

NATIONAL UNIVERSITY



Third Year Syllabus Department of Botany

Four Year B.Sc. Honours Course
Effective from the Session: 2013–2014

National University
Subject: Botany
Syllabus for Four Year B.Sc. Honours Course
Effective from the Session: 2013-2014

Year wise Papers and marks distribution

THIRD YEAR

Paper Code	Paper Title	Marks	Credits
233001	Gymnosperm, Paleobotany and Palynology	100	4
233003	Plant Physiology and Plant Nutrition	100	4
233005	Plant Biochemistry	100	4
233007	Ecology and Environmental Science	100	4
233009	Plant Pathology	100	4
233011	Cytology and Cytogenetics	100	4
233013	Genetics	100	4
233014	Practical-III	100	4
	Total =	800	32

Detailed Syllabus

Paper Code	233001	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Gymnosperm, Palaeobotany and Palynology			

A. Gymnosperm and Palaeobotany (Marks 50)

Gymnosperm

- 1. Introduction:** Habit, habitat, characteristic features, origin, evolution and importance of Gymnosperms.
- Classification of Gymnosperms.
- Comparative account of Gymnosperms with Pteridophytes and Angiosperms.
- Distribution of Gymnosperms with reference to Bangladesh and their economic importance.
- Life history and comparative account of *Cycas*, *Pinus* and *Gnetum*.

Palaeobotany

- 1. Introduction:** Definition and scope of Palaeobotany
- Types of fossils and fossilization process.
- Geological time scale of the earth.
- Appearance and extinction of life forms in different geological periods.
- Fossil Pteridophytes:** *Lepidodendron* and *Calamites*.
- Fossil Gymnosperms:** Cycadophyliales- *Lygenopteris*, *Oldhamia*; Bennettitales- *Cycadeoidea*.

Books Recommended

- Arnold, C. R. 1977: An Introduction to Palaeobotany. Tata McGraw Hill Pub. House Co., New Delhi.
- Biswas, C. and B.M. Johri. 1997: The Gymnosperms. Norasa Pub. House, New Delhi.

3. Cautler, J. M. and C. J. Chamberlain, 1917 (1964): Morphology of Gymnosperms. Central Book Depot, Allahabad, India.
4. Mukherji, H. 1997: Plant Groups. New Central Book Agency, Ltd. Calcutta.
5. Parihar, N.S. 1955: An Introduction to Embryophyta Vol. I & II. Central Book Depot, Allahabad.
6. Sharma, O. P. 1980: Gymnosperms – A treatise, Progatei Prakashan, Meerut, India.
7. Smith, G.M. 1955: Cryptogamic Botany. Vol. II, Bryophyta & Pteridophyta. McGraw Hill Co. London.
8. Vashishta, P.C. 1994: Botany for Degree Students. Vol. V. Gymnosperms. S. Chand and Co. Ltd. Ramnagar, New Delhi.
9. K⁺v⁺j K₂⁺vi iv⁺, wbx₂ K₂⁺vi cvj Ges +⁺v⁺ —dv Kv⁺vj cvkv 1995 : Ac_γ⁺úK Dw⁺č⁺ weÁvb, 2-LÛ, evsjv GKv±W⁺x, XvKv|

B. Palynology (Marks 50)

1. **Introduction:** Historical review, fundamentals, branches, scope and application.
2. **Palynomorphology:** Pollen grain-wall, development, character, morphology (primary, secondary and tertiary characters); sporoderm stratification, NPC-system, evolutionary aspect of pollen and spores, palynotaxonomical aspects, pollen flora.
3. **Melissopalynology:** Bee and bee foraging, pollen load, pollen in honey, identification of bee flora and preparation of bee flora calendar, marker pollen, bee flora- importance and management.
4. **Aeropalynology:** Principles, pollen productivity, buoyancy, frequency, dissemination, distribution and dispersion principles, pollen as pollutants, scope and importance.
5. **Paleopalynology:** Principles, microfossils, reconstruction of vegetation; relation with archaeology and palaeobotany, tracing of pollen in geological era, scope and importance.
6. **Pharmacopalynology:** Pollen in nutrition and health, allergy in forensic medicine, scope and importance.
7. **Biogenic palynology:** Pollen as biological material, relation to agriculture, horticulture and plant improvement.

