



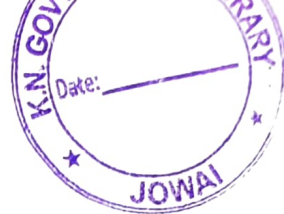
BOTANY

Under Graduate SYLLABUS

FOR SEMESTER SYSTEM

DISTRIBUTION OF PAPERS OVER 6 SEMESTERS

SUBJECT	SEMESTER I	SEMESTER II	SEMESTER III	SEMESTER IV	SEMESTER V	SEMESTER VI	TOTAL MARKS
ELECTIVE I	100	100	100	100			400
ELECTIVE II	100	100	100	100			400
ELECTIVE HONS.	100	100	100	100	200	200	800
ENGLISH					100		100
ENVIRONMENTAL STUDIES						100	100
TOTAL MARKS	300	300	300	300	300	300	1800



**UG BOTANY SYLLABUS
SEMESTER SYSTEM
North- Eastern Hill University, Shillong**

SEMESTER AND PAPER	COURSE TITLE	MARKS		
		Theory	Practical	Total
SEMESTER – 1				
PAPER –1: THEORY	Algae, Bryophytes and Pteridophytes	75		
PAPER – 1: PRACTICAL	Algae, Bryophytes and Pteridophytes		25	
				100
SEMESTER – 2				
PAPER –2: THEORY	Gymnosperms, Paleobotany, Morphology and Anatomy	75		
PAPER – 2: PRACTICAL	Gymnosperms, Paleobotany, Morphology and Anatomy		25	
				100
SEMESTER – 3				
PAPER –3: THEORY	Angiosperm taxonomy, Economic Botany, Ethnobotany and Phytogeography	75		
PAPER – 3: PRACTICAL	Angiosperm taxonomy, Economic Botany, Ethnobotany and Phytogeography		25	
				100
SEMESTER – 4				
PAPER –4: THEORY	Microbiology, Mycology and Plant Pathology	75		
PAPER – 4: PRACTICAL	Microbiology, Mycology and Plant Pathology		25	
				100
SEMESTER – 5				
PAPER –5: THEORY	Plant Physiology and Biochemistry	75		
PAPER – 5: PRACTICAL	Plant Physiology and Biochemistry		25	
				100
PAPER –6: THEORY	Ecology and Conservation Biology	75		
PAPER – 6: PRACTICAL	Ecology and Conservation Biology		25	
				100
SEMESTER – 6				
PAPER –7: THEORY	Genetics, Plant Breeding and Molecular Biology	75		
PAPER – 7: PRACTICAL	Genetics, Plant Breeding and Molecular Biology		25	
				100
PAPER –8: THEORY	Plant Reproductive Biology and Plant Biotechnology	75		
PAPER – 8: PRACTICAL	Plant Reproductive Biology and Plant Biotechnology		25	
				100
	Grand Total			800



Duration of Examination: Theory Papers: 3 hours each; Practical Papers: 4 hours each

Semester 1

Paper 1: Theory

Algae, Bryophytes and Pteridophytes

Unit 1

1. Classification of algae according to Fritsch and Lee;
2. Range of vegetative and reproductive structures of Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae.
3. Life cycle types in green algae.

Unit 2

1. Life cycles of *Chara*, *Oedogonium*, *Ectocarpus*, *Polysiphonia* and Centric diatoms.
2. Origin and evolution of sex in algae.
3. Pigmentation in algae.
4. Economic importance of algae.

Unit 3

1. Classification of bryophytes according to Proskauer.
2. Origin and range of gametophyte structure in bryophytes.
3. Reproduction in bryophytes.
4. Evolution of sporophyte and gametophyte in bryophytes
5. Life cycles of *Anthoceros*, *Marchantia* and *Sphagnum*.

Unit 4

1. Classification of pteridophytes by Smith.
2. Evolution of stele in pteridophytes and telome concept.
3. Heterospory and seed habit.
4. Life cycles of *Lycopodium* and *Selaginella*.
5. Economic and ecological importance of pteridophytes.

