

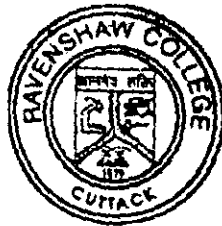
COURSES OF STUDIES

P G - I EXAMINATION - 2006

P G - II EXAMINATION - 2007

M.Phil EXAMINATION - 2006

BOTANY



RAVENSHAW COLLEGE
(AUTONOMOUS)
CUTTACK

RAVENSHAW AUTONOMOUS COLLEGE

COURSES OF STUDIES

M. PHIL. EXAMINATION IN BOTANY, 2005-2006

There shall be two theory papers, one practical paper and one dissertation each carrying 100 marks. The theory papers shall each be of 4 hours duration and the practical paper shall be in two parts (Part A & Part B), each part carrying 50 marks shall be of 3 hours duration.

Theory Papers

Paper - I Core Paper

Compulsory for all candidates 100 Marks

Paper - II Elective Paper :

A student may select any one of the following subjects for this paper 100 Marks

- (a) Plant Cytogenetics
- (b) Plant Biochemistry
- (c) Microbiology
- (d) Floristic study
- (e) Environmental Biology
- (f) Environmental Physiology
- (g) Plant Pathology
- (h) Plant Morphogenesis

Practical Paper

Paper - III	100 Marks
Part A (Microbiology & Biochemistry)	50 Marks
Part B (Cytogenetics, Biosystematics & Environmental Biology)	50 Marks
Dissertation	<u>100 Marks</u>
Total	400 Marks

Detailed Syllabus

THEORY PAPER - I (Core Paper)

1. Plant Genetic Engineering:

Genetic engineering vs. conventional breeding; Clonal propagation by tissue culture; Somaclonal and gametoclonal variation; Protoplast technology; Recombinant DNA technology; Genetic transformation.

2. Phytohormones:

Types, their structure, chemistry, occurrence and biosynthesis; role of hormones in germination, shoot growth, root growth, cell proliferation, differentiation, flowering and fruiting, interaction of growth hormones and inhibitors; phenols as growth regulating chemicals; hormonal regulation of growth, metabolism and common

physiological processes (translocation, abscission, tuber formation, leaf expansion and water uptake); molecular biology of plant hormones (hormones and nucleic acid metabolism, hormonal amplification and trigger action, hormonal receptors.)

3. Host-Parasite Relationship in Plants:

Concept of pathogenicity; classification of diseases; principle of plant infection; avenues of infection of biotrophs and hemibiotrophs; host barriers and ability of parasites to overcome the barriers; effects of enzymes involved and parasitic influence on the host physiology; alteration of metabolic pathways and production of secondary metabolites; theoretical aspects of disease resistance; passive and active defence; role of prohibitions and phytoalexins on disease resistance, role of lectins and elicitors in disease development and host specificity; plasmatic defence.

4. Environmental Pollution:

Major sources of water and air pollution: sewage, power industry, autoexhausts and agrochemicals; conversion of organic pollutants in nature - dissimilation and hydrolysis of proteins, polysaccharides, lignins and fats, metabolism of hydrocarbons and their derivatives, anionic detergents and pesticides; control of pollution

standards of water and air quality, control at point and distributive sources, recycling of wastes, renewable energy systems, biomass, biogas, microhydels, solar, wind, ~~ocean~~ and geothermal systems.

5. **Germplasm conservation:**

Taxonomy and evolution of cultivated plants; centres of diversity ~~and centres~~ of origin; exploration and collection of genetic resources; population structure and sampling methods; ~~germplasm~~ of cultivated plants and their wild relatives; establishment of gene banks and germplasm storing; ~~germplasm~~ conservation in rice and pigeonpea.

THEORY PAPER - II

(Elective Paper)

A.-Plant Cytogenetics

1. **Chromosomal Analysis:**

Chromosome number and polyploid analysis; Karyotypic pattern ~~and karyographic~~ analysis; breeding relations and genome analysis; chromosomes, taxonomic relations and phylogenetic analysis.