Books recommended:

1. K. Faegri and J. Iversen. 1990: A Text Book of Modern Pollen Analysis. Copenhagen.
2. P.K.K. Nair, 1985: Essentials of Palynology. Asia Publishing House. New Delhi.
3. G. Erdman, 1952: Pollen Morphology & Plant Taxonomy, Waltham Mass, USA.
4. G. Erdtman 1954: An Introduction to Pollen Analysis. Waltham Mass, USA.
5. M.R. Saxena, 1993: Palynology – A treatise, Oxford & IBH Pub., New Delhi.
6. A.K. Shukla, M.R. Vijoyraghvan and B. Choudhury. 1998. Biology of Pollen. A.P.H. Pub. Corp. New Delhi.
7. K.R. Shivanna 2005. Pollen Biology and Biotechnology. Oxford & IBH Pub. Comp. New Delhi.
8. K. Bhattacharya, M.R. Majumder & S.G. Bhattacharya. 2008. An introduction to Palynology, New Central Book Agency. New Delhi.
9. R.B. Knox. 1979. Pollen and Allergy. Edward Arnold. London.
10. cvkv, Gg. +K. 2008: civM±iYy weÁvb, evsjv GKv±Wg_x, XvKv|

Paper Code	233003	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Plant Physiology and Plant Nutrition			

A. Plant Physiology (Marks: 80)

1. **Life and life related physico-chemical phenomena:** Physiology of life, colloids, diffusion, osmosis, plasmolysis, imbibition, osmotic pressure and root pressure.

2. **Absorption of water:** Mechanism of absorption, active and passive absorption, external factors affecting absorption of water; translocation of water, path of translocation of water, mechanism of translocation, different theories on transpiration pull and adhesion-cohesion theory.
3. **Transpiration:** Overview of transpiration, types of transpiration, mechanism of transpiration, mechanism of opening and closing of stomata, significance of transpiration.
4. **Photosynthesis:** Overview of photosynthesis, photosynthetic pigments, light dependent reaction: action of light, photophosphorylation, light independent reaction: assimilation of CO₂, Calvin cycle, Hatch & Slack cycle, Crassulacean acid metabolism, comparison of C₃, C₄ and CAM pathways, factors affecting photosynthesis.
5. **Respiration and fermentation:** Definition and types of respiration, glycolysis, pyruvate to acetyl CoA formation, TCA cycle, electron transport system, respiratory quotient, anaerobic respiration; definition of fermentation, alcohol fermentation and lactic acid fermentation, comparison of respiration and fermentation.
6. **Plant Growth Regulators:** Discovery, classification, distribution, chemical nature of plant growth regulators; physiological effects of auxin, gibberellin, cytokinin, ethylene and abscisic acid.
7. **Photoperiodism:** An overview, photoperiodic induction, importance of dark period, critical photoperiod, perception of photoperiodic stimulus, discovery and distribution of phytochrome, physical and chemical properties of phytochrome, physiological effects of phytochrome.
8. **Vernalization:** Brief history, vernalization and flowering, site of perception of vernalization, mechanism of vernalization, devernialization, factors affecting vernalization.
9. **Physiology of seed:** Seed structure and development, viability of seeds, germination process and types of germination, conditions necessary for germination; physiological, biochemical and other changes accompanying seed germination; overview of seed dormancy, causes of seed dormancy, methods of breaking dormancy, advantages of dormancy of seed.
10. **Plant growth:** Plant growth curve, phases of growth; factors affecting plant growth, types and causes of senescence.

Books Recommended

1. Devlin, M.R. and H.F. Witham. 1986: Plant Physiology (4th. Ed.). CBS Publishers and Distributors, New Delhi.
2. Jain JL 1983. Fundamentals of Biochemistry, S. Chand and Company Ltd., New Delhi.
3. Hess, D. 1975: Plant Physiology. Springer International Student Edition, New Delhi.
4. Pandey, S.N. and B.K. Sinha. 1990: Plant Physiology (2nd. Ed.). Vikash Pub. House Pvt. Ltd.
5. Salisbury, F.B. and C. Ross. 1969 : Plant Physiology. Wardsworth Pub. Co. Inc., Belmont, California.
6. Srivastava HS 1991. Elements of Biochemistry, Rastogi Publications, Shiraji Road, Meerut, India.
7. Kg©Kvi, h`yvj. 2000 : Dw™Ç` kixi weÁvb, nvmvb eyK nvDR, XvKv|

B. Plant Nutrition (Marks: 20)

1. **Plant Nutrition:** Introduction to plant nutrition, essential elements; criteria of essential elements; micronutrients and macronutrients, role and deficiency symptoms of essential elements.
2. **Ion absorption of plants:** Factor affecting ion absorption, Barrier of ion absorption, structure of plasma membrane, mechanism and types of ion absorption, passive absorption (Donnan equilibrium and cation exchange theory), active absorption

(evidence of active absorption; carrier concept; and anion respiration or Lundegardth theory).

