

SYLLABUS**B.Sc. (Botany) Part-III (Semester-V and VI)**

(Session 2019-20, 2020-21 and 2021-22)

Semester-V**THEORY**

	External Marks	Internal Assessment
Paper IX: Plant Physiology	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper X: Plant Growth, Development and Biotechnology	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)

PRACTICAL

Pertaining to Theory Paper IX:	40	-
Pertaining to Theory Paper X:		

Total Marks (Semester-V)

Theory	80 Marks
Practical	40 Marks
Internal Assessment Pertaining to Theory Paper IX & X	30 Marks
Total	: 150 Marks

Semester-VI**THEORY**

	External Marks	Internal Assessment
Paper XI: Plant Ecology	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)
Paper XII: Plant Utilization	40	15 (Attendance: 3 + Assignment: 6 + House Test 6)

PRACTICAL

Pertaining to Theory Paper XI:	40	
Pertaining to Theory Paper XII:		

Total Marks (Semester-VI)

Theory	80 Marks
Practical	40 Marks
Internal Assessment Pertaining to Theory Paper XI & XII	30 Marks
Total	: 150 Marks

Note:

- 1) The number of teaching hours per week will be three for each theory paper and three for each practical in every semester. In all, there will be 12 teaching hours per week covering both theory and practical requirements. (Six teaching hours for theory and Six teaching hours for practical per week)
- 2) Practical paper in each semester will be of 3 hours. The timing of practical examination will be 9.00 am to 12.00 noon.

B.Sc. (Botany) Part-III (SEMESTER-V)

PAPER IX: PLANT PHYSIOLOGY

Max. Marks: 55 marks

Total Teaching hours: 45

Pass Marks: 35% in Theory and Practical Separately

Time Allowed: 3 Hours

Theory Paper: 40 marks

Internal Assessment: 15 marks

Objective of the paper is to impart knowledge to students about the functional aspects of plant metabolism in relation to its dynamic environment.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Plant-water relations: Importance of water to plant life; diffusion and osmosis; absorption, transport of water and transpiration; mechanism of stomatal opening and closing.
2. Mineral nutrition: Essential macro- and micro- elements and their role; mineral uptake; deficiency and toxicity symptoms.
3. Transport of organic substances: Mechanism of phloem transport; source-sink relationship; factors affecting translocation.
4. Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concepts of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action.

SECTION-B

5. Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effect; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C₄ pathway; CAM plants; photorespiration.
6. Respiration: ATP- the biological energy currency; aerobic and anaerobic respiration; Krebs' cycle; electron transport mechanism (chemi-osmotic theory) redox potential; oxidative phosphorylation; pentose phosphate pathway.
7. Nitrogen metabolism: Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation.
8. Lipid metabolism: Structure and function of lipids; fatty acid biosynthesis; β -oxidation; saturated and unsaturated fatty acids.

RECOMMENDED READINGS

1. Dennis, D.T., Turpin, D.H., Lefevre, D.D. and Layzell, D.B.(eds.) 1997, *Plant Metabolism* (2nd Edition). Longman, Essex, England.
2. Galston, A.W. 1989. *Life Processes in Plants*. Scientific American Library, Springer, Verlag, New York, USA.

3. Heldt, H.2003. *Plant Biochemistry*, Academic Press, Indian Edition, Reed Elsevier India Pvt. Ltd., New Delhi.
4. Hopkins, W.G. 1999, *Introduction to Plant Physiology* (2nd Edition). John Wiley & Sons, Inc., New York, USA.
5. Lea, P.J. and Leegood, R.C. 1999, *Plant Biochemistry and Molecular Biology*. John Wiley & Sons, Chichester, England.
6. Mohr, H. and Schopfer, P. 1995. *Plant Physiology*. Springer Verlag, Berlin, Germany.
7. Salisbury, F.B. and Ross, C.W. 2005, *Plant Physiology* (4th Edition). Eastern Press Bangalore, Pvt. Ltd.
8. Tiaz, I and Zeiger, E. 2006. *Plant Physiology* (4th Edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA.

