



COOCH BEHAR PANCHANAN BARMA UNIVERSITY

PANCHANAN NAGAR, VIVEKANANDA STREET, COOCH BEHAR – 736101

4 Year Under Graduate Degree (Honours) In Botany

Course: Theory syllabus of *Major 3*

Paper Name: Phycology and Lichenology

Paper Code: BOT MAJ3

Programme Objective:

The Major 3 offers essential knowledge and technical skills to the students to study the algae and lichens of different habitat. They also will gain the knowledge in habitat, distribution, thallus organization, classification, life cycle patterns as well as origin and evolution of sex in algae. They also gain knowledge of different groups of algae with selected representatives. This paper deals with economic importance of algae as well as lichens in a comprehensive way. This course covers both classroom and practical sessions. The students will be engaged in participatory and interactive activities.

Programme Outcome:

- Gather botanical knowledge of different groups of algae and lichen with preliminary knowledge of economic importance.

Phycology:

General account: Introduction: Habitat and distribution; thallus organization; ultrastructure of algal cell, origin and evolution of sex in algae; Life cycle patterns.

Broad outline of classification of Lee (2008) up to class and divisions.

Cyanophyceae: Salient features, ultra structure of cell, structure and function of heterocyst; reproduction.

Chlorophyceae: Salient features; life history of *Chlamydomonas*, *Oedogonium* and *Trentepohlia*.

Charophyceae: Salient features; life history of *Coleochate* and *Chara*.

Xanthophyceae: Salient features; life history of *Vaucheria*.

Bacillariophyceae: Salient features, cell structure and reproduction.

Phaeophyceae: Salient features; life history of *Ectocarpus*.

Rhodophyceae: Salient features; life history of *Polysiphonia*.

Economic importance – **Beneficial:** Food and Medicine, diatomaceous earth, development of cyanophycean members as biofertilizer. **Harmful:** Algae as pathogen in plants and algal toxins. Ecological importance.

Lichenology:

Lichen: Morphological classification, thallus organisation, reproduction; ecological and economic significance.



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Course: Practical Syllabus of Major 3

Paper Name: Phycology and Lichenology

Paper Code: BOT-MAJ3-L

Details of compound microscope.

Study of the following genera: Preparation of semi permanent slides of *Oscillatoria*, *Oedogonium*, *Chara*, *Vaucheria*, *Polysiphonia* and *Ectocarpus*. The preparation to be stained with cotton blue and drawing of reproductive structures with proper magnification using camera lucida.

Identification of all the genera included in the theoretical syllabus by their vegetative and reproductive structures from permanent slides.

Anatomical and Morphological study of *Parmelia* sp. and *Ramalina* sp.

Field study (Compulsory); Collection of algal members and lichen (photograph only) from the both aquatic bodies as well as terrestrial environments nearby the campus is mandatory for each student.

References:

1. College Botany Vol. -II. - Gangulee and Kar, New Central Book Agency, Kolkata.
2. Studies in Botany, Vol. I. - Mitra, Mitra, Choudhury. Moulik Library, Kolkata.
3. Text Book of Botany, Vol-1 and 2, By Hait, Ghosh and Bhattacharya, New Central Book Agency.
4. Botany – A. C. Datta, Oxford Univ. Press.
5. The structure and reproduction of algae, Fritsch, F. E. Vol. I (1935), Vol. II. Cambridge University Press
6. Introduction to the algae: structure and reproduction. 3rd Edition (1985). Bold, H. C. and Wynne, M. J. Wall. Prentice Hall of India Private Limited.
7. Phycology. 4th edition. Lee, R. E. (2009) Cambridge University Press.
8. An Introduction to Phycology. Van der Hock, D. G. Mann and Johns, H. M. 1995. Cambridge University Press.
9. Text Book of Algae, Sharma O.P. Tata McGraw Hill Publishing Co. Latest edn.
10. Botany for degree students. Algae. B. R. Vashistha, A. K. Sinha. V. R. Singha (Latest edition).

Course: Theory syllabus of Major 4

Paper Name: Mycology and Phytopathology

Paper Code: BOT MAJ4

Programme Objective:

The Major 4 offers essential knowledge and technical skills to the students to study the fungi and phytopathology. They also will gain the knowledge in fungal tissue organization, modification of hyphae, structure of fungal cell, flagella, habit, septum, homothallism and heterothallism, parasexuality, cell division of fungi of different groups of fungi with selected representatives. This paper deals with economic importance of fungi in a comprehensive way. Cultivation of mushroom is also taught.



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This paper also deals with plant diseases, its definition; concepts of parasitism and saprophytism, Koch's postulate, classification of plant diseases, pathotoxins, structural and biochemical defence mechanism of plants, control of Plant diseases, symptoms, disease cycles and control measures selected plant diseases.