3. **Pathways of translocation of ions:** Apoplastic and symplastic pathway, upward movement of ions.
4. **Water and sand culture:** Introduction to water and sand culture, techniques of water culture, advantages and disadvantages of water culture.

Books Recommended

1. Epstein, E. 1972. Mineral Nutrition of Plants: Principles and Perspectives. John Wiley and Sons, Inc.
2. Gauch, H.G. 1982. Inorganic Plant Nutrition. Dowdell, Hutchinson & Ross, Inc.
3. Marschner, H. 1992. Inorganic Nutrition of Higher Plants. Academic Press, New York.
4. Sutchiffe. J.F. and F.S. Baker. 1984. Plants and Mineral Salts. Edward Arnold, London.
5. Hewitt, E.J. and T.A. Smith. 1974. Plant Mineral Nutrition. The English University Press, London.

Paper Code	233005	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Plant Biochemistry			

1. **Introduction:** Name and distribution of biochemical substances in plants.
2. **Carbohydrates:** Introduction to carbohydrates, types of carbohydrates, chemistry and distributions of monosaccharides, oligosaccharides (sucrose, maltose, lactose and cellobiose,) and polysaccharides (starch, cellulose and glycogen).
3. **Amino acids:** General structure, classification of amino acids, essential and non essential amino acids, protein and non-protein amino acids, industrial importance of amino acids.
4. **Proteins:** Biochemistry, structure, classification, functions of proteins.
5. **Lipids:** Overview of lipids, saturated and unsaturated fatty acids, structure and functions of triglycerides, phospholipids, glycolipids, oxidation of fatty acid.
6. **Membrane Chemistry:** Chemical nature of plasma membrane, structure and functions.
7. **Enzymes:** Overview of enzymes, classification, kinetics of enzymes, holoenzyme and apoenzyme, coenzyme and cofactors; structure and mechanisms, specificity (lock and key model, induced fit model), enzyme inhibitors.
8. **Terpenoids:** Main classes of plant terpenoids, path of terpenoid biosynthesis in plants; essential oils; di-terpenoids and gibberellins; triterpenoids and steroids; tetraterpenoids - carotenoids.
9. **Alkaloids:** History, chemistry, distributions, classification, major alkaloids and their plant families, importance of alkaloids.
10. **Phenolic compounds:** Introduction to phenolic compounds, shikimic acid pathway, flavonoid: chemistry and distributions, properties of different flavonoid classes, anthocyanins, importance of phenolic compounds.
11. **Vitamins:** Introduction to vitamin, source and types of vitamins, importance.
12. **Principles of some biochemical methodologies:** Spectrophotometry, centrifugation, chromatography.

Books Recommended:

- 1 Conn EE and PK Stumpf 1972. Outlines of Biochemistry (3rd edn.), John Wiley & Sons. Inc.
- 2 Goodwin, T.W. and E.I. Meeer. 1983: Introduction to Plant Biochemistry (2nd. Ed.). Pergamon Press.
- 3 Harborne JB 1973. Phytochemical methods. Chapman and Hill, London.
- 4 Jain, J. L. 1983: Fundamental of Biochemistry (2nd. Ed.). S. Chand and Co. Ltd. New Delhi.
- 5 Lehninger AL 2005. Principles of Biochemistry (4th edn.), Freeman and Company, New York
- 6 Mahler HR and EH Cordes 1971. Biological Chemistry, 2nd edn., Harper and Row.
- 7 Sivastava, H.S. 1990: Elements of Biochemistry. Rastogi Publication, Meerut.
- 8 Varner, J.E. and J. Bonner. 1965: Plant Biochemistry. Acad. Press, New York, London.