Paper 1: Practical

Algae, Bryophytes and Pteridophytes

1. Study of vegetative and reproductive parts with the help of temporary preparations of all types of genera prescribed in Paper 1.
2. Dissection, sectioning, drawing, description and identification of the specimens covered in the preparations.

Recommended Readings

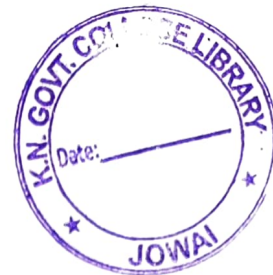
- Kumar H.D. and Singh, H.N. 1995. A Text Book of Algae, East West Press, New Delhi.
- Lee, R.E. 2008. Phycology. 4th Edition, Cambridge University Press India Pvt. Ltd. New Delhi.

- Parihar, N.S. 1986. Bryophyta. Central Book Depot, Allahabad.
- Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
- Sporne, K. R. 1991. Morphology of Pteridophytes. Central Book Depot. Allahabad

- Vashistha, B.R, Sinha, A.K. and Kumar, A. 2012. Botany for degree students: Bryophyta. S Chand & Co., New Delhi.
- Vashistha, B.R., Sinha, A. K. and Kumar, A. 2010. Botany for degree students: Pteridophyta. S Chand & Co., New Delhi.

Suggested Readings

- Bold, H.C. and Wynne, M.J. 1978. Introduction to Algae: Structure and reproduction. Publ. Prentice-Hall, New Delhi.
- Chapman, V.J. and Chapman, D.J. 1975. The Algae. 2nd edition, McMillan Publ. Inc. New York.
- Dodge, J.D. 1973. The Fine Structure of Algal Cells. Academic Press, New York.
- Gangulee, H.C., Das, H.C. and Dutta, T.C. 1986. College Botany. Vol I. New Central Book Agency, Kolkatta.
- Gilbert, M.S. 1985. Cryptogamic Botany, Vol I and Vol II. Tata McGraw Hill Publ. New Delhi.
- Hait, G., Bhattacharya, K. and Ghosh, A. 2013. A Text Book of Botany Volume 1. New Central Book Agency, Kolkata.
- Hoek, C.V., Mann, D.G., Jahns, H.M. 1995. Algae- An introduction to Phycology. Cambridge University Press, New Delhi.
- Kumar, S.S. 1995. Recent Studies on Indian Bryophytes. Publ. Bishen Singh and Mahendra Pal Singh.
- Mitra, D., Guha, J. Chaudhury, S.K. 2000. Studies in Botany. Vol I and II. Publ. Moulik Library.
- Nath, V. and Asthana, A.K. 2001. Perspectives in Indian Bryology. Publ. Bishen Singh and Mahendra Pal Singh.
- Mukherjee, R.N. and Chakravarty, K. 1995. Introduction to Vascular Cryptogams (Pteridophyta). Publ. Kalyani Publishers.
- Pandey, B.P. 2000. College Botany (Vol. I) Algae, Fungi, Bryophyta. S. Chand & Co. New Delhi.
- Pandey, B.P. 2000. College Botany (Vol. II) Pteridophyta, Gymnosperm and Paleobotany. S. Chand & Co. New Delhi.
- Prasad B.N. and Singh Y. 1996. Algal Indicators of Water Pollution. Bishen Singh and Mahendra Pal Singh, Dehradun.
- Prescott, G.W. 1984. The Algae (A review). Publ. Bishen Singh and Mahendra Pal Singh, Dehradun.
- Puri, P. 1985. Bryophytes. Atmaram and Sons, Delhi.
- Rashid, A. 1998. An introduction to Bryophyta. Vikas Publishing House, New Delhi.
- Rashid, A. 1999. An introduction to Pteridophyta. Vikas Publishing House, New Delhi.
- Sharma, O.P. 2007. A text book of Algae. Tata Mc Grow Hill, New Delhi.
- Singh A.P. and Nath, V. 2001. Hepaticaceae of Khasi and Jaintia Hills. Eastern Himalayas. Publ. Bishen Singh and Mahendra Pal Singh, Dehradun.
- Surange, K.R. 1966. Indian Fossil Pteridophytes. CSIR, New Delhi.
- Vashistha, B.R, Sinha, A.K. and Kumar, A. 2010. Botany for degree students: Algae. S Chand & Co., New Delhi.



