and function. To make them understand the basic regulation of cell processes and molecules. To give them an idea about the functioning of cell.

Unit I

First cell, prokaryotic and eukaryotic cell. Membrane Structure and Membranous Organelles: Introduction, The fluid-mosaic membrane model, Plasma membrane, Endoplasmic reticulum, Golgi apparatus, Exocytosis and endocytosis, Vacuoles, The nucleus, Peroxisomes, Plastids, Mitochondria. **(7 Lectures)**

The Cell Wall: Introduction, Sugars as building blocks of cell wall, Macromolecules of the cell wall, Cell wall architecture, Cell wall biosynthesis and assembly, growth of cell walls and Cell differentiation. **(5 Lectures)**

Unit II

Membrane Transport: Overview of plant membrane transport systems, Pumps, Ion channels, Cotransporters, Water transport through aquaporins. **(4 Lectures)**

Protein Sorting and Vesicle Traffic: The cellular machinery of protein sorting, Targeting proteins to - plastids, mitochondria, peroxisomes and nucleus, Protein traffic and sorting in the secretory pathway: ER, Golgi apparatus and beyond. **(5 Lectures)**

The Cytoskeleton: Introduction to the cytoskeleton, Characteristics of actin filaments and microtubules, Role of actin filaments in intracellular movement, Cortical microtubules and expansion in plants, Acentric Mitosis and cytokinesis. **(4 Lectures)**

Unit III

Cell Division: Plant cell cycle, Mechanisms of cell cycle control, The logic of cell cycle control, Cell cycle control in multicellular organisms, Cell cycle control during development, Senescence and cell death, cancer. **(4 Lectures)**

Signal Transduction: Characteristics of signal perception, transduction, and integration in plants, Intracellular signal transduction, amplification, and integration via second messengers and MAPK cascades, Phytohormone signal transduction - an overview, Signal transduction from phytochromes, regulation of stomatal aperture. **(8 Lectures)**

Unit IV

Carbohydrates: Classification, structure and function of carbyhydrates a) monosaccharides b) oligosaccharides c) polysaccharides, storage polysaccharides, structural polysaccharides, glycoproteins. **(3 Lectures)**

Amino Acids: Assimilation of inorganic nitrogen into amino acids, Aromatic amino acids, Aspartate- derived amino acids, Branched- chain amino acids, Glutamate- derived amino acids, Histidine. **(3 Lectures)**

Protein Synthesis, Folding, and Degradation: From RNA to protein, Mechanisms of plant viral translation, Post- translational modification of proteins, Protein degradation. **(3 Lectures)**

Lipids: Structure and function of lipids, Fatty acid biosynthesis, Acetyl- CoA carboxylase, Fatty acid synthase, Desaturation and elongation of C16 and C18 fatty acids, Synthesis and catabolism of storage lipids. **(5 Lectures)**

Learning Strategies:	Class room lectures, practical, crop land visits, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome:	This will enable the students to learn the working of the cell.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted
Text Books:	1. Stryer, L. Biochemistry. 5thed. New York: W.H. Freeman and Co., 1995. Print. 2. Voet, D., and Voet, J.G. Biochemistry. New York: John Wiley and Sons Inc., 1995. Print.
Reference Books:	3. Buchanan, B.B., Gruissem, W. and Jones, R.L. Biochemistry and Molecular Biology of Plants. India: I K Internationals, 2005. Print. 4. Heldt, H.W. Plant Biochemistry. California: Elsevier, 2005. Print

DAV University, Jalandhar.

Term-18192/1819T (Backlog)

MSE

March 2019

Name: ……

Regd. No.: ……

Roll No.: ……

Course Code: BOT 539

Course Name: Plant Cell Biology and Biochemistry……

Time: 1 Hour 30 Minutes

Maximum Marks: 25

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Describe following terms.

a. Aquaporins

b. Ion channels

c. Targeting proteins

d. Endocytosis

e. Protein traffic

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain structure and function of Golgi apparatus.

Q.3 Explain the function of peroxisomes.

Q.4 Explain water transport through aquaporins.

Q.5 Explain characteristics of role of actin filaments in intracellular movement.

Q.6 Explain cell differentiation.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Explain macromolecule of cell wall.

Q.8 Explain Fluid mosaic model of plasma membrane.

DAV University, Jalandhar.
(Term-Sample)

ETE

Name: ……..... **Regd. No.: ……**

Course Code: BOT 539 **Time: 3 Hours**
Course Name: …Plant Cell Biology and Biochemistry **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Explain briefly following terms:-

i. Endocytosis
ii. Protein sorting
iii. MAPK cascades
iv. Catalyst
v. Signal molecules
vi. Senescence
vii. Phragmosome
viii. Aquaporins
ix. Microtubules
x. Phytochrome

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain macromolecules of cell wall.
Q.3 What are targetting proteins? Explain targetting proteins in nucleus.
Q.4 Explain the characteristics of actin filaments and microtubules.
Q.5 Write a short note on functions of carbohydrates and lipids
Q.6 What is signal transduction. Explain Signal transduction from phytochromes.
Q.7 Explain protein synthesis in plastids.
Q.8 What is Apoptosis? Explain the molecular basis of Cancer.
Q.9 Write a short note on Protein degradation and enzymes.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Explain briefly
a) Assimilation of inorganic nitrogen into amino acids.
b) Acetyl- CoA carboxylase.
c) Senescence and cell death.
d) Function of Golgi apparatus.

Q.11 Explain Intacellular Signal transduction, amplification and integration via second messengers.
Q.12 Explain the role of actin filaments in intracellular movement, cortical microtubules and expansion in plants.
Q.13 What do you mean by protein sorting? Explain protein traffic and sorting in ER and Golgi apparatus.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Archegoniate Biology**
Course Code: **BOT531**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To expose the students to evolutionary history, morphology, biology and affinities of Bryophytes and Pteridophytes and Gymnosperms.

Unit I

Bryophytes: 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: Indian bryodiversity with particular emphasis to Himalayas; Threatened bryophytes; strategies to conserve diversity at National and Global levels. **(6 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 hyper accumulators of arsenic, mechanism of uptake, transfer and tolerance and use in phyto remediation.

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

Learning Strategies: Class room lectures, practicals, field visits, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: The students will come to know about bryophytes, pteridophytes and gymnosperms: their classification, identification and

	distribution as well as their conservation etc.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……. **Regd. No.: ……**

Course Code: BOT531 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Archegoniate Biology **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Write two important characters of endohydric bryophyte.
ii. Write a short note on halophytic bryophytes.
iii. Explain calcicoles and calcifuges.
iv. Define endemism in case of bryophyte.
v. Write the names of 4 threatened bryophytes in India.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.
Q.2 Write a note on uptake of water and minerals in bryophytes.
Q.3 Write salient features of Takakiales.
Q.4 Explain epiphytic, epiphyllic and epilithic bryophytes.
Q.5 Write salient features of Marchantiales
Q.6 Write a note on Anthocerotales.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.
Q.7 Write classification and explain salient features Hepaticopsida, Anthoceropsida and Bryopsida.
Q.8 Explain bryogeography and conservation with particular emphasis to Indian Himalayas

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Archegoniate Biology Laboratory**
Course Code: **BOT532**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To acquaint the students about morphology, anatomy and reproductive systems of bryophytes, pteridophytes and gymnosperms.

List of Experiments

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*

Learning Strategies: Practical, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: The students will come know to about morphology, anatomy and reproductive systems of bryophytes, pteridophytes and gymnosperms.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Gilbert M. Smith. Cryptogamic Botany- Bryophytes and pteridophytes. 1938, The Mcgra w-hill Book Company, *inc.*
2. Jeffrey, E. C. 1917. The anatomy of woody plants. Chicago. 478 pp. 306 figs.

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.

Websites and Audio Video lectures:

www.bryophyte.org, www.pteridophyte.org, www.gymnosperms.org

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Physiology**
Course Code: **BOT533**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To acquaint the students about various physiological processes at cellular and organ level in plants.

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; Role of microbes in nutrient acquisition by plants; Assimilation of mineral nutrients with emphasis on phosphorus and potassium assimilation. **(6 Lectures)**

Unit II

Photosynthesis: Energy pathways in photosynthesis; Composition and characterization of photosystem-I and -II; 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)**

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

Plant Respiration: Detailed mechanism; Glycolysis and TCA cycle, Mitochondria as biological oxidators; Chemiosmatic regeneration of ATP, Boyer and Walkers confirmation change model; CN- resistant respiration. **(5 Lectures)**

Unit III

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

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

Unit IV

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)**

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

Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and

	presentations by students
Learning Outcome:	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.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT533 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: PLANT PHYSIOLOGY **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Define the following terms:

i. Water Potential
ii. Cohesion
iii. Tension
iv. Chlorosis
v. Substrate level phosphorylation

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 What is xanthophyll cycle? What is its importance in plants?
Q.3 Differentiate between the deficiency symptoms of nitrogen and sulphur.
Q.4 What is your opinion is the reason behind upward movement of water in plants?
Q.5 Transpiration is a necessary evil. Justify the statement.
Q.6 Discuss the importance of photosynthesis for humans.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Discuss the importance of micro-organisms in nutrient uptake in plants.
Q.8 Write an essay on C3 carbon fixation cycle in higher plants.

DAV University, Jalandhar. **ETE**

(Term-Sample)

Name: ……..... **Regd. No.: ……**

Course Code: BOT533 **Time: 3 Hours**

Course Name: PLANT PHYSIOLOGY **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory. Fill in the Blanks with appropriate choice.

Q.1 Define the following

i. Competence
ii. Climectric Fruit
iii. Fruit ripening
iv. ABA
v. Cadastral genes
vi. Source-Sink relationship
vii. ABC model
viii. Site of Sucrose synthesis
ix. Phloem loading
x. Fruit set

Section – B **(Maximum Marks: 6 x 4 = 24)**

Answer any 6 out of the following questions. Short Answer Type, questions should be answered between 2-3 pages.