Paper Code	233007	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Ecology and Environmental Science			

A. Ecology (Marks 50)

1. **Introduction:** Definition, history and scope of Ecology.
2. **Plant Succession:** Types and causes of succession, hydrosere and xerosere, models of succession.
3. **Ecosystem:** Definition, structure, components, functions and types of ecosystem; habitat and ecological niche; trophic level and trophic structure; energy flow in ecosystem; food chains, food webs and ecological pyramids, dynamics of aquatic and terrestrial ecosystems.
4. **Plant adaptations:** Morphological, anatomical and physiological adaptive features of hydrophytes, xerophytes, mesophytes.
5. **Forest ecology:** Introduction to forest, types of forests, dominant plants of deciduous, semi-evergreen and tidal forests of Bangladesh and their edaphic features.
6. **Phytogeographical region of the world:** Brief account of phytogeographical regions of the world and Indian sub-continent, interactions among floristic plant geography.
7. **Methods of studying vegetation:** Quantitative and qualitative analysis, measurements of vegetation by quadrat, transect and point methods, study of communities, community dynamics, classification of community.
8. **The role of green plants in nature with reference to:** (i) The sun-a thermonuclear energy source; (ii) radiant energy; (iii) human population and food supply.
9. **Bio-geochemical cycles:** Introduction to bio-geochemical cycles, types, carbon and nitrogen cycle.

Books Recommended

1. Bannister, P. 1976: Introduction of Physiological Plant Ecology. Blackwell Scientific Publications.
2. Doubenmire, R. F. 1974: Plants and Environment. (3rd Ed.). Wiley International.
3. Daubenmire, R. F. 1974: Plant Communities – A Text Book of Synecology. Harper and Row Publ. London.
4. Etherington, J. R. 1971: Environmental and Plant Ecology. John Wiley and Sons, Inc., New York.
5. Kershaw, K. A. 1973: Quantitative and Dynamic Plant Ecology, Edward Arnold Ltd.
6. Krebs, C. J. 1978: Ecology: The Experimental Analysis of Distribution and Abundance, Harper International.
7. Kumar, H. D. 1995: Modern Concepts of Ecology, Vikash Pub. House, India.
8. Muller Dombois, D. and H. Ellenberg. 1974: Aims and Methods of Vegetation Ecology, John Wiley & Sons. Inc., New York.
9. Odum, E. P. 1971: Fundamentals of Ecology. Toppan Co. Ltd. Japan.
10. Poole, R. W. 1974: An Introduction of Quantitative Ecology. McGraw-Hill Book Co., NY.
11. Sharma, P. D. 1995: Ecology and Environment. Rastogi Pub., New Delhi.
12. Shukla and P. S. Chandel. 1991: Plant Ecology and Soil Science, S. Chand & Co., India.
13. Waisel, J. 1972: Biology of Halophytes. Academic Press, London.

B. Environmental science (Marks 50)

1. **Introduction:** Definition, aims and objectives, plant-environmental relationship.
2. **Environmental components:** Biosphere, atmosphere, hydrosphere, lithosphere and their importance.
3. **Natural resources:** Concepts and types, water, land, biological, mineral, energy, ocean, wildlife and human resources and their impact on environment.

4. **Global environmental issues:** Population explosion, effects of population explosion on the environment.
5. **Drought and desertification:** Drought and aridity index, drought and desertification caused by human activity, prevention and reversal of desertification.
6. **Pollution:** Definition, types of pollutants and pollution, causes and effects of pollution; nature, sources and causes of water and air pollution, control of water and air pollution.
7. **Greenhouse effects:** Introduction to greenhouse effects, sources and effects of greenhouse gases, ozone layer depletion, greenhouse gases and world climate, control of greenhouse gases, carbon dioxide and the world climate.

Books Recommended

1. Asthana, D. K. and M. Asthana. 1985: Environment : Problems and Solutions, S. Chand & Co.
2. Baldwin, J. H. 1988: Environmental Planning and Management. Int. Book. Dist.
3. Bhatia, H.S. 1998: A Text Book on Environmental Pollution and Control. Galgotia Pub.
4. Chiras, D.D. 1984: Environmental Science. The Benjamin Pub. Co. Inc.
5. Gain, P.S. Moral and P. Raj. 1998: Bangladesh-Environment: Pacing the 21st century. SHED, 44/D, West Panthapath, Dhanmondi, Dhaka-1205, Bangladesh.
6. Jeffries, M.J. 1997: Biodiversity and Conservation. Routledge, London and New York.
7. Kemp, D.D. 1990 : Global Environmental Issues. Routledge.
8. Pandey, G.N. 1999 : Environmental Management. Vikas Pub. House.
9. Santra, S.C. 2001 : Environmental Science. New Central Book Agency, Calcutta.
10. Shukla, R.S. and P. S. Chandel. 1991: Plant Ecology and Soil Science. S. Chand & Co., India.
11. Srivastava, N.Y. 1997 : Environmental Pollution. Ashish Pub. House.
12. Trivedi, R.N. 1997: A Text Book of Environmental Science. Anmol Pub.
13. Watt, K. F. 1973: Principles of Environmental Science. McGraw Hill Book Co. New York.