Semester 3

Paper 3: Theory

Angiosperm taxonomy, Economic Botany, Ethnobotany and Phytogeography

Unit 1

1. Major systems of classification – artificial, natural and phylogenetic.
2. Bentham and Hooker's, and Hutchinson's system of classification.
3. I.C.N. – Principles of Botanical Nomenclature, Type method and typification, and Rules and limitations of Priority.

Unit 2

1. Distinguishing features and economic importance of the following dicotyledonous families: Ranunculaceae, Fabaceae, Asteraceae, Solanaceae, Verbenaceae and Lamiaceae.
2. Distinguishing features and economic importance of the following monocotyledonous families: Liliaceae, Zingiberaceae, Orchidaceae and Poaceae.

Unit 3

1. Ethnobotany and its significance; Study of some ethnobotanical plants of north- eastern India having medicinal and food values.
2. Study of economically important plants – cereals, pulses, oil yielding, spices, condiments, fibres, ornamentals and aromatic (scientific names, families, and parts used of at least three plants under each category).
3. Characteristics, cultivation and uses of aromatic and medicinal plants (*Citronella* and *Rauwolfia*).
4. Characteristics, cultivation and uses of timber yielding plants (Teak and Sal).
5. Cultivation and processing of tea and rubber.

Unit 4

1. Floristic regions of India.
2. Continuous and discontinuous plant distribution in India: Factors and theories.
3. Centre of origin of plants (Primary and Secondary centres).
4. Barriers to plant migration.

Paper 3: Practical

Angiosperm taxonomy, Economic Botany, Ethnobotany and Phytogeography

1. Taxonomic studies of angiosperm plants belonging to both dicot and monocot families mentioned in Paper 3. Flower dissection, drawing and description in technical language, and identification upto Genera.
2. Qualitative detection of starch, protein, fat and cellulose in plant materials by chemical tests.
3. Spotting: Economically important plants or plant products prescribed in Paper 3.
4. Techniques for preparation of herbarium sheets of flowering plants and submission of at least 5 herbarium sheets.
5. Study of 5 plants having ethnobotanical importance.
6. One local field trip of botanical relevance.

Recommended Readings

- Naik, V.N. 2014. Taxonomy of Angiosperms. Tata McGraw Hill Publ. New Delhi.
- Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. Macmillan Company, New York.
- Puri, G.S. 1990. Forest Ecology Volume 1. Oxford IBH, New Delhi.
- Jain, S.K. 1981. Glimpses of Indian Ethnobotany. Oxford IBH, New Delhi.



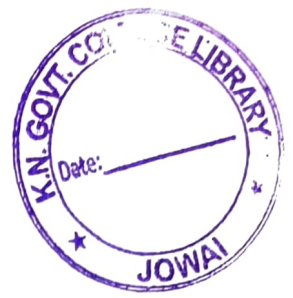
- Hill, A.F. 2003. Economic Botany: A Textbook of Useful Plants and Plant Products. Textbook Publishers

