

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Botany For

Bachelor of Science (Medical)

Semester V-VI

(Under Credit Based Continuous Evaluation Grading System)

(12+3 System of Education)

Session: 2025-26



**The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)**

Kanya Mahavidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE-YEARS DEGREE PROGRAMME

Semester –V										
Course Name	Program Name	Course Code	Course Type	Total Marks	Marks				CA	EXAM TIME In Hrs
					Paper	Credits	Ext.			
						L-T-P	L	P		
Botany	Bachelor of Science (Medical)	BSMM- 5075(I)	C	50	Plant Physiology	2-0-0	40		10	3
		BSMM- 5075 (II)		75	Biochemistry &Biotechnology		60		15	3
		BSMM- 5075 (P)		50	Practical (Based on Papers–I and II)	0-0-2		40	10	3
Semester –VI										
Botany	Bachelor of Science (Medical)	BSMM-6075 (I)	C	50	Ecology	2-0-0	40		10	3
		BSMM- 6075(II)		75	Economic Botany	3-0-0	60		15	3
		BSMM- 6075 (P)		50	Practical (Based on Papers–I and II)	0-0-2		40	10	3

Bachelor of Science (Medical) Semester-V (Session 2025-26)

BOTANY

Course Code: BSMM-5075 (I)

**Course Title: Plant Physiology
(Theory)**

Course outcome: -

After passing this course the student will be able to:

CO1. Understand the plant cells in relation to water and mineral nutrition.

CO2. Learn about the movement of sap & absorption of water and growth in plant.

CO3. Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.

CO4. Understand the growth regulator in higher plants.

Bachelor of Science (Medical) Semester-V (Session 2025-26)

BOTANY

Course Code: BSMM-5075 (I)

Course Title: Plant Physiology

(Theory)

Examination Time: 3Hrs

Theory Marks:40

Instructions for the Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Plant-Water Relation: Importance of water to plant life, physical properties of water, (imbibition) diffusion and osmosis, absorption, transport of water and transpiration, physiology of stomata.

Mineral Nutrition: Essential macro-and micro-elements and their role, mineral uptake, deficiency and toxicity symptoms (hydroponics).

Unit-II

Transport of Organic Substances: Mechanism of phloem transport, source-sink relationship, factors affecting translocation.

Growth and Development: Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation, plant movements, the concept of photoperiodism, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening.

Unit-III

Photosynthesis: Significance, historical aspects, photosynthetic pigments, action and absorption spectra and enhancement effects, concept of two photosystems, z-scheme, photophosphorylation, Calvin cycle, C4 pathway, CAM plants, photorespiration.

Unit-IV

Plant growth regulators - auxins, gibberellins, cytokinin's, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action, general account of salicylic acid, jasmonates and brassinosteroids, photomorphogenesis, phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

Suggested Readings: -

1. Bhatia, K.N. (2019). Plant Physiology I and II. Trueman Book Company. New Delhi
2. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology (4th Edition). John Wiley and Sons. U.S.A.
3. Jain, V.K. (2017). Fundamentals of Plant Physiology. S. Chand Publishing. New Delhi.
4. Mandavia, C., Patel, S. V., Mandavia, M. K., Golakiya, B. A. and Chovatia, V. P. (2009). Glimpses in Plant Physiology. International Book Distributing Co., Lucknow, India.
5. Mohr, H. and Schopfer, P. (1995). Plant Physiology. Springer-Verlag, Berlin, Germany.
6. Pandey, S.N. and Sinha, B. K. (2005). Plant Physiology. Vikas Publishing. New Delhi.
7. Salisbury, F.B. and Ross, C.W. 2006. Plant Physiology (4th Edition). Wadsworth Publishing., California, USA.
8. Srivastava, H. N. (2019). Plant Physiology, Biochemistry and Biotechnology. Pradeep Publications, Jalandhar.
9. Taiz, L. and Zeiger, E. (2010). Plant Physiology (5th Edition). Sinauer Associates Inc. USA.

Bachelor of Science (Medical) Semester-V (Session 2025-26)

BOTANY

Course Code: BSMM-5075 (II)

**Course Title: Biochemistry & Biotechnology
(Theory)**

Course outcome: -

After passing this course the student will be able to:

CO1. Understand the properties and function of enzymes, and process of carbohydrate metabolism.

CO2. Understand the Properties of nitrogen metabolism & lipid metabolism and its significance in plants

CO3. Understand the fundamentals of Recombinant DNA Technology. Know about the Genetic Engineering.

CO4. Understand the principle and basic protocols for Plant Tissue Culture.