Paper Code	233009	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Plant Pathology			

1. **Introduction:** History of Plant Pathology, concept of disease in plants, causes, diagnosis, classification and importance of plant diseases.
2. Koch's postulates and methods of studying plant diseases.
3. **Parasitism and disease development:** Parasitism and pathogenesis; development of plant disease- inoculation, penetration, infection, growth and reproduction, dissemination, over wintering and over summering of the pathogen.
4. **Symptomatology:** Viral, bacterial and fungal disease symptoms.
5. **Toxins in relation to plant disease:**
 - a) Types of toxins- pathotoxins, vivotoxins and phytotoxins; b) Host specific and non-specific toxins; c) Effect of toxins on plant disease.
6. **Host defense against pathogens:** Structural and biochemical defense.
7. **Principles of plant disease management:** Disease forecasting; regulatory, physical, cultural, chemical and biological methods of disease management.
8. **Chemical control of plant diseases:** Nature of chemical compounds - copper, mercury and sulphur compounds; methods of application- spraying, dusting, seed treatment and soil treatment.
9. **Selected fungal diseases of crop plants:** Causal organisms, symptoms, disease cycle and control measures of the following: i) tikka disease of ground nut; ii) stem rot, anthracnose and black band of jute; iii) late blight and early blight of potato; iv) rust and leaf spot of bean; v) brown spot, stem rot and blast of rice, vi) red rot of sugarcane; vii) stem rust and loose smut of wheat.
10. **Selected bacterial diseases of crop plants:** Characteristics and classification of plant pathogenic bacteria, mode of action of bacteria on host tissues; causal organisms, symptoms

and etiology and control measures of the following diseases: i) angular leaf spot of cotton; ii) bacterial blight of rice; iii) citrus canker; iv) wilt of tomato; v) soft rot of potato.

11. **Viral diseases of plants:** Symptoms, causal organisms, vectors and control measures of the following diseases: i) tungro of rice, ii) bunchy top of banana; iii) vein clearing of lady's finger, iv) leaf curl of tomato, v) mosaic of bean.
12. **Seed pathology:** Scope and importance of seed borne diseases; major seed diseases: seed abortion, discoloration, necrosis, rot; seed health testing; control of seed borne diseases.

Books Recommended

1. Agrios, G.N. 1997: Plant Pathology (4th Ed.). Academic Press, London.
2. Fahy, P.C. and G.J. Persley. 1993: Plant Bacterial Disease. A Diagnostic Guide. Acad. Press, London.
3. Mehrotra, R.S. 1980: Plant Pathology. Tata McGraw-Hill Pub. Co., Ltd. New Delhi.
4. Rangaswami, G. 1972: Diseases of Crop Plants in India. Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Singh, R.S. 1978 : Plant Diseases. Oxford & IBH Pub. Co., New Delhi.
6. Lvb, G.G. 2000 : c-vU c`v‡_vjwR, †`vjb Puvcv, KvRx cÖKvkbx, XvKv|

Paper Code	233011	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Cytology and Cytogenetics			

A. Cytology (Marks 50)

1. **Introduction:** Definition, cell theory and cell concept, historical background of cytology.
2. Concept of prokaryotic and eukaryotic cells and their differences.
3. **Ultra-structure of eukaryotic cell:** Detailed structure and functions of cell wall, cell membrane, chloroplast, mitochondria, ribosome, lysosome, endoplasmic reticulum, golgibody, nucleus, and nucleolus.
4. **Chromosome:** Physical and chemical structure; classification; secondary constriction.
5. **Chromatin:** Eu-chromatin and heterochromatin; nucleosome- shape and organization; histone and non-histone proteins.
6. **Special type of chromosome:** Introduction, major special type of chromosomes viz. i) salivary gland chromosome; ii) lamp-brush chromosome, iii) B-chromosome and synaptenal complex.
7. **Cell division:** Cell cycle, amitosis, mitosis, meiosis and their biological significance.