Suggested Readings

- Cronquist, A. 1968. The Evolution and Classification of Flowering Plants. Thomas Nelson, London.
- Davis, P.H. and Heywood, V.H. 1967. Principles of Angiosperm taxonomy. Oliver & Boyd, London.
- Gangulee, H.C., Das, K.S. and Dutta, T.C. 1986. College Botany Vol II. New Central Book Agency, Calcutta.
- Hutchinson, J. 1979. Evolution and Phylogeny of Flowering Plants. Publ. Acad. Press, London.
- Jain, S.K. 1987. A Manual of Ethnobotany, Scientific Publishers, Jodhpur.
- Jain, S.K. and Mundgal, V. 1999. Handbook of Ethnobotany, London.
- Mitra, D., Guha, A.C. and Chaudhury, S.K. 2000. Studies in Botany. Vol I and II Moulik Library, Calcutta.
- Misra, K.C. 1988. Manual of Plant Ecology 3rd edition. Oxford and IBH Publishing Co. New Delhi.
- Mondol, A.K. 2014. Advanced Plant Taxonomy. New Central Book agency, Kolkata.
- Pandey B.P. 2013. College Botany. Volume I, II and III. S.Chand & Company New Delhi.
- Saxena, N.B. and Saxena, S. 2008. Plant Taxonomy. PragatiPrakashan, Meerut.
- Koromondy, E.J. 1996. Concepts of Ecology. Prentice Hall, New Delhi
- Kumar, N.C. 1995. An Introduction to Taxonomy of Angiosperms. Himalaya Publishing House, Mumbai.
- Santra, S.C., Chatterjee, T.P. and Das, A.P. 2012. College Botany Practical Volume 2. New Central Book Agency.
- Sen, S. 2004. Economic Botany. New Central Book Agency.
- Shreemali, J.L. 1979. Economic Botany, KitabMahal, Allahabad.
- Singh, B.D. 1998. Plant Breeding. Kalyani Publishers.
- Vairavan, K. 2007. Biofuel Crops: Cultivation and Management (Jatropha, Sweet sorghum and Sugarbeet), Agrobios India Publications.



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Paper 5: Theory

Plant Physiology and Biochemistry

Unit 1

1. Water potential and its significance
2. Translocation of minerals; active and passive transport
3. Mineral nutrition (micro and macro nutrients, criteria of essentiality - properties and deficiency symptoms)

Unit 2

1. Photosynthesis: Structure of chloroplast, photosynthetic pigments, PSI and PSII, mechanism of C₃, C₄ and CAM pathways, photosynthetic electron transport chain, and effect of environmental factors on photosynthesis.
2. Respiration: Glycolysis, Krebs's cycle, Electron transport chain.
3. Photorespiration.
4. Biological N₂ fixation, assimilation of ammonia.

Unit 3

1. Photoperiodism and Vernalization
2. Physiological effects of auxins, gibberellins, ABA and cytokinins.
3. Seed dormancy and its regulation.
4. Physiology of senescence

Unit 4

1. Structure and classification of carbohydrates, amino acids and proteins. Levels of protein structure- primary, secondary and tertiary.
2. Enzymes – Classification, structure and mechanism of action (characteristics of enzyme active sites, kinetics of enzyme catalysis, Vitamins as co-enzymes).
3. Laws of Thermodynamics.

Paper 5: Practical

Plant Physiology and Biochemistry

1. Study of transpiration rate in dorsiventral leaves by Blackman's apparatus.
2. Determination of water potential by plasmolytic and gravimetric method.
3. Study of the effect of light on oxygen evolution during photosynthesis by Winkler's Method.
4. Preparation of standard curves for estimation of the following
 - a) Starch by I₂KI method.
 - b) Amino acid by Ninhydrin reagent.
6. Separation of amino acids by paper chromatography
7. Effect of substrate concentration on amylase activity.

Recommended Readings

- Hopkins, W.G. and Hunter, N.P. 2009. Introduction to Plant Physiology. John Wiley and Sons.
- Murray, R.K., Rodwell, V. W., Bender, D., Botham, K.M., Weil, P.A., Kennelly, P.J. 2009. Harper's illustrated Biochemistry, 28th Edition, MC Graw Hill.
- Nelson, D. L. and Cox, M. M. 2012. Lehninger Principles of Biochemistry, Sixth Edition. W.H. Freeman and Co. Publishers.
- Salisbury, F.B. and Ross, C.W. 2009. Plant Physiology, Publ. Wadsworth.