2. **Mutation breeding:**

Mutation breeding vs. ~~conventional~~ breeding; techniques of mutagen treatment; induced mutation in seed

propagated species; induced mutation in asexually propagated species; plant characters to be improved by mutation breeding; induced mutation for solving special problems (chromosome reconstruction, altering reproductive system, facilitating recombination); somatic cell genetics and induced mutation.

3. **Cytogenetics of Haploids:**

Anther culture and haploid production; culture of isolated microspores; monoploid production by chromosome elimination; haploid induction in different crops.

4. **Somatic cell genetics:**

Protoplast isolation, culture and fusion; somatic hybrids and selection systems; cell modification by DNA uptake; chloroplast uptake and genetic complementation; bacterial uptake and nitrogen fixation.

B. Plant Biochemistry

1. **Basic Plant metabolism:**

Photosynthesis bioenergetics, pathways of carbondioxide fixation, productivity estimates.

Respiration: use of radio-isotopes in glycolysis, HMP shunt and TCA cycle; action of inhibitors in respiration; regulation of glycolysis and TCA cycle. Enzymology kinetics of one and two substrate reactions;

thermodynamics of enzymatic transformations; activation, specificity and mechanism of enzymes. Assimilation of nitrogen, sulphur and phosphorus, nitrate reduction, nitrogen fixation, sulphur reduction and phosphate uptake.

2. **Biosynthetic Mechanisms:**

Biosynthesis of starch and other polysaccharides; amino acid biosynthesis; protein synthesis; biosynthesis of flavonoids, chlorophyll, carotenes, lignins and alkaloids.

3. **Biochemistry of Development:**

Carbohydrate, soluble nitrogen, protein, RNA and DNA levels during seed germination, leaf growth, root growth, bud growth, callus growth and organogenesis.

4. **Structural studies of macromolecules:**

Starch, Polypeptides and nucleic acids.

C. Microbiology

1. **Fermentation process in microbes:**

Energy transfer basis in microbes; types of fermentation in bacteria; carbon energy balance; regulation of carbohydrate metabolism by facultative anaerobes; fermentation by saccharolytic and proteolytic clostridia, propionic acid bacteria, lactic acid bacteria, euterobacteriaceae and yeast; ethanol production from biomass.

2. Microbial soil amelioration and bioconversion process:

Soil microflora and soil microbial processes in nutrient recycling; rhizosphere as key site of microbial activity; rhizosphere effect and humus formation; immobilisation of nitrogen and phosphorus solubilisation, bioconversion of lignins and polysaccharides; biological nitrogen fixation; mycorrhiza; biofertilisers and their application.

3. Microbes vs. environmental pollution:

Role of microbes in environmental pollution; accumulation of waste and pollution problem; degradation of hydrocarbons; pesticide degradation by microbes; microbial regeneration of energy from waste.

4. Microbes and immune systems:

Historical perspective; classical precipitation reaction and basis of specificity, immunoglobins structure and classification; antibodies-synthesis, antigen and antibody reaction *in vitro*; monoclonal antibody and hybridoma technique; immunity of bacterial, viral and parasitic infection; hypersensitivity and allergy; immunodeficiency and autoimmunity.

D. Floristic Study

- 1. Floristic Survey:**
Field collections and preservation of specimens in herbarium; phytography, identification and formulation of diagnostic keys; documentation of data; analysis of flora; flora of Orissa: its past present and future; flora of India.
- 2. Synthetic plant classification:**
Characterisation and evidence; morphological; anatomical; palynological, embryological, cytological genetic, reproductive biological, chemical, ecological distributional data for developing a synthetic approach to plant classification.
- 3. Herbarium management**
Concept and definition; historical development; role of herbarium; famous herbaria of the World; present state of herbarium; changing nature of herbarium and its future; arrangement of specimens in the herbarium; operation and maintainance.
- 4. Plant nomenclature:**
Historical development and a critical evolution of various facets of International Code of Botanical Nomenclature; typification and guide for the determination of types; priority and limitations of the principle of priority; retention, choice and rejection of names and epithets; orthography of names and epithets; concept of epithets.