Q.2 Discuss the functions of Auxin in plants.
Q.3 Write a short note on source-sink relationship.
Q.4 Write a note on mobilization of food reserves in seed germination.
Q.5 What do you understand by shade avoidance and how does phytochrome help in it?
Q.6 Explain photoperiodism in relation to flowering in higher plants.
Q.7 Explain along with a diagram Munch's pressure flow hypothesis for phloem transport.
Q.8 Write a short note on vernlization.
Q.9 Write a note on Kreb's cycle.

Section – C **(Maximum Marks: 8 x 2 = 16)**

In this section attempt any 2 Questions out of following questions. The questions should be answered within 5-6 pages.

Q.10 Write an essay on control of flowering in plants with special mention to phase change and photo-inductive cycles.
Q.11 What are the 5 key enzymes involved in the C3 cycle? How they are regulated?
Q.12 Define different types of seed dormancy and the different methods used to overcome seed dormancy.
Q.13 Write a note on uptake of mineral nutrients by green plants.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Physiology Laboratory**
Course Code: **BOT534**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To acquaint the students about various physiological processes at cellular and organ level in plants.

List of Experiments

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.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: 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.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Srivastava, L.M. *Plant Growth and Development*. NewYork: Associated Press, 2002. Print.
2. Taiz, L., and Zeiger, E. *Plant Physiology*. California: The Benjamin/Cumming Publishing Company, 1998. Print.

Reference Books:

1. Bonner, B., and Varner, J.E. *Plant Biochemistry*. London: Academic Press, 1976. Print.
2. Stryer, L. *Biochemistry*. 5th ed. New York: W.H. Freeman and Co., 1995. Print.
3. Voet, D., and Voet, J.G. *Biochemistry*. New York: John Wiley and Sons Inc., 1995. Print.
4. Wilkins, M.B. *Advanced Plant Physiology*. New York: Pitman, 1984. Print.
5. Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. India: I K Internationals, 2005. Print.

Websites and Other Supportive Material: www.plantphys.org

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Conservation of Natural Resources**
Course Code: **BOT535**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To make the students learn about the significance of different natural resources and their conservation strategies.

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: Soil structure, soil orders, properties and services of soil, reasons of soil degradation, dust bowl, types of soil erosion and its check; Role of soil micro-organisms; Soil reclamation. **(6 Lectures)**

Conservation of Mineral Resources: Demographic quotient and mineral exploration, mining, processing and utilization; conservation. **(2 Lectures)**

Unit II

Conservation of Agriculture: Conservation of arable land; conservation agriculture, conservation tillage, genetic erosion, conservation of crop genome; Strategies of conservation of crops, mulches. **(4 Lectures)**

Pesticides and herbicides: role in crop protection; Organic, inorganic and hormonal pesticides and herbicides. Environmental hazards of pesticides and insecticides - their impact on life and life support system. **(6 Lectures)**

Role of botanicals in crop protection; Biological management of pests; Integrated weed management. **(4 Lectures)**

Unit III

Bioremediaton and Phytoremediation: Major contaminants, plant ecotoxicology, phytosquestration, rhizodegradation, phytoextraction, phytodegradation, phytovolatization,. Bioremediation of pesticides, contaminants and metallic pollutants, Importance of GMOs in crop biodiversity and agroecology. **(5 Lectures)**

Conservation of Forests: Joint Forest Management, Plantation Programmes in India – Social and Urban Forestry; Forest Conservation Act. **(2 Lectures)**

Conservation of Aquatic System: water cycle, significance of wetlands, need and strategies of conservation of Aquatic systems-water pollution (sediment, inorganic, heavy metal, organic, thermal), desalination, reclamation of sewage water, drip irrigation. **(5 Lectures)**

UNIT IV

Biodiversity and its Conservation: Definition, levels, measurement, threats, drivers of biodiversity loss, strategies for biodiversity conservation. **(4 Lectures)**

Endangered and threatened species: IUCN Categories of Extinction

Principles and strategies for biodiversityconservation: *In-situ* conservation: protected areas sanctuaries, biosphereresreserves, national parks. *Ex-situ* conservation: botanical gardens,herbarium; *In-vitro* Conservation: germplasm and gene Bank; tissueculture: pollen and spore bank, DNA bank. **(6 Lectures)**

Biodiversity Hotspots:concept; Biodiversity hotspots of India **(3 Lectures)**

Learning Strategies: Class room lectures, practicals, models, charts, power point

	presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome:	The students will gain the knowledge of significance of biodiversity, different conservation strategies, biosphere reserves etc.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT535 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Conservation of Natural Resources **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Write briefly about the functions of National Green Tribunal.
ii. What is meant by field capacity of the soil?
iii. What is meant by soil profile?.
iv. What is genetic erosion?
v. What are hyperaccumulator plants? Give one example.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Give an account of various divisions of NBPGR.
Q.3 Write briefly about any two soil orders.
Q.4 With the help of suitable examples, discuss the importance of plant genetic resources.
Q.5 Which agricultural practices are followed in alternative agriculture?
Q.6 Write a short note on i. rhizodegradation and ii. phytostabilization.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Give the methodology followed for genetic resource conservation. Discuss the advantages and disadvantages of various methods used for conservation of plant genetic resources.
Q.8 Discuss in detail the various steps involved in the mining process.

DAV University, Jalandhar. **ESE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT535 **Roll No.: ……**

Time: 3 Hours

Course Name: Conservation of Natural Resources **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. What are the main sources of toxic organic waste in water?

ii. Differentiate between natural erosion and accelerated erosion.

iii. What are aquifers?

iv. Give one important feature of Water Act of 1974.

v. What is 'rainmaking'?

vi. Mention two important features of biosphere reserves.

vii. Water permeability is dependent on the soil texture. Explain.

viii. When is a taxon classified as 'extinct'?

ix. Differentiate between 'national parks' and 'strict nature reserves'.

x. What is dredging?

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write briefly about the following soil orders: i) aridisol, ii) mollisol and iii) oxisol.

Q.3 Give an account of the five major mass extinction events in Earth's history

Q.4 Discuss the various types of water erosion.

Q.5 Write about the different factors that are responsible for biodiversity loss.

Q.6 What is social forestry? Discuss the different types of social forestry.

Q.7 Describe the structure and function of a biosphere reserve.

Q.8 Describe any two botanicals in detail.

Q.9 Give a detailed account of different strategies for reclamation of water.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Give detailed account of the causes and control of i) thermal pollution and ii) sediment pollution

Q.11 Give an elaborate description of any two major biodiversity hotspots in India.

Q.12 Write in detail about the various categories of protected areas given by IUCN.

Q.13 What are the major challenges to commercialization of botanicals?

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Conservation of Natural Resources Laboratory**
Course Code: **BOT536**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To make the students learn about the significance of different natural resources and their conservation strategies.

List of Experiments

1. To study pH and EC of different types of soil.
2. To evaluate the status of natural resources present in the University campus.
3. To estimate and categorise the waste generated in University campus.
4. To study the impact of salinity on plant growth
5. To undertake a field visit to understand the concept and consequences soil degradation and erosion.
6. To study different types of ecological systems.
7. Ecological footprint analysis.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: The students will come to know the status of natural resources, land degradation, water pollution and soils in the surrounding area. Also the concept of ecological footprint will enlighten then towards developing a sustainable environment

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 25 Marks
- Spotting – 15 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Michael, L., McKinney and Schoch, R.M.*Environmental science: Systems and Solutions*. West publishing company, 2002.Print.
2. Oehme, W.F. *Toxicity of Heavy Metals in Environment.* Marcel DakkarInc, 1989.Print.
3. James, P. and Lodge, J. R. *Methods of Air sampling and Analysis.* ISc Lewis Pub. Inc, 1971.Print.

Reference Books:

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

water and Waste water. (XX Edn), 1990. American Public Health Association. Print.
5. Butter, G.C. *Principles of Ecotoxicology.* 1988. John Wiley and Sons. Print.
6. Cockerham, G. L. and Shane, B.S. (Eds.). *Basic Environmental Toxicology*. CRC Press, 1994. Print.
7. Eisenbude, M. *Environmental Radioactivity*. Academic Press, 1998. Print.
8. Fellenberg, G. *Chemistry of Pollution*. John Wiley and Sons, 1999.Print.
9. Hayes, W.A.*Principles and Methods of Toxicology*. CRC Press, 2001.Print.
10. Klaassen, C.D. andAlkinsJ.B.W.*Essentials of Toxicology*. McGraw-Hill Professional, 2003.Print.
11. Lutgens, F.K. andTarbuek, J.E.*The Atmosphere*. Prentice Hall, 1992.Print.

Websites and Audio Video lectures: https://www.footprintnetwork.org/our-work/ecological-footprint/

Other Supportive Material: http://www.geokniga.org/bookfiles/geokniga-handbook-soil-analysis.pdf

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Evolutionary Biology of Plants**
Course Code: **BOT540**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: This course presents an overview of biological evolution. Students are introduced to the Darwin's ideas about the mechanisms of evolution, to an up-to-date history of life, to current evolutionary theory.