Bachelor of Science (Medical) Semester-V (Session 2025-26)

BOTANY

Course Code: BSMM-5075 (II)

**Course Title: Biochemistry & Biotechnology
(Theory)**

Examination Time: 3Hrs

Theory Marks:60

Instructions for the Paper Setters:

Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Basics of Enzymology: Discovery and nomenclature, characteristics of enzymes, concept of holoenzyme, apoenzyme, coenzymes and cofactors regulation of enzyme activity, mechanism of action.

Respiration: ATP-the biological energy currency, aerobic and anaerobic respiration, Krebs cycle, electron transport mechanism (chemiosmotic theory), redox potential, oxidative phosphorylation, pentose phosphate pathway.

Unit-II

Nitrogen and Lipid Metabolism: Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid biosynthesis, β -oxidation, saturated and unsaturated fatty acids, storage, and mobilization of fatty acids.

Unit-III

Genetic Engineering: Tools and techniques of recombinant DNA technology, cloning vectors, genomic and cDNA library, transposable elements, techniques of gene mapping.

Unit-IV

Biotechnology: Functional definition, basic aspects of plant tissue culture, cellular totipotency, differentiation and morphogenesis, biology of Agrobacterium, vectors for gene delivery and marker genes, salient achievements in crop biotechnology.

Suggested Readings: -

1. Bhojwani, S.S. (1996). Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
2. Dennis, D.T., Turpin, D.H. Lefebvre, D.D. and Layzell (eds.) (1997). Plant Metabolism (2nd Edition). Longman, Essex, England.
3. Gallstone, A.W. (1994). Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.
4. Glick, B.R., Pasternak, J.J. (2010). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
5. Lea, P.J. and Lee good, R.C. (1999). Plant Biochemistry and Molecular Biology. John Wiley Sons, Chichester, England.
6. Old, R.W. and Primrose, S.B. (2006). Principles of Gene Manipulation, Blackwell Scientific Publishers, Oxford, UK.
7. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics (5th Edition). John Wiley and Sons Inc., U.S.A.
8. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques And Applications. John Wiley & Sons Inc. U.S.A.
9. Vasil, I.K. and Thorpe, T.A. (2012). Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands

Bachelor of Science (Medical) Semester-V (Session 2025-26)

BOTANY

Course Code: BSMM-5075(P)

**PRACTICAL – Plant physiology, Biochemistry & Biotechnology
(I & II)**

TIME: 3Hours

Total:-50

Practical: 40

CA: - 10

Instructions for the paper setter: question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Laboratory Exercises

1. To study the permeability of plasma membrane using different concentrations of organic solvents.
2. To study the effects of temperature on permeability of plasma membrane.
3. To prepare the standard curve of protein and determine the protein content in unknown samples.
4. To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature.
5. Separation of chloroplast pigments by solvent method.
6. Determining the osmotic potential of vacuolar sap by plasmolytic method.
7. Determining the water potential of any tuber.
8. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.
9. Bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant material.
10. Demonstration of the technique of micropropagation by using different explants, e.g. axillary buds, shoot meristems.
11. Demonstration of the technique of another pollen culture.
12. Demonstrate the ascent of sap using a dye.
13. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones.
14. Demonstrate the transpiration pull by mercury method.
15. Demonstration of osmosis by potato Osmoscope.
16. Comparison of loss of water from two surfaces of leaf by CoCl_2 method/four leaf method.
17. Demonstration of imbibition by plaster of Paris method.
18. Demonstration that O_2 is evolved during photosynthesis.
19. Separation of pigments by paper chromatography/TLC method.
20. Demonstration of phototropism movements.
21. Demonstration the measurements of growth by arc auxanometer.
22. Requirements for setting up the tissue culture laboratory.
23. Preparation of nutrient medium.
24. Sterilization of glassware and plant material.
25. Preparation of explant for aseptic manipulation.

Suggested Readings (For Laboratory Exercises)

1. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Agrobios, Jodhpur, India.
3. Dixon, R.A. (Ed.) 1994. Plant Cell Culture: A Practical Approach, IRL Press, Oxford.
4. Kochhar, S. L. and Gujral, S. K. (2016). Comprehensive Practical Plant Physiology. Macmillan Publishers India Ltd., Delhi.
5. Moore, T.C. 2012. Research Experiences in Plant Physiology: A Laboratory annual. Springer-Verlag. Berlin.
6. Plummer, D.T. (2001). An Introduction to Practical Biochemistry (3rd Edition). Tata McGraw-Hill Publishing Co. Ltd. New Delhi.
7. Roberts, J. and Tuckar, G.A. (Eds.) 2000. Plant Hormone Protocols. Human Press, New Jersey, USA.
8. Scott, R.P.W. 1995. Techniques and Practices of Chromatography. Marcel Dekker, Inc., New York.
9. Smith, R.H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, New York.