E. Environmental Biology

1. **Cycling of nutrients:**

Production and breakdown of organic ~~matter~~, cycling of hydrogen, oxygen, phosphorus, carbon, nitrogen, sulphur, iron and manganese.

2. **Water in natural environment:**

Water chemistry, bound water and its biological implications, solutions, suspensions and colloids, surfaces and adsorption, hydrologic cycle, water availability and use.

3. **Natural resources management:**

Monitoring, shrinkage and conservation of natural areas, resources and biota, watershed management, river valley projects, irrigation, degraded land, mined areas, healthy cropland, grassland and overgrazing, shifting cultivation.

4. **Integrated land use and revegetation strategy:**

Social forestry, agroforestry and traditional forestry, forest cover, forest destruction, requirement of wood, protection forestry, exploitative forestry, conservation of biological diversity.

F. Environmental Physiology

1. **Plant and Environment:**

Natural and artificial environment, physics of environment, physical and chemical environments of plants.

2. **Environmental control of plant growth and development:**

Seed dormancy, germination, flowering; environmental regulation of stomatal movement; photosynthesis under different environment, plurality of carbon pathways and its ecological significance; climatic conditions determining plant yield.

3. **Plant physiology of environmental stress resistance:**

Stress concept and terminology, nature of environmental stress, injury and resistance-water, salt, temperature, radiation; mechanism of stress injury and resistance.

4. **Ecophysiological responses to atmospheric pollutants and metals:**

Pollutants in the atmosphere, action of pollutants on plants; toxicity and tolerance of plants to heavy metals.

G. Plant Pathology

- 1. Epidemiology and disease forecasting:**
Factors responsible for establishment of epiphytotics; disease migration and condition of decline of disease; disease forecasting.
- 2. Physiological plant pathology:**
Factors affecting plant infection, mechanical, physiological factors; interactions with host and other microorganisms; allelopathy and antibiosis; rhizosphere and phyllosphere effects.
Alteration of growth pattern in host due to infection, alteration in growth regulators, enzymatic activity, carbohydrate and nucleic acid metabolism.
Toxins involved with necrosis and with diseases; biochemical aspect of crown gall disease development; physiological disease syndrome and hunger signs of plants.
Production of secondary metabolites-prohibitions, phytoalexins, tanins, nature and synthesis.
- 3. Genetics of disease development:**
Genetics of host-parasite relationship; concept of susceptibility and virulence; Flor's hypothesis; multiple gene inheritance of resistance and host specialisation.
- 4. Principles of plant protection:**
Quarantine, prophylaxis and therapy; plant protection through chemicals, antibiotics and natural products; chemistry of fungicidal action.

H. Plant Morphogenesis

1. **Development of form:**

Concept of morphogenesis; the factors in morphogenesis (structural, physico-chemical and genetic) correlation of factors; cellular control mechanism and molecular basis of differentiation.

2. **Meristems involved in growth:**

Vegetative to flowering shoot apices and root apices; experimental studies on apical meristems; control and differentiation of vascular elements; germination and seedling.

3. **Reproductive development:**

Models of floral differentiation, mechanism of embryogenesis in higher plants-cell lineage, compartmentalisation, cell to cell interactions, gradients, differentiation and organogenesis.

4. **Experimental embryogenesis:**

Control and modification of sex in higher plants; morphogenetic potentialities in tissue cultures-anther, embryo, endosperm and protoplast cultures.

PAPER - III

(Practical Paper)

Part A. (Microbiology and Biochemistry)

Microbiology:

Isolation and pure culture of common bacteria and fungi of soil, water and air. Estimation of microbial population and microbial growth measurement by dilution plate and turbidometry. Effect of pH and heavy metals on microbial growth. Antibiotic assay.

Microbial staining—Gram's and acid fast staining, capsule staining, Neisser's metachromatin granule staining of bacteria. Staining of fungi and spirochaets staining; measurement of microbial dimensions.