Unit I

Historical perspective of evolutionary biology, fundamental concepts in cosmology and geology **(2 Lectures)**

Earliest forms of plant life: the earliest environments, accumulation of organic material and formation of the first cell, the first prokaryotes geological evidence, evolution of photosynthesis, evolution of plants using C4 and CAM photosynthetic pathways, evolution of eukaryotes **(6 Lectures)**

Pre-Darwinian and Darwinian theories of organic evolution, Concept of Oparin and Haldane; Experiment of Miller (1953), phylogenetic tress, taxonomic and biological concept of species, dating methods **(5 Lectures)**

Unit II

Paleontology, geological time scale, eras, periods and epochs, major evolutionary events in the geological time scale, fossil evidence for plant terrestrialization, examples of earliest land plants in the fossil record **(5 Lectures)**

Evolutionary trend: algae to land plants, evolutionary trend in land plants: vascular to non-vascular, influence of land dwelling plants on the earth system **(4 Lectures)**

Mass extinction events in plants: evidence in the geological record, evidence for persistence in the plant fossil record, Pleistocene glaciations **(4 Lectures)**

Unit III

Origins of multicellularity in the plant kingdom, development and genetics in the evolution of land plant body plans, the evolution of plant development: past, present and future, innovations in the origin of vascular plants **(6 Lectures)**

Altruism, Kin selection, Biological clocks; Mating systems, Parental investment and Reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral changes **(7 Lectures)**

UNIT IV

Allopatric speciation, genetic models, peripetric speciation, disjunct distributions, the theory of island biogeography, Sympatric speciation, the role of genetic drift and gene flow in evolution, models of genetic drift, evolutionary development of plant speciation, macroevolution and the biological diversity of plants, Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; origin of new genes and proteins; Gene duplication and divergence. **(13 lectures)**

Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome:	Students are expected to become familiar with the conceptual models through which we attempt to understand complex biological systems, the facts upon which those models are based, and the processes through which we discover these facts.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted
Text 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 InIndia: Conservation and Utilization.* New Delhi: National Bureau of Plant Genetic Resources, 1996.Print.
Reference Books:	1. Cristi, B.R. *Handbook of Plant Science and Agriculture*, Vol. I. *In-situ Conservation*, Florida, U.S.A: CRC Press, Boca Raton, 1999.Print. 2. Council for Scientific & Industrial Research. *The Useful Plants of India*, New Delhi: Publications and Information Directorate, CSIR, 1986.Print. 3. Kocchar, S.L. *Economic Botany of the Tropics*, 2nd ed., New Delhi Macmillan India Ltd., 1998.Print. 4. Swaminathan, M.S., and Kocchar, S.L., (eds.). *Plants and Society*. London: MacMillan Publications Ltd., 1989.Print. 5. Thakur, R.S., Puri, H.S. and Husain, A.*Major Medicinal Plants of India.* Lucknow: Central Institute of Medicinal and Aromatic Plants, 1989.Print. 6. 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.
Websites and Audio Video lectures:	http://frienvis.nic.in/Database/Dye-Yielding-Plant-Species_2432.aspx; https://www.youtube.com/watch?v=cMacWINhxls

Other Supportive Material: https://www.youtube.com/watch?v=a55PG2d0V9c

DAV University, Jalandhar. **MSE**
Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT540 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Evolutionary Biology of Plants **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. What is meant by half life of a radioactive substance?
ii. What is the composition of universe?
iii. List five major mass extinction events in history of earth.
iv. Mention an important contribution of Charles Darwin.
v. What are stromatolites?

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Discuss briefly how protocells were formed?
Q.3 What evidences are given for the mass extinction event that took place 65 MYa?
Q.4 Give a brief account of Miller's experiment.
Q.5 Describe the geological time scale.
Q.6 Describe briefly how the Solar system originated?

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 What is meant by 'absolute dating'? Write in detail about the Carbon 14 dating method.
Q.8 Give a detailed account of the origin and genetic system of mitochondria.

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT540 **Roll No.: ……**

Time: 3 Hours

Course Name: Evolutionary Biology of Plants **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Mention two differences between mechanical pulping and chemical pulping.

ii. What is 'patent based biopiracy'?

iii. Write about the ethnobotany related to the drug 'asprin'.

iv. Which plants have provided the ethnobotanical leads for the drugs a) digoxin; and b) codeine.

v. What is bionic prospecting?

vi. Mention the sources for a) Pfu polymerase; and b) Taq polymerase.

vii. Draw a well labeled diagram of the T.S. of coffee drupe.

viii. Differentiate between a) softwood and hardwood; b) sapwood and heartwood.

ix. What is the difference between an abrasive paper and an absorbent paper?

x. Write about any one substitute of para rubber.

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 According to The Protection of Plant Varieties and Farmers' Rights Act of India, mention the eligibility criteria for registration of a variety. Define the following: a) extant variety; and b) farmers' variety.

Q.3 Give an account of any two species of coffee. Write about the wet method of processing of coffee.

Q.4 Discuss the controversy related to the patent grant for Harvard's oncomouse.

Q.5 Mention the characteristic of Traditional Knowledge. Why is it important to protect Traditional Knowledge?

Q.6 Discuss any two non-mechanical properties of wood.

Q.7 Write a note on TKDL.

Q.8 Write briefly about the various methods used for tapping of latex from *Heveabrasiliensis*.

Q.9 Mention various uses of cotton fibre.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Give a detailed account of chemical pulping. Explain how paper is manufactured from pulp.

Q.11 Discuss in detail the cases of biopiracy related to Neem and Basmati.

Q.12 Classify the fibres on the basis of their a) nature and structure; and b) use.

Q.13 Write in detail about the processing of black tea; green tea and oolong tea. Give an account of the chemicals present and their properties in tea leaves.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Seminar**
Course Code: **BOT538**
Total Credits: **1**
Credit Components: **L-0; T-0; P-0**
Learning Objectives: To develop public talking ability of the students

Description

During the course students will come to know about the general understanding of the common problems and recent advances in research. Each student shall be allotted a topic by the instructor. Student will have to understand the topic and collect literature. The students shall give a presentation on the allotted topic, which shall be evaluated by the concerned internal faculty. Through this, the students will develop habit of reading newer topics, will become inquisitive and develop research aptitude.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Scientific Writing and Research Methodology**
Course Code: **BOT621**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To make the students learn how to design an experiment and what are the various research strategies.

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)**

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)**

Probability theory: Origin and concept, deterministic and random experiments, concept of events, sample space, mutually exclusive and equally likely events; classical concept of probability, addition theorem and multiplication theorem in probability. **(3 Lectures)**

Unit II

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)**

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 **(4Lectures)**

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. **(14 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; Software's to check plagiarism. **(10 Lectures)**

Learning Strategies: Class room lectures, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: 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.

Assessment: Mid Semester Exam (MSE) – 25 Marks
Written Quiz (MCQs) – 10 Marks

	Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted
Text Books:	McKillup, S. *Statistics Explained. An Introductory Guide for Life Scientists*. Cambridge, UK: Cambridge University Press, 2006. Print.
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. Selvin, S. *Biostatistics – How it Works.* First Impression. New Delhi: Pearson Education Inc., 2007. Print. 3. Agarwal, B.L. *Basic Statistics*. New Delhi: New Age International, 2006. Print.

DAV University, Jalandhar. **ESE**

(Term-Sample)

Name: ……..... **Regd. No.: ……**

Course Code: BOT621 **Time: 3 Hours**

Course Name: Scientific Writing and Research Methodology **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Write a short note on the following

i. Probability

ii. Type I error

iii. Internal Validity

iv. Null hypothesis

v. Correlation

vi. Regression

vii. Research Design

viii. FRBD

ix. Research article

x. Impact Factor

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Discuss the steps involved in calculation of one way ANOVA.

Q.3 Write a short note on factors governing internal and external validity of an experiment.

Q.4 What are the different types of articles frequently encountered by a researcher?

Q.5 Discuss in short the main headings included in a research paper.

Q.6 Calculate median and mode for the following data

CI	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Frequency	12	15	15	18	20	22	13	12

Q.7 Calculate correlation coefficient between the two given series X and Y, and comment on the relationship between them.

X:	23	25	29	33	37	43	52	36
Y:	12	50	50	28	32	56	65	30

Q.8 What is the probability of getting a red card or a king from a standard pack of 52 cards.

Q.9 Calculate standard deviation for the following data:

CI	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
Frequency	23	25	26	29	32	33	28	20

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Random samples are drawn from two populations and the following results were obtained regarding their blood cholesterols:

Sample X	16	15	20	22	22	18	15	18	20	19		
Sample Y	19	25	20	20	19	19	23	23	25	20	35	15

Compare the groups and comment whether sample X had higher cholesterol than sample Y. [$F_{(9,11,0.05)} = 2.90$; $F_{(11,9,0.05)} = 3.11$; $t_{(21,0.05)} = 1.721$; $t_{(9,0.05)} = 1.833$; $t_{(11,0.05)} = 1.796$]

Q.11 Calculate the regression equations of X on Y and Y on X from the following data:

X:	23	25	29	33	37	43	52	36
Y:	12	50	50	28	32	56	65	30

Q.12 Describe the following:

(a) Latin square design (b) Factorial design

Q.13 Write an essay on how to conduct a good experiment.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Advanced Plant Systematics**
Course Code: **BOT622**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: The students will learn to describe, identify, name and classifyplants. They will also be acquainted with the hierarchical evolution of plant classification. Students will learn about various changes effected in International Code of Nomenclature for algae, fungi and plants over the period of time. They will also learn various techniques to find out phylogenetic relationships between various taxonomic groups of plants.

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. **(8 Lectures)**

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

Unit III

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

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)**

Learning Strategies: Class room lectures, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: The students will be able to derive evolutionary links between various taxa of plants. They will have the knowledge of various principles, rules and amendments in International Code of Nomenclature for algae, fungi and plants.Students will be able to identify and classify the local flora of

	Jalandhar.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: …….**

Course Code: BOT622 **Roll No.: …….**

Time: 1 Hour30 Minutes

Course Name: Advanced Plant Systematics **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. What are telomorphs and anamorphs?

ii. What is Protologue?

iii. Differentiate between tautonym and autonym.

iv. Name any four families whose alternative names are allowed under ICN.

v. What are Latin endings? Give suitable example.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Enlist various principles of ICN.

Q.3 Write a brief note on primary and secondary ranks of taxa.

Q.4 Discuss various voting rights of possessed by members of Nomenclature committee at IBC.

Q.5 What do you understand by principle of priority? Discuss its limitations.

Q.6 Explain different kinds of "typification" as recognized by ICN.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7. Explain all the conditions under which scientific names of plants are rejected. Give suitable examples.

Q.8 Write a note on author citation. Give suitable examples to support your answer.