Suggested Readings

- Berg, J.M., Tymoczko, J.L. and Stryer, L. 2011. Biochemistry, 5th edition. W.H. Freeman & Co.
- Buchanan, B.B., Wilhelm, G. and Russel, J. 2003. Biochemistry and Molecular Biology of Plants. ASPB. US.
- Datta, S.C. 1989. Plant Physiology. Allahabad Central Book Depot, Allahabad.
- Devlin, R.M. 1969. Plant Physiology. Affiliated East West, New Delhi.
- Gangulee, H.C. & Kar, A.K. 1986. College Botany, Vol II. Central Book Depot, Calcutta.
- Lender, D.W. 2001. Photosynthesis. Mercer Dekker.
- Mathews, C.K., Van Holde, K.E. & Ahern, K.G. 2000. Biochemistry. Macmillan Worth.
- Mitra, D., Guha, J. & Chaudhury, S.K. 2000. Studies in Botany Vol II. Moulik Library, Kolkata.
- Mukherjee, S., Ghosh, A.K. 2012. Plant Physiology. New Central Book Agency, Kolkata.
- Nelson, D.L. and Cox, M.M. 2000. Lehninger's Principles of Biochemistry. Macmillan Worth.
- Nelson, D.L. and Cox, M.M. 2005. Lehninger, Principles of Biochemistry, 4th edition, W.H. Freeman & Co.
- Noogle, G.R. and Fritz, G.J. 1985. Introductory Plant Physiology. Prentice Hall of India, New Delhi.
- Pandey, S.N. and Sinha, B.K. 2014. Plant Physiology. Vikas Publishing House, New Delhi.
- Santra, S.C., Chatterjee, T.P. and Das, A.P. 2012. College Botany Practical Volume 1. New Central Book Agency.
- Sinha, R.K. 2007. Modern Plant Physiology 2nd edition. Publ. Narosha Publ. House.
- Taiz, L. and Zeiger, E. 2010. Plant Physiology, 5th edition. Panama Publishing Corp.
- Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in Plants. Academic Press.
- Verma, S.K. 2013. Text book of Plant Physiology and Biochemistry. S. Chand & Company, New Delhi.
- Voet, D.J., Voet, J.G. & Pratt, C.W. 2008. Principles of Biochemistry. John Wiley Inc.
- Voet, D., Voet, J.G. & Pratt, C.W. 2006. Fundamentals of Biochemistry, 2nd edition. John Wiley and Sons Biochemistry (3rd edition) John Wiley & Sons.
- Wilkins, M.B. 1987. Advanced Plant Physiology. ELBS, Longman Group Ltd.



Semester 5

Paper 6: Theory

Ecology and Conservation Biology

Unit 1

1. Ecological Factors: Climatic (light, temperature, precipitation and fire), Edaphic (soil formation process, soil types, soil texture, soil profile, soil reaction and soil organic matter), Physiographic (slope and aspect of mountain) and Biotic (anthropogenic and non- anthropogenic) factors.
2. Ecological adaptations: hydrophytic, xerophytic, epiphytic and halophytic adaptations.
3. Ecological levels of organization: population, community, ecosystem, landscape, biome and biosphere.

Unit 2

1. Population ecology: Attributes of plant populations, mortality, natality, survivorship curves and population growth.
2. Population interactions: Types of interactions, symbiosis, parasitism, commensalism, proto-cooperation and competition.
3. Community ecology: Community structure – qualitative and quantitative attributes of community; Community dynamics – primary and secondary succession, stages of succession; hydrosere and xerosere.

Unit 3

1. Structural attributes of ecosystem: Abiotic components (Inorganic elements, organic compounds and climatic regimes) and Biotic components (producers, macroconsumers and microconsumers).
2. Functional attributes of ecosystem: Flow of energy: Energy flow model (Box and pipemodel), Ecological pyramids, Primary production (types and distribution), Food chain and food web.
3. Biogeochemical Cycles: Hydrological cycle, Gaseous cycle (carbon) and Sedimentary cycle (phosphorus).