Books Recommended

1. Akhtaruzzaman, M. 1997: Koshbidhya (3rd. Ed.), Hassan Book House, Dhaka.
2. Dupraw, E. J. 1970: DNA and Chromosomes, Holt, Rinehart and Winston, New York.
3. Gupta, M. L. and M. L. Jangir. 1998: Cell Biology: Fundamentals and Applications, Agro Botanika, New Delhi.
4. Sharma, A. 1976: The Chromosomes. Oxford & IBH Pub. Co., New Delhi.
5. Wilson, G. B. and J. H. Morrison. 1966: Cytology. Litton Educational Pub. Inc., New York.
6. Rvgvb, Gg. G. 1975 : †Kvlwe``v, evsjv GKv‡Wgx, XvKv|
7. mywnZ ,n. 1978 : mvB‡UvjwR. cwđg e½ ivR`` cy` —K cl©`|

B. Cytogenetics (Marks 50)

1. **Introduction:** Definition, scope and brief history of Cytogenetics.
2. **Chromosomal aberration:** A general account and classification.
3. **Deletion:** Definition, types, genetic detection, phenotypic and genotypic effects, breakage–fusion bridge cycle (meiotic behaviour).
4. **Duplication:** Definition, kinds, genetic detection, position effect, breakage–fusion bridge cycle (meiotic behaviour).

5. **Inversion:** Definition, types, synapsis in inversion heterozygote, consequences of 2-strands, 3-strands and 4-strands double cross over (one extra and another intra loop) of a paracentric inversion heterozygote.
6. **Translocation:** Definition, types, different kinds of orientation and configurations of reciprocal translocation, heterozygote at MI, formation of different gametes from those configuration, identification of chromosomes involved in translocation and breeding behaviour.
7. **Numerical aberrations:** Introduction, classification, a brief account on origin, meiotic behavior and genetic ratio of monosomic, trisomic, nullisomic.
8. **Polyploidy:** Definition, classification, polyploidy in plants (natural and artificial), artificial induction of polyploidy and its significance in crop improvement, origin of new species by allopolyploidy (wheat).
9. **Human Cytogenetics:** Introduction, Down's syndrome, Klinefelter's syndrome, Turner's syndrome.

Books Recommended

1. Akhtaruzzaman, M. 1997: Koshbidhya (3rd. Ed.), Hassan Book House, Dhaka.
2. Akhtaruzzaman, M. 1997: Kosh-Bangshagatibidhya, Bangla Academy, Dhaka.
3. Garber, E.D. 1992: Cytogenetics, McGraw Hill Inc., New York.
4. Moore, D.M. 1976: Plant Cytogenetics. Chapman and Hall Ltd., England.
5. Schulz-Schaeffer, J. 1980: Cytogenetics. Springer-Verlag, New York.
6. Sinha, U. and S. Sinha. 1997: Cytogenetics, Plant Breeding and Evolution. Vikas Pub. House Pvt. Ltd., New Delhi.
7. Swaminathan, M.S., P.K. Gupta and U. Sinha. 1983: Cytogenetics of Crop plants. MacMillan Ltd., New Delhi.
8. Swanson, C.P., T. Merz and W.J. Young. 1982: Cytogenetics: The Chromosomes in Division, Inheritance and Evolution. (3rd. Ed.). Reprint. Prentice Hall of India. Pvt. Ltd., New Delhi.
9. Avn#g`, mvgmywib, 2000 : mvB#Uv#R#bwUKm& | evsjv GKv#Wgx, XvKv|

Paper Code	233013	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Genetics			

1. **Historical background of Genetics.**
2. **Mendelian principles:** Mendel's law of inheritance; exceptions of Mendel's laws.
3. **Physical and chemical basis of heredity.**
4. **Interaction of genes:** Complementary, duplication, epistatic and additive gene interaction, complete and incomplete dominance.
5. **Linkage and crossing over:** Introduction; linkage and recombination; gene mapping; interference and coincidence.
6. **Sex determination:** Chromosomal and genetic basis of sex determination; sex linked, sex limited and sex influenced characters.
7. **Allelism and pleiotropism:** Introduction; multiple alleles (ABO blood type) and pseudoalleles, pleiotropism.
8. **Quantitative inheritance:** Qualitative versus quantitative traits; multiple factors hypothesis- kernel colour in wheat and skin colour in human; polygenic inheritance and continuous variation.
9. **Fine structure of gene:** Chemical concept of gene, development of the concept of cistron, recon, muton and complon.
10. **Biochemical genetics:** Gene-protein relationship, one gene-one enzyme hypothesis, isolation of biochemical mutation.
11. **Mutation:** Discovery, causes, classification, mutagens, detection of mutation in *Drosophila* by CIB, detection of autosomal mutation, biochemical mutants- prototroph and auxotroph selection.
12. **Cytoplasmic inheritance:** Inheritance of variegated leaves in higher plants, inheritance of extranuclear genes, maternal inheritance, general idea of plasmid and episome.