DAV University, Jalandhar. **ESE**

Term-Sample

Name: ……..... **Regd. No.: …….**

Course Code: BOT622 **Roll No.: …….**

Time: 3 Hours

Course Name: Advanced Plant Systematics **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. What are apomorphic characters?
ii. Define morphocline. Comment on ordered and unordered morphocline.
iii. Explain Gynophore with suitable example.
iv. Diagrammatically show node, internode, synapomorphies on a phylogenetic tree.
v. Write a few lines on: (i) Stipule (ii) Peduncle
vi. What is tetradynamous condition? Give example.
vii. Explain "Ontogeny repeats Phylogeny".
viii. What is Obdiplostemonous condition?
ix. What isPollinia? How does it help in pollination?
x. What is APWeb? Who maintains it?

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Define Homoplasy? Explain reversal and convergence with suitable examples.

Q.3 Enlist various precautions that should be taken before taxon selection and character selection.

Q.4 What is a character step matrix? Explain its types.

Q.5 Explain the following:

(i) Lineage (ii) Polytomy

Q.6 Differentiate between artificial, natural and phylogenetic system of classification.

Q.7 What is scaling of characters? Under what conditions it is done?

Q.8 Write a note on character discretness. Why is it necessary in cladistics analysis?

Q.9 Give an account of author citation with suitable examples.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Write a note on APG system of classification. Mention its various updations.

Q.11 Give an account of Polarity in cladistics analysis? Explain various methods of assigning polarity.

Q.12 Write vegetative and floral description of any two dicot families. Draw floral diagram and write floral formula.

Q.13 From the given character taxon matrix, construct best possible cladogram:

Taxa	Placentation	Aestivation	No: of carpels	Stamen number	Ovule position	Fruit type
P	Marginal	Imbricate	3	2	Campylotropous	Achene
Q	Marginal	Imbricate	4	2	Campylotropous	Achene
R	Axile	Imbricate	5	4	Campylotropous	Drupe
S	Axile	Valvate	5	4	Campylotropous	Drupe
T	Axile	Twisted	5	4	Campylotropous	Berry
Outgroup	Axile	Twisted	5	5	Orthotropous	Berry

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Advanced Plant Systematics Laboratory**
Course Code: **BOT623**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: Students will also learn various techniques to find out phylogenetic relationships between various taxonomic groups of plants.

List of Experiments

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
3. Preparation of herbarium by the students having at least 20 specimens.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: Students will have the knowledge of various principles, rules and amendments in International Code of Nomenclature for algae, fungi and plants.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., and Donoghue, M.J. *PlantSystematics: A Phylogenetic Approach*. Massachusetts: Sinauer Associates, Inc., 2002. Print.
2. Simpson, M.G. *Plant Systematics*. Amsterdam: Elsevier, 2006. Print.

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. Maheshwari, J.K. *The Flora of Delhi*. New Delhi: CSIR, 1963. Print.
5. Nei, M., and Kumar, S. *Molecular Evolution and Phylogenetics*. New York: Oxford University Press, 2000. Print.

6. Radford, A.E., Dickison, W.C., Massey, J.R., and Bell, C.R. *Vascular Plant Systematics*. New York: Harper and Row, 1974. Print.
7. Semple, C., and Steel, M.A. *Phylogenetics*. Oxford: Oxford University Press, 2003. Print.
8. Stuessy T.F. *Plant Taxonomy: The systematic Evaluation of Comparative Data*. New York: Columbia University Press, 2009. Print.
9. Bierhorst, D.W. *Morphology of Vascular Plants*. New York: The Macmillan and Co., 1971. Print.
10. Cronquist, A. *The Evolution and Classification of Flowering Plants*. Boston: Houghton Miffin, 1968. Print.
11. Naik, V.N. *Taxonomy of Angiosperms*. New Delhi: Tata McGraw Hill, 1984. Print.
12. Pandey, S.N., and S.P. Misra. *Taxonomy of Angiosperms*. India: Ane Reference Books, 2008. Print.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Molecular Biology**
Course Code: **BOT629**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To acquaint the students with the basic machinery governing the maintenance of life as it is in the living world.

UNIT I

Maintenance of the genome: Structure of DNA and RNA, significance of major and minor groove, DNA topology, RNA structure, Chromosome, Chromatin and the Nucleosome – structure and organization, Higher order chromatin structure, Regulation of chromatin structure.
Chemistry of DNA synthesis: replication machinery – helicase, gyrase, topoisomerase, ligase, mechanism of DNA polymerase, replication fork, specialization of DNA polymerases, DNA synthesis at replication fork, replication initiation and termination, mechanism of telomere duplication, telomerase. **(15 Lectures)**

UNIT II

Replication errors and their repair: direct reversal of DNA damage, base and nucleotide excision repair, recombination repair and translesion repair. Homologus and site-specific recombination. **(6 Lectures)**
Expression of genome: mechanism of transcription, RNA polymerases and transcription cycle, transcription in prokaryotes and eukaryotes. RNA splicing mechanism and methods, the spliceosome machinery, splicing pathways, alternate splicing, exon shuffling and RNA editing, mRNA transport. **(9 Lectures)**

UNIT III

Translation – mRNA, tRNA, attachment of amino acids to tRNA, ribosome, initiation, elongation and termination of translation. Translation dependent stability of mRNA.The genetic code – degeneracy and governing rules. **(6 Lectures)**
Gene regulation: transcription regulation in prokaryotes (– lac, trp and ara operons) with special mention to phage lambda. Gene regulation in eukaryotes, the two hybrid assay, role of transcription factors and transcription repressors, gene silencing, gene regulation at steps after transcription initiation, RNA in gene regulation. **(6 Lectures)**

UNIT IV

Techniques in molecular biology: Agarose gel electrophoresis for DNA and RNA, DNA hybridization, hybridization probes, PCR, DNA sequencing – mechanisms and instrumentation, model organisms, gene engineering through cutting and joining of DNA molecules, enzymes for DNA modifications. **(12 Lectures)**

Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: To provide insight into structure and functions of DNA and RNA as important hereditary molecules, their regulation and the control they exercise on the individuals metabolism and different techniques used frequently to study the underlying mechanisms to DNA and RNA metabolism. The study will make the students clear regarding what forms the basis of variations in living organisms.

Assessment: Mid Semester Exam (MSE) – 25 Marks

	Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar.

Term-Sample **MSE**

Name: ……..... **Regd. No.: ……**

Course Code: BOT629 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Plant Molecular Biology **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. How cordycepin blocks the RNA elongation.
ii. Define polymerase switching.
iii. Define multirepliconic and primary transcript.
iv. Discuss the role of α-amantin.
v. Name the inhibitor of gyrase enzyme.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2. Give comparison of different forms of DNA.
Q.3 Describe the Meselson –Stahl experiment of DNA replication.
Q.4 Explain the mismatch repair system with suitable diagram.
Q.5 Discuss briefly the process of RNAi with the help of labeled diagram.
Q.6 Explain different types of DNA polymerase.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Explain the mechanism of SOS repair system with well labeled diagram.
Q.8 What do you understand by transcription? Describe its process in prokaryotes.

DAV University, Jalandhar.

Term-Sample **ESE**

Name: ……..... **Regd. No.: ……**

Course Code: BOT629 **Roll No.: ……**

Time: 3 Hours

Course Name: Plant Molecular Biology **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Discuss the following:

i. MALDI
ii. Chromatin
iii. GFP
iv. Intervening sequences
v. Metagenomics
vi. Enhancers
vii. Diauxic growth
viii. Molecular scissors
ix. Attenuation
x. piRNA

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain the mechanism of alternative splicing with example.
Q.3 Describe Southern hybridization with well labelled diagram.
Q.4 Discuss the role of proteomics in crop improvement.
Q.5 Enlist various inhibitors involved in translation and explain their function.
Q.6 Explain DNA sequencing with special emphasis on Sanger method. Make suitable sketch.
Q.7 Explain the following:
(a) RNA Editing (b) Trans-splicing
Q.8 Describe the principle and applications of protein microarray.
Q.9 What do you understand by genetic code? Give various properties of it.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Explain the process of translation in eukaryotes.
Q.11 Describe the principle and working of PCR with well labelled sketch.
Q.12 Define electrophoresis. Discuss the process of two-dimensional gel electrophoresis.
Q.13 Explain the process of Lac operon in detail.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Molecular Biology Laboratory**
Course Code: **BOT630**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To acquaint the students with the basic machinery governing the maintenance of life as it is in the living world.

List of Experiments

1. Demonstration of Equipments: Spectrophotometer; Centrifuge; Electrophoresis unit; pH meter; Water bath; Incubator; Hot air oven; Shaker; Magnetic stirrer; Test tube shaker; Heating plate; Distillation plant; Autoclave; Laminar air flow; PCR; Analytical digital balance; Single-pan balance; Good quality microscope.
2. Isolation of Genomic DNA.
3. DNA detection by Gel electrophoresis.
4. Study of meiosis by smear preparation of PMCs.
5. Study of giant chromosomes in Drosophila/Chironomus.
6. Work out problems based on DNA structure, replication, gene expression and genetic code.

Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: To provide insight into structure and functions of DNA and RNA as important hereditary molecules, their regulation and the control they exercise on the individuals metabolism and different techniques used frequently to study the underlying mechanisms to DNA and RNA metabolism. The study will make the students clear regarding what forms the basis of variations in living organisms.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Cooper, G.M., and Hausman, R.E.*The Cell: A molecular approach* (V Edn). Sinaeur, 2009.Print.
2. Karp, G.*Cell and Molecular biology: Concepts and experiments* (V Edn). John Wiley & Sons, 2008.Print.