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075 (I)

Ecology

(Theory)

Course outcome: -

After passing this course the student will develop:

CO1.Understand the abiotic components and relationship with living organism.

CO2.Demonstrate an understanding keys of community ecology and biodiversity

CO3.Understand the structure and function of ecosystem and growth curve

CO4. Study the biogeographical region and vegetation of India

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075(I)

Ecology

(Theory)

Examination Time: 3Hrs

Max. Marks: 50

Theory: -40

CA:10

Instructions for the Paper Setters:

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Plants and Environment: Atmosphere (gaseous compositions), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties), and biota.

Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes), temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity.

Unit-II

Community Ecology: Community characteristics, absolute and relative frequency, density and dominance, basal area and importance value index (IVI), Whittaker's classification of biodiversity, indices of alpha, beta and gamma diversity, life forms, biological spectrum, ecological succession.

Unit-III

Population Ecology: Growth curves, ecotypes, ecads.

Ecosystem: Structure, abiotic and biotic components, food chain, food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen and phosphorus.

Unit-IV

Biogeographical Regions of India

Vegetation types of India: Forests and grasslands

Landscape Ecology: Definition & concept, effect of patch size and shape on biodiversity, dynamics of land use.

Suggested Readings:

1. De, Debapriya and De, Debasish (2014). Fundamentals of Environment and Ecology. S. Chand Publishing, New Delhi
2. Kumar, H.D. (2018). Modern Concepts of Ecology 8th edition. Vikas Publishing House, New Delhi.
3. Mackenzie, A., Ball, A. and Virdee, S. (2001). Instant Notes in Ecology. Taylor & Francis, London, United Kingdom
4. Odum, E.P. and Barrett, G.W. (2012). Fundamentals of Ecology. Cengage Learning India Pvt.Ltd., New Delhi.
5. Saini, A. (2019). Plant Ecology. Trueman Book Company. New Delhi.
6. Sharma, P.D. (2017). Environmental Biology and Toxicology. 3rd edition. Rastogi Publications, Meerut.
7. Srivastava, H. N. (2020). Botany Vol VI, Ecology and Utilization of Plants. Pradeep publications, Jalandhar.

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075(II)

Economic Botany

(Theory)

Course outcome: -

After passing this course the students will be able to:

CO1: Understand the cultivation and economic importance of various food plant crops, fibre and oil yielding plants.

CO2: Understand the economic importance of spices and condiments.

CO3: Understand economic importance of medicinal plants.

CO4: Understand the processing and economic value of beverages, rubber plant, firewood, timber and bamboos.

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075(II)

Economic Botany

(Theory)

Examination Time: 3Hrs

Max. Marks: 75

Theory :60

CA:15

Instructions for the Paper Setters:

Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (I-IV). Questions of Sections I-IV should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Food Plants: *Oryza sativa* (Rice), *Triticum aestivum* (Wheat), *Zea mays* (Maize), *Solanum tuberosum* (Potato), *Saccharum officinarum* (Sugarcane).

Fibres: *Gossypium hirsutum* (Cotton) and *Chorchorus capsularis* (Jute).

Vegetable Oils: *Arachis hypogea* (Groundnut), *Brassica campestris* (Mustard) and *Cocos nucifera* (Coconut).

Unit-II

Spices: General account of *Piper nigrum* (Black pepper), *Eugenia caryophyllum* (Cloves), *Cinnamomum verum* (Cinnamomum), *Elettaria cardamomum* (cardamom), *Zingiber officinalis* (Ginger), *Curcuma longa* (Turmeric), *Coriandrum sativum* (Coriander), *Foeniculum vulgare* (Fennel) and *Mentha arvensis* (Mint).

Unit-III

Medicinal Plants: General account of *Terminalia chebula* (Harar), *Terminalia belerica* (Bahera), *Azadirachta indica* (Neem), *Phyllanthus emblica* (Amla), *Aconitum napellus* (Aconite), *Rauwolfia serpentina* (Sarpagandha), *Atropa belladonna* (Belladonna), *Datura stramonium* (Datura), *Withaniasomnifera* (Ashwagandha) and *Papaver somniferum* (Poppy).

Unit-IV

Beverages: *Camellia sinensis* (Tea) and *Coffea arabica* (Coffee).

Rubber: Morphology of *Hevea brasiliensis* (Rubber), Processing and Uses. General account of sources of firewood, timber and bamboos.