Estimation of total organic content of soil, R/S of soil microbial population. Estimation of amylase and cellulase activity in bacteria cultures. Total microbial population of phylloplane. Culture of *E.coli*, *Rhizobium*. *Azotobacter*: Isolation of soil actinomycetes.

Biochemistry:

Isolation, purification and characterisation of macromolecules; instrumental methods of analysis: colorimetry, chromatography, viscometry, manometry, electrophoresis; assay of aminoacids, proteins and nucleic acids.

Part B (Cytogenetics, Biosystematics & Ecology)

Cytogenetics:

Chromosome techniques, karyotype analysis. Application of chemicals to induce polyploidy. Use of physical and chemical mutagens. Hybridization techniques. Tissue culture techniques.

Biosystematics:

Methods of field study, collection and field preparation of specimens.

Herbarium technique, preservation and housing of specimens, herbarium maintenance.

Phytography, identification and formulation of diagnostic keys.

Study and application of rules of nomenclature.

Ecology:

Sociological analysis of vegetation, estimation of quantitative data-density, periodicity and pedology.

Limnology- estimation of CO₂, dissolved oxygen and primary productivity of water.

Books Recommended:

Paper I (Core Paper):

1. Plant Molecular Biology - D. Grierson & S. Covey. Blackie, London. 1984.

2. Handbook of Plant Cell Culture - D.A. Evans et al (ed.)
Macmillan, New York. 1983.
3. Experiments in plant tissue culture - J.H. Dodds and L.W.
Roberts. Cambridge University Press, Cambridge. 1982.
4. Plant Propagation by Tissue Culture - E.F. George and
P.D. Sherrington. Exegetics Ltd. U.K. 1984.
5. Plant Hormone and Plant Development - W.P. Jacobs.
Cambridge University Press, London. 1981.
6. The Biosynthesis and Metabolism of Plant hormones-
A. Crozier and J.R. Hillman (ed.). Cambridge University
Press. London. 1984.
7. Hormones, Receptors and Cellular Interactions in Plants
C.M. Chadwick & D.R. Garrod (ed.). Cambridge
University Press. London. 1986.
8. Plant Growth and Development (2nd Edition)- A.C.
Leopold and P.E. Kriedeman. Tata McGraw Hill. Delhi
- 1975.

9. The Biochemistry and Physiology of Plant Disease- R.N. Goodman, Z.Kiraly and M.Zaitlin. Van Nostrand Comp. Inc. London. 1967.
10. A Text Book of Modern Plant Pathology. K.S. Bilgrami & H.C. Dube. Vikas Publication. 1982.
11. Modern concept of Ecology - H.D. Kumar. Vikas Publishing House.
12. Biochemical Ecology of Water pollution - P.R.Dugan. Pleaum Press.
13. Genetic Resources in Plants, their exploration and conservation. O.H. Frankel and E.Bennett Blackwell Scientific Publication. Oxford. 1970.
14. Crop genetic resources for today and tomorrow-O.H. Frankel and J. G. Hawkes, Cambridge University Press. Cambridge, 1975.
15. Crop genetic resources, conservation and evaluation- J.H.W. Holden & J.T. Williams. George Allen and Unwin. London. 1984.

Paper II (Elective Paper) :

Plant Cytogenetics

1. Chromosomal Evolution in Higher Plants- G.L.Stebbins.Edward Arnold Ltd. London. 1971.
2. Induced Mutation in Plants- I.A. E.A. Publication. 1970.
3. Chromosome Techniques- A.K. Sharma & A.Sharma Butterworth. London. 1981.
4. Plant Cell, Tissue and Organ culture- J. Reinert and Y.P.S. Bajaj (ed.). Springer- Verlag. New York. 1977.

Plant Biochemistry

5. Plant Biochemistry (3rd ed.)- J.Bonner and J.E Varner, Acad. Press. New York. 1973.
6. Bioenergetics- Govindji (ed.) Academic Press. New York. 1975.
7. The Physiology and Biochemistry of Plant Respiration- J.M.Palmer (ed.) Cambridge University Press, London. 1984.