References books:

1. Becker,W.M.,Kleinsmith,L.J. and Hardin, J. *The world of the cell* (VI Edn).Pearson.,2007.Print.
2. Lodish, H., Berk, A., Zipursky, L., Matsudaira, P., Baltimore, D. and Darnell, J.*Molecular cell biology* (IV Edn). W H Freeman & Company, 2000.Print.
3.Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and

Walter, P.*Molecular biology of the cell* (IV Edn). Garland Science, Taylor and Francis group, 2002.Print.
4. Brooker, R.J.*Genetics: analysis and principles* (III Edn). McGraw Hill, 2009.Print.
5. Krebs, J.E., Goldstein, E.S. and Kilpatrick, S.T.*Lewin's Genes X*. Jones and Bartlett Publishers, 2011. Print.
6. Buchanan, B.B., Gruissem, W. and Jones, R.L.*Biochemistry and Molecular biology ofplants*. I K International Pvt. Ltd, 2000.Print.
7. Hartl, D.L. and Jones, E.W. *Genetics: Analysis of genes and genomes* (VII Edn). Jonesand Bartlett publishers, 2012.Print.
8. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. andLosick, R.*Molecular biology of the gene* (V Edn). Pearson, 2009.Print.
9. Klug, W.S. and Cummings, M.R.*Concepts of Genetics* (VII Edn). Pearson, 2004.Print.
10. Weaver, R.F.*Molecular biology* (II Edn).McGraw Hill, 2002.Print.
11. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P.*Essential Cell Biology*. Garland Science, 2010.Print.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Project-I**
Course Code: **BOT624**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To develop research aptitude in the students

Description

During the course students will come to know about the general understanding of the common problems and recent advances in research. Each student shall be allotted a topic by the instructor. The students shall submit a synopsis on the allotted topic, 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.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Resource Utilization**
Course Code: **BOT641**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: 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.

Unit I

Centers of origin: Concept, their importance with reference to Vavilov's work; World centers of primary diversity and secondary centers of cultivated plants. **(3 Lectures)**
Plant introductions and exchange: history, plant introduction and exchange agencies in India, activities of NBPGR. **(4 Lectures)**
Fibers: Classification of fibres, physical and chemical processes involved in the manufacturing of fibres from different types of fibre yielding plants **(5 Lectures)**
Sugars: Extraction of sugar from sugar cane- process with a critical study of the steps involved. By-products of sugar industry and their uses. **(3 Lectures)**

Unit II

Gums and resins: Sources of gums and resins and their classifications according to their chemical nature. **(3 Lectures)**
Essential oils: Essential oil yielding plants, their use in perfumery **(4 Lectures)**
Natural dyes: Sources and types of natural dyes in India and their extraction methods, merits and limitations of plant based dyes. **(4 Lectures)**
Natural Rubber: Para rubber, tapping and processing, various substitutes of Para rubber. **(3 Lectures)**

Unit III

Woods: Physical characteristics of Indian woods, methods of seasoning and chemical treatment. Industrial manufacturing of packing material and plywood. Some important commercial woods: *Dalbergia* spp., *Shorea robusta*, *Tectona grandis*, *Cedrus deodara*, Bamboo - the 'green gold' of India **(6 Lectures)**
Paper: Manufacturing of paper and board from raw plant material. Manufacturing of crude and high quality paper, recycled paper. **(5 Lectures)**
Beverages: tea, coffee, cocoa **(4 Lectures)**

UNIT IV

Ethnobotany: Indigenous traditional knowledge, Traditional Knowledge Digital Library (TKDL),Systems of medicines- Ayurveda, Sidda, Unani **(6 Lectures)**
Bioprospecting and Intellectual property rights: Patenting of higher plants, genes and DNA sequences, Plant Breeders Rights and Farmers Rights, bioprospecting (Biotic, chemical and gene prospecting, Benefits sharing and Ethanopharmacology) and biopiracy: examples of turmeric and rice **(7 Lectures)**
Green Revolution*:* Introduction, the wheat revolution, rice varietal improvement, the brown rice, side of green revolution. **(2 Lectures)**
Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome: 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.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT641 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Plant Resource Utilization **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Differentiate between the fibers of cotton and jute.

ii. Mention two differences between essential oils and fixed oils.

iii. Which method is used for extraction of essential oil from citrus fruit?

iv. Which plant and plant part is used to make 'Panama hats'?

v. What was the basis of classification of plants by Alphonse de Candolle?

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Describe the characteristic features of any two species of cotton.

Q.3 Give a brief account of the uses of different by-products of sugarcane industry.

Q.4 Give details of the enfleurage process used for the extraction of essential oils.

Q.5 Explain the various steps involved in the extraction of jute fibers.

Q.6 List the various conditions that are required to be fulfilled in India for obtaining plant germplasm from abroad.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Give a detailed description of Vavilov's work regarding centers of origin of cultivated plants**.**

Q.8 Give an elaborate account of the steps followed during manufacture of sugar from sugarcane.

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT641 **Roll No.: ……**

Time: 3 Hours

Course Name: Plant Resource Utilization **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Mention two differences between mechanical pulping and chemical pulping.
ii. What is 'patent based biopiracy'?
iii. Write about the ethnobotany related to the drug 'asprin'.
iv. Which plants have provided the ethnobotanical leads for the drugs a) digoxin; and b) codeine.
v. What is bionic prospecting?
vi. Mention the sources for a) Pfu polymerase; and b) Taq polymerase.
vii. Draw a well labeled diagram of the T.S. of coffee drupe.
viii. Differentiate between a) softwood and hardwood; b) sapwood and heartwood.
ix. What is the difference between an abrasive paper and an absorbent paper?
x. Write about any one substitute of para rubber.

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.
Q.2 According to The Protection of Plant Varieties and Farmers' Rights Act of India, mention the eligibility criteria for registration of a variety. Define the following: a) extant variety; and b) farmers' variety.
Q.3 Give an account of any two species of coffee. Write about the wet method of processing of coffee.
Q.4 Discuss the controversy related to the patent grant for Harvard's oncomouse.
Q.5 Mention the characteristic of Traditional Knowledge. Why is it important to protect Traditional Knowledge?
Q.6 Discuss any two non-mechanical properties of wood.
Q.7 Write a note on TKDL.
Q.8 Write briefly about the various methods used for tapping of latex from *Heveabrasiliensis*.
Q.9 Mention various uses of cotton fibre.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.
Q.10 Give a detailed account of chemical pulping. Explain how paper is manufactured from pulp.
Q.11 Discuss in detail the cases of biopiracy related to Neem and Basmati.
Q.12 Classify the fibres on the basis of their a) nature and structure; and b) use.
Q.13 Write in detail about the processing of black tea; green tea and oolong tea. Give an account of the chemicals present and their properties in tea leaves.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Resource UtilizationLaboratory**
Course Code: **BOT642**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To acquaint the students about various economic uses of plants by providing them knowledge about plant sources and processing methodologies.

List of Experiments

Laboratory Work

1. Morphology, anatomy, microchemical tests for stored food materials*:* Wheat, jute, rice, maize, chickpea (Bengal gram), potato, sugarcane.
2. Learn the processing of various plant products (cotton, jute, rubber, essential oils, sugarcane etc.)
3. To learn Recycling of paper.
4. To demonstrate methods for extraction of essential oils and their use in perfume making
5. Extraction and use of natural dyes.

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.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: The students will come to know the various economically important plants, their products and processing to yield commercial products.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 25 Marks
- Spotting – 15 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Thakur, R.S., Puri, H.S. and Husain, A.*Major Medicinal Plants of India.* Lucknow: Central Institute of Medicinal and Aromatic Plants, 1989.Print.
2. 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.

Reference Books:

1. Council for Scientific & Industrial Research. *The Useful Plants of India*, New Delhi: Publications and Information Directorate, CSIR, 1986.Print.

2. Kocchar, S.L. *Economic Botany of the Tropics*, 2nd ed., New Delhi Macmillan India Ltd., 1998.Print.
3. Swaminathan, M.S., and Kocchar, S.L., (eds.). *Plants and Society*. London: MacMillan Publications Ltd., 1989.Print.

Websites and Audio Video lectures:	https://www.youtube.com/watch?v=Zq99Ev69GD8&t=16s; https://iinrg.icar.gov.in/; http://sugarcane.dac.gov.in/
Other Supportive Material:	https://www.nite.go.jp/data/000007615.pdf

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Agricultural ecology –principles and application**
Course Code: **BOT627**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning objective: To provide an understanding of the basic theories and principles of ecology and to help study various aspects related to ecology

UNIT I

Ecology: Introduction, 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 optionaldensity.Exponentialgrowth, limits of population growth, population dynamics, life history pattern, fertility rate andage structure. Ecological consequence of overpopulation. **(9 lectures)**

UNIT III

Genecology - ecological amplitude, ecads, ecotypes, ecospecies, coenospecies, k-selection and r-selectionpopulations. **(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 criteriaof classification,dynamicsystem of classificationby 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. **(6 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)**

Learning Strategies:	Class room lectures, practical's, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome:	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.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT627 **Roll No.: ……**

Time:1Hour30 Minutes

Course Name: Agricultural ecology –principles and application **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Explain the following:

i. Niche
ii. Speciation
iii. Natality
iv. Altruism
v. Carrying capacity

Section – B **(Maximum Marks: 4 x 3 = 12)**

Short Answer Type: Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2.Discuss the various characteristics of population ecology.
Q.3 Explain adaptive radiation in light of Galapogos finches.
Q.4 Describe exponential growth equation.
Q.5 Discuss the ecological consequences of overpopulation.
Q.6 Describe Sympatric speciation with the help of suitable example.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Long Answer Type: Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Explain the various reproductive isolating mechanisms for evolution.
Q.8 Describe*Lotka–Volterra* model for an interspecific competition.

DAV University, Jalandhar. **ESE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT627 **Roll No.: ……**

Time: 3 Hours

Course Name: Agricultural ecology –principles and application **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Semelparous
ii. Ecotone
iii. Demography
iv. Facultative mutualism
v. Ectoparasites
vi. Niche width
vii. Dispersion
viii. Ecological equivalents
ix. Character displacement
x. Edge effect

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain Shelford's law of tolerance.
Q.3 What do you understand by age pyramids? Discuss various types of it.
Q.4 Discuss various characteristics of plant communities.
Q.5 Derive population growth equation when resources assumed to be unlimited.
Q.6 Explain various types of ecological succession.
Q.7 Explain the following:
(a) Ecological Efficiencies (b) Productivity
Q.8 Define ecological pyramids and explain its various types.
Q.9 Discuss various theories of interpreting climax.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Explain prey-predator interaction model.
Q.11 Define ecological succession. Explain the various stages of xerarch succession.
Q.12 Explain survivorship curve with well labeleddiagram.
Q.13 Describe in detail Sorenson's Index of similarity.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Agricultural Ecology-Principles and Applications Laboratory**
Course Code: **BOT628**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To provide an understanding of the basic theories and principles of ecology and to help study various aspects related to ecology

List of Experiments

1. Quantitative and qualitative community analysis. Carry out a project on species structure and thefrequency, abundance, density of different species and similarity index of different communities in anatural system. Students must be able to explain the structure of vegetation from the given data on theabove 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, plantdiversity (species and community).