PAPER X: PLANT GROWTH, DEVELOPMENT AND BIOTECHNOLOGY

Max. Marks: 55 marks

Total Teaching hours: 45

Pass Marks: 35% in Theory and Practical Separately

Time Allowed: 3 Hours

Theory Paper: 40 marks

Internal Assessment: 15 marks

Objective of the paper is to impart knowledge to students about the different technologies in biology of plants to understand its growth, growth kinetics and effect of light on germination and growth of seed and seedling under different environments.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Growth, phases of growth, growth kinetics; plant hormones: discovery, bioassay, physiological effects and application of auxins, gibberellins, cytokinins, abscisic acid and ethylene.
2. Photomorphogenesis, discovery, structure, physiological role and mechanism of action of phytochrome and cryptochrome.
3. Photoperiodism, vernalization, biological clocks, physiology of senescence and abscission.
4. Physiology of seed dormancy and seed germination; plant movements.

SECTION-B

5. Tools and techniques of recombinant DNA technology with special reference to restriction enzymes, gel electrophoresis, Southern blotting, cloning vectors and PCR. Genomic and cDNA library.
6. Techniques of gene mapping and chromosome walking; methods of gene transfer in plants.
7. Basic concept of plant tissue, culture, totipotency, micropropagation, anther culture, embryo culture, synthetic seeds and somatic hybridization.
8. Biotechnology and its application in human welfare with particular reference to industry, plant breeding and molecular farming.

RECOMMENDED READINGS

1. Bhojwani, S.S. 1990, *Plant Tissue Culture: Applications and Limitations*, Elsevier Science Publishers, New York, USA.
2. Hopkins, W.G. 1999, *Introduction to Plant Physiology* (2nd Edition). John Wiley & Sons, Inc., New York, USA.
3. Purohit, S.S. 2005, *Biotechnology: Fundamental and Applications*, Agrobios, India.
4. Gupta P.K. 2004. *Biotechnology and Genomics*, Rastogi Publications, Meerut, India.
5. Singh D.B. 2008. *Biotechnology: Expanding Horizons*, Kalyani Publishers, India.
6. Mohr, H. and Schopfer, P. 1995. *Plant Physiology*. Springer Verlag, Berlin, Germany.
7. Old, R.W. and Primrose, S.B. 1989, *Principles of Gene Manipulation*. Blackwell Scientific Publications, Oxford, UK.

8. Raghavan, V. 1986, *Embryogenesis in Angiosperms: A Developmental and Experimental Study*. Cambridge University Press, New York, USA.
9. Salisbury, F.B. and Ross, C.W. 2005, *Plant Physiology* (4th Edition). Eastern Press Bangalore, Pvt. Ltd.
10. Srivastava, L.M. 2005. *Plant Growth and Development, Hormones and Environment*. Academic Press, USA.
11. Tiaz, I and Zeiger, E. 2006. *Plant Physiology* (4th Edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Vasil, I.K. and Thorpe, T.A. 1994. *Plant Cell and Tissue Culture*. Kluwer Academic Publishers, The Netherlands.

SUGGESTED LABORATORY EXERCISES (Pertaining to theory paper IX &X)

1. To study the permeability of plasma membrane using different concentrations of organic solvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To study the enzyme activity of catalase and peroxidase.
4. To demonstrate of the rate of respiration of various plants.
5. Separation of chloroplast pigments by solvent method.
6. Demonstration of the osmotic potential of vacuolar sap by plasmolytic method.
7. Demonstration of the water potential of any tuber.
8. Separation of amino acids in the mixture by paper chromatography and their identification by comparison with standard.
9. Demonstration of the technique of micropropagation by using different explants e.g. auxiliary buds, shoot meristems.
10. Demonstration of the techniques of anther culture.
11. Isolation of protoplasts from different tissues using commercially available enzymes (Demonstration only).
12. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones.
13. Preparation of synthetic seeds in potato and sugarcane.
14. Separation of proteins of a given sample through Gel Electrophoresis.
15. Demonstration of necessity of light, CO₂, and Chlorophyll for photosynthesis.
16. Demonstration of rate of transpiration by Ganong's apparatus.
17. Comparison of loss of water from two surfaces of leaf by 4 leaf method.
18. Demonstration of path of Ascent of sap by eocin ringing experiment.
19. Demonstration of phototropism and geotropism.
20. Demonstration of the presence of reducing sugars, fats and proteins in plant tissue by micro-chemical tests.
21. To determine the seed viability through Triphenyl Tetrazolium chloride and actual germination Tests.