Microbiology

8. Bacterial Metabolism- H.W. Doyle. Academic Press. 1975.
9. Advances in Agricultural Microbiology. N.S.Subba Rao. Oxford IBH. Calcutta.
10. Symbiotic Nitrogen fixation in Plants- P.S. Nutman (Ed.) IBB-7. Cambridge University Press. 1976.

11. Microbial Ecology- M.Alexander. McMillan Press. 1971.
12. General Microbiology- M.Davis & Dulbecco.1980.
13. Current Development in Biological N₂ fixation. N.S. Subba Rao. Oxford IBH. Calcutta. 1981.
14. Essential immunology- Ivan M.Roitt. Blackwell and Scientific Publications. Oxford. 1979.
15. Biotechnology Vol. 1-3- H.J. Raam & G.Reed. Academic press. 1983.

Floristic Study

16. Vascular Plant Systematics- A.E. Radford (ed.) Harper & Row, New York. 1974.
17. Modern Methods in Plant Taxonomy- V.H.Heywood Academic Press, London. 1968.
18. Plant Taxonomy and Biosystematics- C.A. Stace Arnold. London. 1980.
19. Handbook of Field and Herbarium Methods- S.K.Jain & R.R. Rao. Today and Tomorrow's Printers & Publishers, New Delhi-1977.
20. An Introduction to Plant Taxonomy- C.Jeffry. Cambridge University Press, London. 1968.
21. New Concepts in Flowering Plant Taxonomy- J.Heslop-Harrison, Heinemann Educational Books-1970.
22. Vistas in Botany- W.B.Turril (Ed.) Pergamon Press. 1960.

Environmental Biology

23. Aquatic Microbiology- G. Rheinheimer. John Wiley & sons. London. 1974.
24. Air Pollution (vol 1-3) A.C.Stern. Academic Press. NewYork. 1980.
25. The ecosystem concept in natural resource management- G.Van Dyne. Academic press. 1983.
26. Conservation in perspective- W.Goldsmith. Wiley Publication. 1981.
27. The Ecology of Natural Resources- E. Simmons, Arnold London. 1979.

Environmental Physiology

28. Responses of Plants to Environmental Stresses. Vol. I &II. J. Levitt. Academic Press. NewYork 1981.
29. Photosynthesis and productivity in different environments J.P.Cooper (ed.) Cambridge University Press, London. 1975.
30. Environmental Effects of Crop Physiology- J.J.Lansberg & C.R. Cutting (ed.) Academic Press. NewYork, 1977.
31. The Physiology & Biochemistry of Drought Resistance in Plants. L.G. Paleg and D. Aspinall (ed.) Academic Press. Sydney. 1981.
32. Physiological Plant Ecology- W.Larcher. Springer-Verlag Berlin. 1983.

Plant Pathology

33. A Treatise on Plant Pathology (Vol. 1-3) - E.Horsfall & A. Dimond. Academic Press. 1962.
34. Biochemical aspect of Disease Resistance- A.Mahadevan. Today and Tomorrow Printers & Publishers. 1982.
35. Physiological Plant Pathology - R.K.S.Wood. Blackwell & Scientific Publication. Oxford. 1972.
36. Plant Pathology - G.N. Agrios. Academic Press. 1979.
37. Genetics of Host - Parasite Interaction - P.R.Day, S.Chand and Co. Ltd., New Delhi. 1979.

Plant Morphogenesis

38. Physiology and Biochemistry of Seeds; Viability, Dormancy and Environmental Control. Springer Verlag, Berlin, 1982.
39. Apical Meristem - F.A.L. clowes. Blackwell Scientific Publication. Oxford. 1961.
40. Recent Advances in Embryology of Angiosperms. International Society of Plant Morphologists. N.Delhi. 1963.
41. Anatomy of Seed Plants - K. Eames. John Willey and Sons. New York. 1977.
42. Experimental Embryology of Vascular Plants - B.M.Hohn. (ed.) Springer - Verlag, Berlin, 1982.
43. Experimental Embryogenesis in Vascular Plants- V.Raghaban., Academic Press., 1976

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