Learning Strategies: Class room lectures, practical's, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students

Learning Outcome: 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.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text 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.

Reference books:

1. Conklin, Alfred R., and Rolf Meinholtz. *Field Sampling: Principles and Practices in Environmental Analysis*. New York: Marcel Dekker, 2004. Print.
2. Fahey, Timothy J. *Principles and Standards for Measuring Primary Production*. Oxford: Oxford UP, 2007. Print.
3. Grant, William E., and Todd M. Swannack. *Ecological Modeling: A Common-sense Approach to Theory and Practice*. Malden, MA: Blackwell Pub., 2008. Print.
4. Wilkinson, D.M. *Fundamental Processes in Ecology: An Earth system Approach*.Oxford: Oxford Scholarship Online. 2007.

Print.
5. Briggs, D. and Walters, S.M. *Plant Variation and Evolution*. Cambridge: CambridgeUniversity Press. 1997. Print.
6. Futuyma, Douglas J. *Evolutionary Biology*. 3rd ed. Sunderland, Mass.: Sinauer Associates, 1998. Print.
7. Ridley, M. *Evolution*. New York: Blackwell. 2003. Print.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Ecology and Phytogeography**
Course Code: **BOT645**
Total Credits: **4**
Credit Components: **L-2; T-0; P-0**
Learning Objectives: To inspire the students about ecological importance of the environment, natural resources, various problems related to environment and its protection.

UNIT-I

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

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)**

UNIT-II

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 environment protection, global plan, Stockholm summit, Earth summits **(2 Lectures)**

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

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

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 invegetation classification, understanding the key environmental issues and ecosystem management**.** **(6 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, bioaugmentation, biofilms, biofilters, bioscrubbers and trickling filters. Use of bioreactors in waste management. **(6 Lectures)**

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

Learning Outcome: 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.

Assessment:
Mid Semester Exam (MSE) – 25 Marks
Written Quiz (MCQs) – 10 Marks
Assignment (written) – 10 Marks
End Semester Examination (ESE) – 50 Marks

	Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar.

Term-Sample **MSE**

Name: ……..... **Regd. No.: ……**

Course Code: BOT645 **Roll No.: ……**

Time: 1 Hour 30 Minutes

Course Name: Plant Ecology and Phytogeography **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Explain the following:

i. Biomagnification
ii. Hotspot
iii. Nagoya Protocol
iv. Ecological footprinting.
v. JFM

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write a note on the Chipko movement.
Q.3 Discuss the impacts of global warming on the environment.
Q.4 Describe the causes, effects and control measures of water pollution.
Q.5 Explain the process of EIA.
Q.6 Write notes on following:
(a) Cartagena Protocol (b) CBD

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Enlist various principles of Stockholm Declaration.
Q.8 Describe the following:
(a) Eutrophication (b) Social forestry

DAV University, Jalandhar.

Term-Sample **ESE**

Name: ……..... **Regd. No.: ……**

Course Code: BOT645 **Roll No.: ……**

Time: 3 Hours

Course Name: Plant Ecology and Phytogeography **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Discuss the following:

i. Bioventing
ii. Sustainable development
iii. Passive sensors
iv. Image enhancement
v. Ozone hole
vi. Resource economics
vii. Biome
viii. Xenobiotics
ix. Ecological backlash
x. Lotic freshwater

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Q.3 Write a note on various grassland types of India.

Q.3 Describe the process of formation of biofilms.

Q.4 Explain various types of bioindicators.

Q.5 Discuss the following:

(a) Biosphere reserve (b) Hotspots

Q.6 Describe various application of remote sensing in plant ecology.

Q.7 Explain the following:

(a) Kyoto protocol (b) AQI

Q.8 Define platforms. Discuss various types of platforms with examples.

Q.9 Describe climatic zones of India.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Define plant invasion. Give their characters and different stages of plant invasion.

Q.11 Describe solid waste management. Discuss the various effects and methods of solid waste disposal.

Q.12 Define allelopathy. Describe the various mechanisms for the release of allelochemicals into the environment and applications of allelopathy in crop production.

Q.13 What do you understand by phytogeography. Explain the characteristics features of Indian forest types.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Ecology and Phytogeography Laboratory**
Course Code: **BOT646**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To inspire the students about ecological importance of the environment, natural resources, various problems related to environment and its protection.

List of experiments

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

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

Learning Outcome: 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.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Singh, H.P., Batish, D.R., and Kohli, R.K. *Handbook of Sustainable Weed management*. New York, USA: Food Products Press, 2006. Print.
2. Odum, E.P. *Fundamentals of Ecology*. USA: Saunders Toppan, 1971. Print.

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. Ramakrishanan, P.S. *Ecology of Biological Invasion in the Tropics*. New Delhi: International Scientific Publications, 1991. Print.
7. Raven, P.H., Berg, L.R., and Hassenzahl, D.M. *Environment*. 7thed. USA: Wiley, Hoboken, 2010. Print.
8. 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.
9. Singh, J.S., Singh, S.P., and Gupta, S.R. *Ecology,Environment and Resource Conservation*. New Delhi: Anamaya Publishers, 2006. Print.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Project-II**
Course Code: **BOT631**
Total Credits: **8**
Credit Components: **L-0; T-0; P-8**
Learning Objectives: To develop research aptitude in the students

Description

Students have to carry out a project on any topic from the syllabus and submit a report on the work done in the project for assessment.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Techniques in Plant Analysis**
Course Code: **BOT647**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To acquaint the students about the various techniques used to analyze a biological system.

Unit I

pH metery – Principles and applications. **(2 Lecture)**
Histochemical and Immuno techniques: Antibody generation, detection of molecules using ELISA, RIA. **(4 Lectures)**
Microscopy: Principles and applications of Light, Phase Contrast, Fluorescence, Scanning and Transmission Electron Microscopy, STEM fixation and staining of EM, Freeze-etch and Freeze fracture methods for EM, image processing methods in molecules. **(6 Lectures)**

Unit II

Chromatography: Paper Chromatography, Thin Layer Chromatography, Gel filtration, Ion Exchange and Affinity Chromatography, GLC; High Pressure Liquid Chromatography; and Flame Photometry, GC-MS, LC-MS, Atomic absorption spectrometery. **(6 Lectures)**
Biophysical Methods: Principle, procedure and applications of UV/visible, fluorescence, UV, circular dichroism, NMR and ESR spectroscopy, Structure determination using X-ray fluorescence and X-ray diffraction and NMR. **(7 Lectures)**

Unit III

Centrifugation: Technique and principles; Preparative and analytical centrifugation. **(4 Lectures)**

Sequencing: Protein sequencing methods, detection of post translation modification of proteins.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. **(7 Lectures)**

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. **(6 Lectures)**
Molecular techniques: Restriction 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. **(5 Lectures)**

Learning Strategies: Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome: This course will make the students learn the principles, procedures and uses of various bioanalytical techniques used for plant/animal analysis.
Assessment:
Mid Semester Exam (MSE) – 25 Marks
Written Quiz (MCQs) – 10 Marks
Assignment (written) – 10 Marks
End Semester Examination (ESE) – 50 Marks

	Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT645 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: TECHNIQUES IN PLANT ANALYSIS **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Describe the following terms:

i. FID

ii. GLC

iii. Monochromator

iv. Retention time

v. Stationary Phase

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write a short note on pH electrode.

Q.3 Discuss Beer-Lambert Law.

Q.4 Write a short note on High Performance Liquid Chromatography.

Q.5 How column chromatography is better than thin layer chromatography?

Q.6 Discuss principle and application of paper chromatography.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Give an account of instrumentation used in spectrophotometer.

Q.8 Discuss principle and application of GLC. What are the different types of detectors used in GLC?

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Techniques in Plant Analysis Laboratory**
Course Code: **BOT648**
Total Credits: **2**
Credit Components: **L-0; T-0; P-2**
Learning Objectives: To acquaint the students about the various techniques used to analyze a biological system.

List of Experiments

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.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

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

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Plummer, D.T. *An Introduction to Practical Biochemistry*. New Delhi: Tata McGraw Hill Publishing Ltd., 1994. Print.
2. Potter, G.W.H. *Analysis of Biomolecules: An introduction to Principles, Instrumentation and Techniques*. London: Chapman and Hall, 1995. Print.

Reference Books:

1. Primrose, S.B., Twyman, R.M., and Old, R.W. *Principles of Gene Manipulation.* UK: Blackwell Publishers, 2001. Print.
2. Sawhney, S.K., and Singh, R. *Introductory Practical Biochemistry.* New Delhi: Narosa Publishing House, 2002.
3. Wilson, K., and Walker, J. *Principles and Techniques of Practical Biochemistry.* Cambridge: Cambridge University Press. 2000. Print.

Programme Name: **M.Sc. (Hons) Botany**
Course Name: **Advanced Plant Physiology and Metabolism**
Course Code: **BOT649**
Total Credits: **4**
Credit Components: **L-4; T-1; P-0**
Learning Objectives: To acquaint the students about molecular regulation of various physiological processes in plants.

Unit I

Energetics: Primary charge separation events in reaction centres; regulatory action of uncoupling agents of photophosphorylation; energy loss during vectorial electron transfer in light reaction; genetics of RUBISCO subunit assembly and organization in plants; physiological and ecological aspects of photosynthesis; efficiency of carbohydrate synthesis. **(5 Lectures)**

Respiration – regulation of key respiratory enzymes with particular emphasis on phosphofructokinase, glyceraldehydes-3-phosphate dehydrogenase and pyruvate dehydrogenase; mechanism of action of inhibitors of oxidative phosphorylation; arrangement and organization of protein complexes in mitochondrial electron transport chain. **(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. **(6 Lectures)**

Unit III

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

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

Plant genomes: Organization and importance of chloroplast and mitochondrial genomes; Retrograde signaling. **(4 Lectures)**

Unit IV

Plant Stress Biology: Plant responses to abiotic stresses, mechanisms of abiotic stress tolerance.