Suggested Readings:

1. Verma, V. (2016). Textbook of Economic Botany, ANE Books, New Delhi.
2. Das, K. (2014). Medicinal plants- Their importance in Pharmaceutical Sciences, Kalyani Publishers, New Delhi.
3. Kocchar, S.L. (2016). Economic Botany of the Tropics, Macmillan India Pvt. Ltd., New Delhi.
4. Prinotel, D. and Hall, C.W. (Eds.) (2001). Food and Natural Resources. Academic Press, London, New York.
5. Reddy, K. et al. (2015). Advances in Medicinal plants, Universities Press, Hyderabad.
6. Sharma, O.P. (1996). Hill's Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.
7. Swaminathan, M.S. and Kocchar, S.L. (Eds) (2009). Plants and Society. Macmillan Publications Ltd., London.
8. Council of Scientific & Industrial Research (1986). The Useful Plants of India. Publications and Information Directorate. CSIR, New Delhi.

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075(P)

**PRACTICAL: - Ecology and Economic botany
(I &II)**

Course Outcomes:

On completion of this course, the students will be able to:

CO1. Determination of abundance and frequency of species by quadrat method.

CO2. To measure the dissolved oxygen content in polluted and unpolluted water samples.

CO3. Study of anatomical peculiarities with reference to ecological adaptations.

CO4. Preparation of different stains, solutions and reagents as per theory paper.

CO5. To understand the economic importance of plants.

CO6. To acquire knowledge in the preparation of herbarium techniques. Submission of field report and practical records.

Bachelor of Science (Medical) Semester-VI (Session 2025-26)

BOTANY

Course Code: BSMM-6075(P)

**PRACTICAL: - Ecology and Economic botany
(I &II)**

TIME: 3Hrs

Max Marks: 50

Practical: -40

CA: -10

Instructions for the paper setter: question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Suggested Laboratory Exercises

1. To determine minimum number of quadrats required for reliable estimate of biomass in grasslands through species area curves.
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 for grassland species on the basis of relative frequency, relative density, and relative dominance in protected and grazed grassland.
4. To measure the vegetation cover of grassland through point frame method.
5. To measure the above ground plant biomass in a grassland.
6. To study the morphological anatomical features of hydrophytes (*Hydrilla*, *Eichhornia*)
Xerophytes (*Nerium*, *Calotropis*).
7. To determine diversity indices (richness, Simpson, Shannon-Weaver) in grazed and protected grassland.
8. To estimate bulk density and porosity of grassland and woodland soils.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH, and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples.
14. To determine the percent leaf area injury of different leaf samples collected around polluted sites.
15. To estimate dust-holding capacity of the leaves of different plant species.
16. **Food Plants:** Study of the morphology, structure and simple microchemical tests of the foods storing tissues rice, wheat, maize, potato, and sugarcane. Microscopic examination of starch in these plants (excepting sugarcane).
17. **Fibers:** Study of cotton flowers, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibers. Microscopic study of cotton and test for cellulose.
18. Sectioning and staining of jute stem to show the location and development of fibers.
19. Microscopic structure. Tests for lignocelluloses.
20. **Vegetable Oils:** Study of hand sections of groundnut, mustard and coconut and staining of oil droplets by Sudan III and Sudan Black.

21. **Field Visits:** To study sources of firewood (10 plants)/timber yielding trees (10 trees)/bamboos, list to be prepared mentioning special features, collection of plant-based articles of common use.
22. **Spices:** Examine black pepper, cloves, cinnamon (hand sections) and opened of cardamom and describe them briefly.
23. Preparations of an illustrated inventory of 10 medicinal plants used in indigenous systems of medicine or allopathy: Write their botanical and common names parts used and diseases/disorders for which they are prescribed.
24. **Beverages:** Section boiled coffee beans and tea leaves to study the characteristic structural features.
25. Visit to *in situ* conservation site/Botanical Garden.

Suggested Readings (for laboratory exercises)

1. Council of Scientific & Industrial Research. (1986). The Useful Plants of India. Publications and Information Directorate. CSIR, New Delhi.
2. Kocchar, S.L. (2016). Economic Botany of the Tropics, Macmillan India Pvt. Ltd., New Delhi.
3. De, Debapriya and De, Debasish (2014). Fundamentals of Environment and Ecology. S. Chand Publishing, New Delhi
4. Kumar, H.D. (2018). Modern Concepts of Ecology 8th edition. Vikas Publishing House, New Delhi.
5. Mackenzie, A., Ball, A. and Virdee, S. (2001). Instant Notes in Ecology. Taylor & Francis, London, United Kingdom
6. Princentel, D. and Hall, C.W. (Eds.) (2001). Food and Natural Resources. Academic Press, London, New York.
7. Sharma, O.P. (1996). Hill's Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.
8. Swaminathan, M.S. and Kocchar, S.L. (Eds.) (2009). Plants and Society. Macmillan Publications Ltd., London.