13. **Population genetics:** Hardy-Weinberg law and its conditions; gene frequencies; equilibrium of gene sequences; forces of evolution.
14. **Genetic recombination in bacteria:** Introduction, transformation, conjugation, transduction.

Books Recommended

1. Benjamin Lewin. 2000: Gene 2000. Oxford University Press, NY.
2. Gordner, E.J. 1960 hrs.: Principles of Genetics. John Wiley and Sons, Inc. New York, London.
3. Singleton, W.R. 1967: Elementary Genetics. D. Von Nostrand Co., Inc., Canada.
4. Sinnot, E.W., L.C. Dunn and Th. Dobzhansky. 1985: Principles of Genetics. (5th ed.). McGraw Hill Book Co. Inc., New York, London.
5. Snustad, D.P., *et al.*: Principles of Genetics, John Willey & Sons, Inc.
6. Strickberger, M.W. 1996: Genetics. MacMillan Pub. Co. Inc., New York, London.
7. Whitehouse, H.L.K. 1973: Towards and Understanding of the Mechanism of Heredity, Edward Arnold. England.
8. Bmjvg, G. Gm. 1984 : eskMwZ we``vi g~j K_v, evsjv GKv#Wgx, XvKv|
9. AvLZvi“%vgvb, g. : eskMwZ we``v, nvmbv eyK nvDR, XvKv|

Paper Code	233014	Marks: 100	Credits: 4	Class Hours: 60 hrs.
Paper Title:	Practical - III (Gymnosperm, Palaeobotany and Palynology, Plant Physiology and Plant Nutrition, Plant Biochemistry, Ecology and Environmental Science, Plant Pathology, Cytology and Cytogenetics, Genetics)			

N.B. Practical examination will be carried out in two days with 6 hours duration each under the same Paper code.

Part A (Marks 50, Credit 2)

(Gymnosperms, Palaeobotany & Palynology; Plant Physiology & Plant Nutrition; Plant Biochemistry, Ecology

Gymnosperms and Palaeobotany: 9 Marks

1. Study of museum specimens.
2. Detailed study including dissection, mountings, description, drawing and identification of *Cycas* and *Pinus* sp.
3. Study of fossil plants.

Palynology: 4 Marks

1. Techniques of pollen collection, preparation and study of permanent pollen slide preparation.
2. Morphology and identification of common plants by using pollen morphology.
3. Pollen trapping from atmosphere and their study.
4. Pollen study in honey samples.

Plant Physiology: 8 Marks

1. Chlorophyll is essential for photosynthesis.
2. Evolution of oxygen during photosynthesis at different light intensities.
3. Demonstration of stomatal transpiration by four leaves method.
4. Heat evolution during respiration.
5. Pigment separation by paper chromatography technique.
6. Demonstration of plasmolysis by *Rhoeo discolor* leaf peal.

Plant Nutrition: 4 Marks

1. Preparation of various plant nutrient solutions such as Knop's solution, Hoagland solution.
2. Study of mineral deficiency symptoms.

Plant Biochemistry: 8 Marks

1. Tests for reducing and non-reducing sugars.
2. Quantitative test for starch, lipid and protein.
3. Observation of starch grains under compound microscope.

Ecology: 10 Marks

1. Morphological and anatomical studies of hydrophytes and xerophytes.
2. Common hydrophytes and xerophytes of Bangladesh.
3. Determination of frequency, density and abundance of different species by quadrat method.
4. Study of different stomatal types of sun and shade habitats.
5. Halophytic adaptations such as pneumatophore, viviparous germination etc.

Collections: 2 Marks

Practical Note Book: 5 Marks

Part B (Marks 50, Credit 2)

(Environmental Science, Plant Pathology, Cytology & Cytogenetics, Genetics)

Environmental Science: 6 Marks

1. Determination of BOD/COD of polluted water of pond, lake, river etc.
2. Identification of environmentally threatened categories of plants of an area.

Plant Pathology: 12.0 Marks

1. Preparation and staining of plant pathogenic specimens.
2. Study of symptoms and causal organisms of common plant diseases.
3. Preparation of Bordeaux mixture
4. Preparation and sterilization of Potato Dextrose Agar (PDA) for fungal growth.
5. Collection, identification and preservation of viral, bacterial and fungal specimens.

Cytology and Cytogenetics: 14 Marks

1. Preparation of fixative: Carnoy's fluid.
2. Preparation of cytological stain: Acetocarmine, aceto-orcein.
3. Study of mitosis in onion root tip cells by acetocarmine squash method.
4. Study of meiosis in *Rhoeo discolor*/*Setcreasea purpurea*.
5. Studies of interchange complex in *Rhoeo discolor*.
6. Determination of centromeric type, centromeric index, relative length and chromosome formula from the supplied data.