Water stress: Membranes and water stress, Stomatal response to water stress-Role of ABA and drought tolerance **(4 Lectures)**

Salinity stress: Effect of high salt concentration of plants – water stress, nutrient ion deficiency, ion toxicity, regulation of salt content – Salt elimination, salt succulency, Mechanisms of salt resistance and tolerance

Metal toxicity: Metal toxicity and tolerance with special reference to i) Aluminum ii) Iron iii) Zinc **(4 Lectures)**

Freezing and heat stress: Effect of low temperature and frost injury on plant productivity; **Cellular responses to high temperature:** enzyme activities, photosynthesis, Heat shock proteins. High temperature tolerance mechanisms in plants. Plant stress signalling; NO mediated signaling, markers of nitrosative stress, NO crosstalk with other hormones, antioxidant mechanisms. **(5 Lectures)**

Learning Strategies:	Class room lectures, practicals, models, charts, power point presentations, online lectures, group discussions, assignments and presentations by students
Learning Outcome:	The students will have a comprehensive knowledge aboutthe physiological and biochemical regulation of the processes that are necessary for sustenance of life on earth.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT649 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Advanced Plant Physiology and Metabolism **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Name the inhibitors of complex I in oxidative phosphorylation. How does it affect oxidative phosphorylation?
ii. Give the reaction catalyzed by Nitrate reductase along with its structural component.
iii. Draw the structure of cytb6f complex with its protein component.
iv. Name the two factors of F-ATP synthase and draw the suitable structure.
v. Write down the name of various symbiotic and free living nitrogen fixing genera.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Discuss the binding change mechanism for ATP synthesis.
Q.3 Describe the various protein components for oxygen evolving photosystem. Draw the suitable diagram.
Q.4 Which reaction is catalyzed by Pyruvate dehydrogenase complex? Briefly explain the regulation of PDC?
Q.5 What is the role of uncoupling agents in photophosphorylation? Give suitable example.
Q.6 Discuss the various genes involved in molecular nitrogen fixation.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Explain the process of nodule formation in leguminous plant. Draw the suitable diagrams.
Q.8 Expand RUBISCO. Briefly describe the assembly and functioning of RUBISCO factor in chloroplast.

DAV University, Jalandhar.
(Term-Sample)

ESE
Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT649 **Time: 3 Hours**

Course Name: Advanced Plant Physiology and Metabolism **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Explain following

i. Escapers
ii.Resurrection plants
iii.Strain
iv. PUFA
v. Retrograde signaling
vi. Saturated fatty acids
vii. Secondary metabolites
viii. Circanual rhythm
ix. nod gene
x. Compatible solute

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write short note on phosphofructokinase regulation.
Q.3 Describe the various pathways for terpenoid biosynthesis.
Q.4 Briefly describe the various effects of salt stress on plants.
Q.5 Describe the biosynthetic pathway for cholesterol biosynthesis with suitable sketch.
Q.6 What are heat shock proteins? How they are produced during heat stress?
Q.7 What is plant genome? Briefly describe the plastid genome.
Q.8 Describe the various inhibitors of oxidative phosphorylation.
Q.9 Give the biosynthetic pathway of terpenes. How they are important.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Give an account of circadian rhythm in plants with suitable diagrams.
Q.11 What are lipids? Give an account of storage lipids.
Q.12 Discuss about the nitrate and nitrite assimilation in plants.
Q.13 What are phenols? Give their biosynthetic pathway. Briefly describe simple phenolics.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Advanced Plant Physiology and Metabolism Laboratory**
Course Code: **BOT650**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: To acquaint the students about various physiological processes at cellular and organ level in plants.

List of Experiments

1. Isolation of lipids from green gram cotyledons.
2.Production and Isolation of gibberellic acid from *Fusariummoniliformae* 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 estimat ion of alkaloids from suitable plant material.
5. Isolation of mitochondria from suitable plant material.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: 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.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Srivastava, L.M. *Plant Growth and Development*. NewYork: Associated Press, 2002. Print.
2. Taiz, L., and Zeiger, E. *Plant Physiology*. California: The Benjamin/Cumming Publishing Company, 1998. Print.

Reference Books:

1. Stryer, L. *Biochemistry*. 5th ed. New York: W.H. Freeman and Co., 1995. Print.
2. Voet, D., and Voet, J.G. *Biochemistry*. New York: John Wiley and Sons Inc., 1995. Print.
3. Wilkins, M.B. *Advanced Plant Physiology*. New York: Pitman, 1984. Print.
4. Buchanan, B.B., Gruissem, W. and Jones, R.L. *Biochemistry and Molecular Biology of Plants*. India: I K Internationals, 2005. Print.
5. Heldt, H.W. Plant Biochemistry. California: Elsevier, 2005. Print.

Websites and Audio Video lectures: www.plantphys.org

Other Supportive Material: https://www.nature.com/subjects/plant-physiology

Programme Name: **M.Sc. (Hons) Botany**
Course Name: **Plant Developmental Biology**
Course Code: **BOT643**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: The students will learn to describe various tissue systems in plants and their relative distribution. They will also understand the reason behind evolution of different thickening materials used by different plants for strengthening their axis. They will also be acquainted with development processes of plant parts.

UNIT I

Introduction to Plant Anatomy: Primary and secondary tissues in plants; Anatomy of root, stem, leaf of monocot and dicot plants; differentiation of vascular tissue in higher plants; Secondary growth in stem and root. **(9 Lectures)**

Shoot Development: organization of shoot Apical meristem and types of vegetative shoot apex **(2 Lectures)**

Root Development: organization of root apex and significance of Quiscent center. **(2 Lectures)**

Leaf: Structure with reference to C3 and C4 plants – Kranz and CAM Syndrome **(2 Lectures)**

UNIT II

Structural Response of Plants to Diseases and other stresses: Abscission, Tissue regeneration, Grafting; Cytological reaction to invasion of parasites; Structural basis of Resistance: Trichomes, Laticifers, Dutch Elm Disease and Tylosis; Virus movement in Plants; Anatomical responses to mineral deficiency **(9 Lectures)**

Morphological and structural adaptations in different ecological groups - hydrophytes, xerophytes, epiphytes and halophytes. **(4 Lectures)**

The composition and structure of plant primary cell walls: Hemicellulose, Xyloglucan, Xylans, Mannose containing hemicellulose; Pectic Polysaccharides: Homogalacturonan, Rhamnogalacturonans. **(4 Lectures)**

UNIT III

Development in flowering plants: Angiosperm life cycle, Anther: Structure and development, microsporogenesis, male gametophyte development **(4 Lectures)**

Palynology: Pollen morphology, pollen kit, NPC formula. Applications of palynology. Viability of pollen grains. Pollination, pollen germination, growth and nutrition of pollen tube **(6 Lectures)**

Ovule: Structure, ontogeny and types. Megasporogenesis. Embryosac – development, types, ultrastructure, and nutrition of embryosac. Female gametophyte development. **(5 Lectures)**

UNIT IV

Pollination and Fertilization: Structural, Functional aspects of pollen style stigma. Current view of double fertilization and development of endosperm and its function. Embryo development - different types. Endosperm development, types of endosperm, haustorial behavior of endosperm. Xenia and metaxenia. **(9 Lectures)**

Cellular and biochemical aspects of embryogenesis: Gene activity during zygotic embryogenesis. Structure and function of embryo suspensor. **(6 Lectures)**

Learning Strategies: Class room lectures, practicals, models, charts, power point Presentations, online lectures, group discussions, assignments and presentations by students.

Learning Outcome:	The students will be able to explain the stages from germination to seed development in Angiosperms. They can recognize various reproductive stages in angiosperms. They can use knowledge of vegetative propagation to develop new plants own their own especially in seedless varieties.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT643 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Plant Developmental Biology **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory. Very Short Answer Type.

Q.1

i. What is heart wood?
ii. Explain dedifferentiation along with its significance.
iii. What do you understand by Primary growth of plant?
iv. Comment on subterminal position of Root Apical Meristem.
v. What is Quiscentcenter?

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Explain "canalization of auxin flow hypothesis". Make suitable diagram.
Q.3 Write a brief note on collenchyma tissue.
Q.4 Explain T.S. of monocot root with well labeled diagram.
Q.5 Give an account of secondary growth in dicot stem.
Q.6 Why sieve tube elements are regarded as partial living? Explain.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Discuss various theories regarding shoot apical meristem.
Q.8 Explain differentiation of xylem elements with the help of suitable sketches.

DAV University, Jalandhar.
(Term-Sample)

ESE Sample

Name:
……..... **Regd. No.: ……**

Course Code: BOT643 **Time: 3 Hours**

Course Name: Plant Developmental Biology **Maximum Marks: 50**

Section – A **(Maximum Marks: 1 x 10 = 10)**

All Questions are compulsory.
Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Explain the following terms:

i. Male Germ Unit
ii. Ombrophily
iii. Hypocotyl
iv. Polyembryony
v. Apomixes
vi. Triple fusion
vii. Obturator
viii. Herkogamy
ix. Sporoderm
x. Allogamy

Section – B **(Maximum Marks: 4 x 6 = 24)**

Short Answer Type: Attempt any **6 Questions out of 8 Questions** and each question should be answered in maximum 2 pages.

Q.2 Draw L.S. of polygonum type of embryo sac. Label all the parts.
Q.3 Briefly explain various ecological modifications in halophytes.
Q.4 What do you understand by dimorphic tapetum? Explain types of tapetum.
Q.5 Explain sequential development stages of dicot embryo with well labeled diagrams.
Q.6 Draw various types of ovules on the basis of their relative position on placenta.
Q.7 What is endosperm? How is it formed? Explain its various types with suitable examples.
Q.8 Briefly explain microsporogenesis in angiosperms?
Q.9 ExplainGametophyticself incompatibility with the help of a labelled diagram.