SUGGESTED READINGS FOR LABORATORY EXERCISES

1. Devi, P. 2000. *Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics*.
2. Dixon, R.A. (Ed.) 1987. *Plant Cell Culture. A Practical Approach*. IRL Press, Oxford.
3. Glick, D.R. and Thompson, J.E. 1993, *Methods in Plant Molecular Biology and Biochemistry*. CRC Press, Boxaraton, Florida.
4. Hall, R.D. (Ed.) 1999. *Plant Cell Culture Protocols*. Humana Press, Inc., New Jersey, USA.
5. Moore, T.C.1974. *Research Experiences in Plant Physiology: A Laboratory Manual*. Springer-Verlag, Berlin.
6. Ninfa, A.J. and Ballou, D.P. 1998. *Fundamental Laboratory Approaches for Biochemistry and Biotechnology*. Fitzgerald Science press, Inc. Maryland, USA.
7. Roberts, J. and Tucker, G.A. (Eds.) 2000. *Plant Hormone Protocols*. Humana Press, Inc. New Jersey, USA.
8. Scott, R.P.W. 1995. *Techniques and Practice of Chromatography*. Marcel Dekker, Inc., New York.
9. Smith, R.H. 2000. *Plant Tissue Culture: Techniques and Experiments*. Academic Press, New York.
10. Wilson, K. and Goulding, K.H. (Eds.) 1986. *A Biologists Guide to Principles and Techniques of Practical Biochemistry*. Edward Arnold, London, UK.

INSTRUCTIONS FOR PAPER SETTER
PRACTICAL PAPER-(PERTAINING TO THEORY PAPER-IX & X)

Practical Paper	Marks.
1) Write up about the requirements, principle procedure and precautions of a minor experiment. Also perform the experiment.	08
2) Write up about the requirements, principle, procedure and precautions of a major experiment. Also perform the experiment.	10
3) Comment upon the experiment set	04
4) Comment upon the experiment/apparatus/culture tube/material.	04
5) Write up about technique used for anther culture/Micropropagation /isolation of protoplast etc.	04
6) viva-voce	05
7) Note Book	05
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	40 Marks

PAPER XI: PLANT ECOLOGY

Max. Marks: 55 marks

Total Teaching hours: 45

Pass Marks: 35% in Theory and Practical Separately

Time Allowed: 3 Hours

Theory Paper: 40 marks

Internal Assessment: 15 marks

Objective of the paper is to make the students conversant with the basic concepts of Ecology and make them aware of the various Environmental issues.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. Concept of ecology and its scope. Environmental factors: climatic, edaphic, topographic and biotic, Shelford's law of tolerance.
2. Population ecology: Characteristics, positive and negative interaction, growth forms, carrying capacity, ecotypes and ecads.
3. Community ecology: Community characteristics, frequency, density and abundance, cover, life forms. ecological succession (Hydrosere, Xerosere). Gause principle of competitive exclusion.
4. Structure and concept of ecosystem, ecological pyramids, food chain, food web, ecological energetics, ecological productivity.