Genetics: 8 Marks

1. Verification of monohybrid and dihybrid F₂ ratios by chi-square test.

2. Studies of interaction of genes with the use of maize cob showing segregation of grain color/supplied data.

Collections (Plant Pathology) and permanent slides (Cytology): 5.0 Marks

Practical Note Book: 5.0 Marks

Instruction to the Examiners

Part –A (Gymnosperms, Palaeobotany & Palynology, Plant Physiology and Plant Nutrition, Plant Biochemistry and Ecology)

Time: 6 hours Marks: 50

- 1. Specimen A will be from Gymnosperms.**

Distribution of marks

Distribution	Marks
I) Preparation of slide	2.0
II) Labelled diagrams	2.0
III) Identifying characters	1.5
IV) Identification	0.5
Total	6.0

- 2. Specimen B will be pollen from fresh flowers/honey samples.**

Distribution of marks

Distribution	Marks
I) Preparation of slide	1.5
II) Labelled diagrams	1.5
III) Comment	1.0
Total	4.0

- 3. C will be an experiment on Plant Physiology. At least two experiments will have to be given alternately.**

Distribution of marks

Distribution	Marks
I) Theory	1.0
II) Requirements	1.0
III) Performance	3.0
IV) Results	2.0
V) Precautions	1.0
Total	8.0

- 4. Preparation of Knop's solution/Hoagland's solution.**

Distribution of marks

Distribution	Marks
I) Requirements	1.0
II) Performance	1.0
IV) Procedure	2.0
Total	4.0

5. 'D' will be an experiment to determine the presence or absence of reducing and non-reducing sugars in the supplied solutions.

Water, Sugar solution and Glucose solution may be supplied. Examinees will have to identify the type of sugar and will have to show the result to the examiners and will have to write results giving reasons.

Distribution of marks

Distribution	Marks
I) Performance	3.0
II) Principle	1.0
III) Results with reason	4.0
Total	8.0

6. Study of vegetation by quadrat method.

Distribution of marks

Distribution	Marks
I) Theory	1.0
II) Requirements	0.5
III) Procedure	1.5
IV) Result	3.0
Total	6.0

7. Specimens/slides/photographs will have to be given for identification:

E-Gymnosperms, F- Palaeobotany

Distribution	Marks
I) Identifying characters	1.0
II) Identification	0.5
Total	1.5×2= 3.0

G & H will be materials of ecological importance

Distribution	Marks
I) Identifying characters	1.0
II) Comment	1.0
Total	2.0×2= 4.0

8. Collection **2.0**

9. Practical Note Book **5.0**

Instruction to the Examiners

Part-B (Environmental Science, Plant Pathology, Cytology& Cytogenetics, Genetics)

Time: 6 hours Marks: 50

- 1. Sample A will be the determination of BOD/COD from supplied water from pond/lake/river.**

Distribution of marks:

Distribution	Marks
I) Requirements	1.0
II) Performance	1.5
III) Procedure and Calculation	2.5
IV) Result with comment	1.0
Total	6.0

- 2. Specimens B & C will be from fungal diseased plant.**

Distribution of marks

Distribution	Marks
I) Preparation of slide	1.0
II) Labelled diagram	1.5
III) Identifying characters with symptoms	1.5
IV) Identification	0.5
Total	4.5×2= 9.0

- 3. Specimen D will be root tip/flower bud for cytological studies. One stage of mitotic/meiotic cell division has to be shown to the examiners except early prophase.**

Distribution of marks:

Distribution	Marks
I) Preparation of slide	4.0
II) Labelled diagrams	2.0
III) Identifying characters	1.0
IV) Identification	1.0
Total	8.0

- 4. Specimens E, F, G, H, I & J should be from herbarium sheet/plant/permanent slide/photomicrograph etc.**

E and F-Diseased plant/plant part

G and H- Cytological specimens

I and J – Cytogenetical specimens

Distribution	Marks
I) Identification	0.5
II) Reasons	1.0
Total	1.5×6= 9.0

- 5. Specimens K and L will be maize cob with different coloured seeds/any other segregating material to tests Mendel's ratios by chi-square test.**

Distribution	Marks
I) Character identification	1.0
II) Hypothesis formulation	1.0
III) Chi-square test	5.0
IV) Comment	1.0
Total	8.0

6. Collection and Permanent slides **5.0**

7. Practical Note Book **5.0**