Unit 4

1. Air, water and soil pollution: sources, effects and abatement.
2. Global environmental problems: Causes, consequences and remedial measures of ozone layer depletion, Climate change and global warming (greenhouse effect), Desertification.
3. Plant diversity and conservation: Magnitude of vascular plant diversity in India, Plant conservation measures – *in-situ* (Biosphere Reserve, National Park, Wildlife Sanctuary, World Heritage Site and Community Conserved Area) and *ex-situ* (Botanical Garden, Seed Bank, Gene Bank and Cryopreservation).

Paper 6: Practical

Ecology and Conservation Biology

1. Determination of pH of soil samples of various sites using pH meter.
2. Determination of moisture content of two different soil samples using gravimetric method.
3. Determination of soil organic matter content of different soil samples by Walkley and Black's rapid titration method.
4. Determination of requisite size and requisite number of quadrats for the study of a plant community.
5. Determination of frequency, density, abundance, and basal area by quadrat method and IVI.
6. Study of morphological and anatomical features of xerophytes, hydrophytes and epiphytes.
7. Study of spatial and temporal variations in climatic factors – light, temperature and relative humidity.

Recommended Readings



- Odum, E.P. 1983. Basic Ecology, 5th edition. Thomson Business International/Waldis Pvt Ltd, Barichad.
- Townsend, C.R., Begon, M. and Harper, J.L. 2006. Essentials of Ecology. 2nd edition. Blackwell Publishers.
- Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand publishing, Delhi.

Suggested Readings

- Ambasht, R.S. and Ambasht, N.K. 2011. A Text Book of Plant Ecology, 15th edition. CBS Publishers and Distributors, New Delhi.
- Bell, P.R. and Woodcock, C.L.F. 1986. Diversity of Green Plants, 3rd edition, ELBS, Edward Arnold.
- Begon, M. Townsend, C.R. and Harper, J.L. 2006. Ecology from Individuals to ecosystem, 4th edition. Blackwell Publishers.
- Begon, M. and Harper, J.L. 2000. Essentials of Ecology. Blackwell Publishing.
- Crawley, M.J. 1997. Plant Ecology. Blackwell Science.
- Dash, M.C. 2001. Fundamentals of ecology, 2nd edition. McGraw hill Companies.
- Daubenmire, R.F. 1959. Plants and Environment, A Text book of Plant Autecology. Wiley Eastern Publ.
- Hill, M.K. 1997. Understanding Environmental Pollution. Cambridge University Press, Cambridge.
- Kandya, A.K. and Gupta, A. 2007. Advancing Frontiers of Ecological Researches in India.
- Koromondy, E.J. 1996. Concepts of Plant ecology, 4th edition, Publ. Prentice Hall of India, New Delhi
- Krebs, C. 2008. The Ecological World View. CSIRO publishing.
- Misra, K.C. 1988. Manual of Plant Ecology, 3rd edition. Oxford and IBH Publishing Co. New Delhi.
- Mitra, D., Guha, J. and Chaudhury, S.K. 2000. Studies of Botany, Vol II. Moulik Library, Kolkata.
- Mohapatra, A.C., Barik, S.K. and Rao, C.S. 2000. Man and Environment. Star Publ. House, Shillong.
- Molles, M.C. 2005. Ecology – Concepts and Applications. McGraw Hills.
- Odum, E.P. 1971. Fundamentals of Ecology, 3rd edition. W.B. Saunders Co. Philadelphia.
- Prasanthrajan, M. and Mahendran, P.P. 2008. A Text Book on Ecology and Environmental Sciences. Publ. Agrotech, Udaipur.
- Sharma, P.D. 2013. Ecology and Environment, Rastogi Publishers.
- Tiwari, S.C. 2005. Concepts of Modern Ecology.
- Weaver, J.E. and Clements, F.E. 1986. Plant Ecology, 2nd edition. Tata McGraw, New Delhi.