Section – C **(Maximum Marks: 8 x 2 = 16)**

Long Answer Type: Attempt **2 Questions out of 4 Questions** and each question should be answered in maximum 4 pages.

Q.10 Write a note on Hydrophilly. Enlist various floral modifications in hydrophytes.
Q.11 Write a note on Mannose containing hemicellulose and Xyloglucans. Discuss their biosynthesis and location in plant cells.
Q.12 Explain the process of Megasporogenesis in angiosperms. Support your answer with well labeled sketches.
Q.13 Explain NPC system. Make suitable sketches.

Programme Name: **M.Sc. (Hons.) Botany**
Course Name: **Plant Developmental Biology Laboratory**
Course Code: **BOT644**
Total Credits: **2**
Credit Components: **L-0; T-0; P-3**
Learning Objectives: Students will also understand the reason behind evolution of different thickening materials used by different plants for strengthening their axis. They will also be acquainted with development processes of plant parts.

List of Experiments

1. Study of angiosperm leaf epidermis in the following taxa: *Crotalaria, Petunia* or *Datura, Rheo discolo*r, *Brassica* and Grass.
2. Estimation of stomatal frequency and stomatal index in the materials studied.
3. Maceration of wood and identification of various elements in *Bombax*, *Tectona, Terminalia* and *Azadirathta*
*4.*Study of wood structure with the help of T.S., R.L.S. in the following: *Tectona*, *Bombax,* and *Azadiratha*
5. Histochemical tests for identification of the following: a) Callose b) Lignin c) Pectin d) Starch e) Suberin f) Silica bodies in the leaf of grasses and sledges.
6. Study of shoot apex in suitable locally available materials to understand cytohistological zonation (*Coleus, Kalanchoe*)
7. Study of roots in Monocots and Dicots.
8. Anomalous secondary growth in the following examples: Stems of *Aristolochia*, *Nyctanthes*, *Tinospora*, *Achyranthes*,
9. Ecological anatomy.
10.Study of the pollen grains of *Hibiscus, Tribulus, Ocimum* and Grass.
11. Embryology: i) Study of ovules by Hand section of ovaries and their identification ii)Pollen germination studies in different locally available plants and estimation of pollenfertility.
12. Study of embryos and Haustoria in locally available.

Learning Strategies: Practicals, models, charts, online demonstrations, group discussions and assignments

Learning Outcome: The students will be able to explain the stages from germination to seed development in Angiosperms. They can recognize various reproductive stages in angiosperms. They can use knowledge of vegetative propagation to develop new plants own their own especially in seedless varieties.

Assessment: Continuous Assessment: 20 Marks
Practical Exam: 80 Marks

Model Question Paper: Practical Exam component is divided into the following sub components:

- Performance – 24 Marks
- Spotting – 16 Marks
- Viva-voce – 24 Marks
- Record – 8 Marks
- Internal Assessment – 8 marks

Text Books:

1. Parihar, N.S. *An introduction to Embryophyta: Vol. I. Bryophyta*. Allahabad, India: Central Book Depot. 1991. Print.
2. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. *Biology*.

New Delhi: Tata McGraw Hill, 2005. Print.

Reference Books:

1. Dickison, W.C. *Integrative Plant Anatomy*.USA: Academic Press, 2000. Print.
2. Fahn, A. *Plant Anatomy*. Sydeny: Pergamon Press. Print.
3. Beck, Charles B. *An introduction to plant structure and development: plant anatomy for the twenty-first century*. Cambridge University Press, 2010.Print.
4. Johansen, Donald Alexander. *Plant embryology*.ChroniceBotanica Company; Waltham, Mass,1950.Print.
5. Johri, Brij M., Kunda B. Ambegaokar, and Prem S. Srivastava. *Comparative embryology of angiosperms*.Vol.1.Springer Science & Business Media, 2013.Print.
6. Bhojwani, Sant Saran, and Woong-Young Soh, eds. *Current trends in the embryology of angiosperms*. Springer Science & Business Media, 2013.Print.
7. Steeves, Taylor A., and Vipen K. Sawhney. *Essentials of Developmental Plant Anatomy*.Oxford University Press, 2017.Print.10. Hacke, Uwe, ed. *Functional and ecological xylem anatomy*. Springer, 2015.Print.

Programme Name:	**M.Sc. (Hons) Botany**
Course Name:	**Forestry**
Course Code:	**BOT636**
Total Credits:	**4**
Credit Components:	**L-4; T-0; P-0**
Learning Objectives:	To expose the students about the practice of growing trees, their legal and social protection, plantation of trees for different purposes etc.

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)**

Learning Strategies:	Class room Lectures, models, charts, power point presentations. Cultivated land and crops visits.
Learning Outcome:	The studies will provide students with the knowledge of importance and conservation of forests.
Assessment:	Mid Semester Exam (MSE) – 25 Marks Written Quiz (MCQs) – 10 Marks Assignment (written) – 10 Marks End Semester Examination (ESE) – 50 Marks Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be

attempted

Model Question Paper: ESE

Q.1 Will Comprise of 10 parts having 1 mark each

Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted.

Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted

Text 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.

Reference Books:

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.* 2nded. Mumbai: Oxford University Press, 2000. Print.
12. Stoddard, C.H. *Essentials of Forestry Practice*. New York: Wiley, 1959. Print.

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT636 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Forestry **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1 Define the following terms

i. Agroforestry

ii. Social forestry

iii. Forest protection

iv. Forest regenertion

v. Ecosystem services

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write a short note on thinning, pruning and harvesting.

Q.3 What is forest succession? What is its importance in forestry?

Q.4 Write a note on major diseases of forest plants.

Q.5 What do you understand by forest regeneration? How you can contribute in it?

Q.6 Discuss different measures used to control forest fires.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 Write an essay on forest protection act 1971.

Q.8 Write an essay on ecological services and their significance.

Programme Name: **M.Sc. (Hons) Botany**
Course Name: **Advances in Plant Breeding**
Course Code: **BOT637**
Total Credits: **4**
Credit Components: **L-4; T-0; P-0**
Learning Objectives: To make the students learn about various breeding techniques that is used to develop new genotypes of important crop plants.

Unit I

An introduction to Quantitative and Qualitative Characters: Dominance, Segregation, Pleiotropy, Penetrance and Expressivity, Modified Genes, Gene interaction and Linkage. Multiple Factor Hypothesis, Polygenic Inheritance and Continuous variation, Normal distribution, Components of Genetic variance. **(7 Lectures)**

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

Genotype × Environment interaction: Models; implications in testing programme; stability of genotype performance. **(4 Lectures)**

Parent selection in Breeding Programme: Choice of Parents; Type of crosses and strategies; Sources of parent germplasm. **(2 Lectures)**

Unit II

Selection theory; Hardy-Weinberg law; Genetic advance under selection

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: 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. **(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. **(7 Lectures)**

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; Top cross testers for inbred line development; Type of testers; Stage of testing. **(6 Lectures)**

Learning Strategies: Class room Lectures, models, charts, power point presentations. Cultivated land and crops visits.

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

Assessment:
Mid Semester Exam (MSE) – 25 Marks
Written Quiz (MCQs) – 10 Marks
Assignment (written) – 10 Marks
End Semester Examination (ESE) – 50 Marks

	Attendance – 5 Marks
Model Question Paper: MSE	Q.1 Will Comprise of 5 parts having 1 mark each Q.2 to Q.6 will carry 4 marks each out of which 3 questions are to be attempted. Q.7 and Q.8 will carry 8 marks each out of which 1 question is to be attempted
Model Question Paper: ESE	Q.1 Will Comprise of 10 parts having 1 mark each Q.2 to Q.9 will carry 4 marks each out of which 6 questions are to be attempted. Q.10 to Q.13 will carry 8 marks each out of which 2 question are to be attempted
Text 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. Poehlman, John Milton, and Dhirendranath Borthakur. *Breeding Asian Field Crops, with Special Reference to Crops of India*. Calcutta: Oxford & IBH Pub., 1969. Print.
Reference Books:	4. Roy, Darbeshwar. *Plant Breeding: A Biometrical Approach*. Oxford: Alpha Science International, 2012. Print. 5. Allard, R.W. *Principles of Plant Breeding*. New York: Wiley India Pvt. Ltd., 2010. Print. 6. Chopra, V. L. *Breeding Field Crops.* New Delhi: Oxford and IBH Pub., 2001. Print. 7. Chopra, V. L. *Breeding Field Crops.* New Delhi: Oxford and IBH Pub., 2004. Print. 8. Gupta, S. K. *Practical Plant Breeding*. 2nd ed. Jodhpur: Agrobios (India), 2010. Print.

DAV University, Jalandhar. **MSE**

Term-Sample

Name: ……..... **Regd. No.: ……**

Course Code: BOT637 **Roll No.: ……**

Time: 1 Hour30 Minutes

Course Name: Advances in Plant Breeding **Maximum Marks: 25**

Section – A **(Maximum Marks: 1 x 5 = 5)**

All Questions are compulsory.

Very Short Answer Type: Each question should be answered within 5-8 lines.

Q.1

i. Define Dominance.

ii. Define Pleiotropy.

iii. Define Heritability.

iv. Define Modifying genes.

v. Define Linkage.

Section – B **(Maximum Marks: 4 x 3 = 12)**

Attempt any **3 Questions out of 5 Questions** and each question should be answered in maximum 2 pages.

Q.2 Write a note on Heritability.

Q.3 Explain Multiple Factor Hypothesis.

Q.4 Explain Penetrance and Expressivity.

Q.5 Explain any one implication in GXE interaction.

Q.6 Explain Quantitative and Qualitative characters.

Section – C **(Maximum Marks: 8 x 1 = 8)**

Attempt **1 Question out of 2 Questions** and each question should be answered in maximum 4 pages.

Q.7 What is Genetic variance? Describe its components in detail.

Q.8 Describe the environmental effects on quantitative characters taking any one mathematical model.