SECTION-B

5. Environmental issues: Brief idea of air, water, noise and soil pollution. Global warming and ozone depletion. International efforts for mitigation of global climate change.
6. Biodiversity: Introduction and Importance of Biodiversity; Elements of Biodiversity; Genetic, species and ecological diversity. Conservation strategies, concept of hot spots, biomes, phytogeographic regions of India, vegetation types (Forests, Grasslands, Desserts and Wetlands).
7. Ecological adaptations in xerophytes, hydrophytes and halophytes.
8. Biogeochemical cycles with particular reference to C, N and P.

RECOMMENDED READINGS

1. Begon, M., Townsend, C.R. & Harper, J.L. 2006. *Ecology: From Individuals to Ecosystems*. (4th Edition) Blackwell Publishers, Australia.
2. Gurevitch, J., Scheiner, S.M. and Fox, G.A. 2006. *The Ecology of Plants* (2nd Edition). Sinauer Associates Inc, Pub. USA.
3. Kormondy, E.J. 1996. *Concepts of Ecology*. Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Mackenzie, A. et al. 1999. *Instant Notes in Ecology*, Viva Books Pvt. Ltd., New Delhi.
5. Mcknney, M.L., Schoch, R.M. & Yonaujak, L. 2007. *Environmental Science: Systems and Solutions* (4th Edition). Johes and Bartl. Pub., USA.
6. Odum, E.P. 1983. *Basic Ecology*, Saunders, Philadelphia.
7. Omasa, K. Saji, H., Youssefian, S. and Kondo, N. 2005. *Air pollution and Plant Biotechnology: Prospects for Phytomonitoring and Phytoremediation*. Springer-Verlog, Tokyo, Japan.

PAPER XII: PLANT UTILIZATION

Max. Marks: 55 marks

Pass Marks: 35% in Theory and Practical Separately

Theory Paper: 40 marks

Internal Assessment: 15 marks

Total Teaching hours: 45

Time Allowed: 3 Hours

Objective of the paper is to impart knowledge to students about the plant resources useful to mankind.

INSTRUCTIONS FOR THE PAPER SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective section of syllabus and will carry 6 marks each. Section C will consist of 8 short-answer type questions (8-10 lines) of 2 marks each which will cover the entire syllabus uniformly and will carry 16 marks in all.

INSTRUCTIONS FOR CANDIDATES

Candidates are required to attempt two questions from each section A and B and the entire section C, which is compulsory.

SECTION-A

1. The importance and nature of plant products; fibres: surface fibres (cotton), soft fibres (Jute), hard fibres (Coir). Forest products: Wood, properties, seasoning and importance, important timber plants of India.
2. Brief history of origin of food plants; cultivation practice and recommended varieties of wheat, rice, maize and sugarcane with particular reference to Punjab.
3. Cultivation practices and use of soyabean, sunflower, mustard, groundnut and coconut.
4. Vegetables and Fruits: Botanical name, family, season and area of cultivation of potato, tomato, brinjal, carrot, ladyfinger, pea, mango, apple, banana, guava, kinnow and grapes.

SECTION-B

5. Spices: General account pertaining to botanical name, family and part used in case of clove, cardamom, black pepper, turmeric, cumin and ginger.
6. Medicinal Plants: General account pertaining to botanical name, family, part used and active principle in case of belladonna, neem, tulsi, stevia, rauwolfia, ashwagandha and glycyrrhiza.
7. Beverages and Narcotics: Cultivation practices, botanical name, family and active ingredients of tea and coffee. Cannabis, tobacco and opium.
8. Rubber: Major sources, cultivation, processing and uses of Para rubber.

RECOMMENDED READINGS

1. Kochhar, S.L. 1998. *Economic Botany in Tropics*. 2nd Edition, Mac Millan India Ltd., New Delhi.
2. Sambamurthy, A.V.S.S. and Subramanyam, N.S. 1989. *A Textbook of Economic Botany*, Wiley Eastern Ltd., New Delhi.
3. Sharma, O.P. 1996. *Hill's Economic Botany* (Late Dr. A.F. Hill, adapted by O.P. Sharma) Tata McGraw Hill Co. Ltd., New Delhi.
4. Simpson, B.B. and Conner, M. 1986. *Economic Botany – Plants in Our World*, McGraw Hill, New York.

SUGGESTED LABORATORY EXERCISES PERTAINING TO THEORY PAPERS: PLANT ECOLOGY AND PLANT UTILIZATION:

Teachers may select plant/material available in their locality/institution.

1. To determine minimum number of quadrats required for study of a grassland.
2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkiaer's Standard Frequency Diagram.
3. To estimate Importance Value Index (IVI) for grassland species on the basis of relative frequency, relative density and relative biomass in protected and grazed grassland.
4. To measure the above ground plant biomass in a grassland.
5. To determine Kemp's constant for dicot and monocot leaves and to estimate the leaf area index of a grassland community.
6. To determine diversity indices (Richness, Simpson, Shannon Wiener) in grazed and protected grassland.
7. To estimate bulk density and porosity of grassland and woodland soil.
8. To determine moisture content and water holding capacity of grassland and woodland soil.
9. To study the vegetation structure through profile diagram.
10. To estimate transparency, pH and temperature of different water bodies.
11. To measure dissolved oxygen content in polluted and unpolluted water samples.
12. To estimate salinity of different water samples.
13. To determine the per cent leaf area injury of different leaf samples collected around polluted sites.
14. To demonstrate dust holding capacity of the leaves of different plant species.
15. Food Plants: Study of the morphology, structure and simple micro chemical tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (excepting sugarcane).
16. Fibres: Study of cotton flower, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic study of cotton and test for cellulose. Sectioning and staining of jute stem showing the location and development of fibres. Microscopic structure. Tests for ligno-cellulose.
17. Vegetable Oils: study of hand sections of groundnut, mustard and coconut and staining of oil droplets with Sudan III and Sudan Black.
18. Field Visits: To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features.
19. Spices: Examine Black pepper, cloves, cinnamon (hand sections) and open fruits of cardamom and describe them briefly.
20. Preparation of an illustrated inventory of 10 medicinal plants and use their in indigenous systems of medicine of allopathy: Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.
21. Beverages: Section of boiled coffee beans and tea leaves to study the characteristic structural features.

SUGGESTED READINGS FOR LABORATORY EXERCISES IN PLANT ECOLOGY AND PLANT UTILIZATION

1. APHA- *Standard Methods for the Examination of Water and Waste Water*. American Public Health Association, Washington, D.C.
2. Krebs, C.J. 1989. *Ecological Methodology*. Harper and Row, New York, USA.
3. Ludwig, J.A. and Reynolds, I.F.1988. *Statistical Ecology*. Wiley, New York.
4. Misra, R. 1968. *Ecology Work Book*. Oxford & IBH, New Delhi.
5. Moore, P.W. and Chapman, S.B.1986. *Methods in Plant Ecology*. Blackwell Scientific Publication.
6. Council of Scientific & Industrial research 1986. *The Useful Plants of India*. Publication and Information Directorate, CSIR, New Delhi.
7. Kochhar, S.L. 2000. *Economic Botany of the Tropics*. Macmillan India Pvt.Ltd., New Delhi.
8. Pimentel. D. and Hall, C.W.(Eds.) 1989. *Food and Natural Resources*. Academic Press, London, New York.
9. Swaminathan, M.S. and Kochhar, S.L. (Eds.) 1989. *Plants and Society*. Macmillan Publication Ltd., London.

INSTRUCTIONS FOR PAPER SETTER

PRACTICAL PAPER-(PERTAINING TO THEORY PAPER-XI & XII)

Practical Paper	Marks
1) Section cutting and preparation of slide of any economically important plant/part and show to the examiner	06
2) Write up about the requirements, procedure and precautions for an ecological experiment	05
3) Write up about the requirements, principle and procedure of anyecological experiment. Show results to the examiner	06
4) Identification of four spots/specimens/slides giving at least two reasons.	08
5) Field Report	05
6) viva-voce	05
7) Note Book	05
	<u>40 Marks</u>