This course covers both classroom and practical sessions. The students will be engaged in participatory and interactive activities.

Programme Outcome:

- Gather botanical knowledge of different groups of fungi and plant pathology with preliminary knowledge of economic importance.

Mycology

Introduction, Salient features - fungal tissue organization, modification of hyphae, structure of fungal cell, flagella, habit, septum, homothallism and heterothallism, parasexuality, cell division.

Broad outline of Classification of Ainsworth and Bisby (1983).

Phycomycetes: Salient features life histories of *Synchytrium*, *Rhizopus*.

Ascomycetes: Salient features, ascus development, types of ascocarps; life histories of *Saccharomyces* and *Ascobolus*.

Basidiomycetes: Salient features (dikaryotization, clamp connection); development of Basidium (holobasidium and phragmobasidium), fruit body types, life histories of *Puccinia*, *Agaricus* and *Polyporus*.

Deuteromycetes: Salient features with special reference to conidial fruit body types.

Economic importance of fungi – Both beneficial and harmful aspects.

Fungi as food: Mushroom – types; procedure of spawn production and cultivation of Oyster and Button mushroom.

Mycorrhizal diversity & association and its applications in agriculture and forestry.

Phytopathology

Terminology: Etiology and causal complex, symptoms and signs, infection, inoculum, primary and secondary inoculum, inoculum potential, pathogenecity and pathogenesis, necrotroph and biotroph, epidemic disease, endemic disease, sporadic disease, disease triangle and disease cycle.

Diseases: Definition; concepts of parasitism and saprophytism, Koch's postulate.

Classification of plant diseases based on symptoms.

Pathotoxins- definition and general account.

Structural and biochemical defence mechanism of plants.

Control of Plant diseases: Physical, chemical and biological methods.



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Symptoms, disease cycles and control measures of White rust of crucifer, Brown spot of rice, Late blight of potato and Rust of wheat.

Course: Practical Syllabus of *Major 4*

Paper Name: Mycology and Phytopathology

Paper Code: BOT MAJ4L

Mycology:

Standardization techniques using ocular and stage micrometer.

Study of the following genera: Preparation of semi permanent slides of *Rhizopus*, *Ascobolus*, *Agaricus* and *Polyporus*. The preparation to be stained with cotton blue and drawing and measurement of reproductive structures.

Identification of all the macroscopic and microscopic genera included in the theoretical syllabus.

Study of mycorrhizal association with roots.

Phytopathology :

Study of the following diseases:

White rust of crucifers, black Rust of wheat/*Justicia*, loose smut of wheat (or any member of Poaceae), late blight of potato, brown spot of rice and blister blight of tea.

Preparation of PDA media and isolation of pathogen from infected plant parts.

Sub-culturing of fungi.

Spawn preparation of Oyster mushroom.

Field study: Botanical excursion is mandatory for each student. Symptomatic study of Viral, Bacterial and Fungal diseases of crop plants and submission of dry specimens/ Photographs is mandatory for each student.

References:

1. Introduction to Fungi. Webster, J. Cambridge University Press.
2. Introduction to Fungi, Dubey, H. C. Vikas Publishing House.
3. Introduction to Mycology. Alexopoulos, C. J., Mims, C. W. and Blackwell Wiley. Bastern Limited, New Delhi.
4. Introductory Mycology. R. S. Mehrotra and Aneja, K. R. New Age International
5. Text Book of Fungi, Sharma, O. P. Tata Mc Graw Hill Publishing Co. Latest edn.
6. Botany for degree students. Fungi. B. R. Vashistha, A. K. Sinha. V. R. Singha (Latest edition). S. Chand
7. Plant Pathology. Agrios R. N. academic Press 18. Plant Pathology, Mehrotra, R. S. Tata Mc Graw Hill Publishing Company. New Delhi
8. Diseases of Crop Plants in India. Rangaswamy, G. Prentice Hall India Pvt. Ltd. New Delhi
9. Plant Diseases. Singh, R. S. Oxford & IBH, New Delhi.
10. Pathogen and Plant Diseases. Pandey, B. P., S. Chand & Company Ltd. Rangaswamy, G. New Delhi



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Course: Theory Syllabus of *Major 5*

Paper Name: Bryology and Pteridology

Paper Code: BOT-MAJ5

Programme Objective:

The Major 5 offers essential knowledge and technical skills to the students to study the bryophytes and pteridophytes. They also will gain the knowledge in adaptations to land habit, colonisation and rise of early land plants, origin of bryophytes and pteridophytes, telome concept and its significance, enation theory and its significance, amphibian nature of bryophytes, apogamy, apospory, parthenogenesis; heterospory and seed habit, stelar evolution in pteridophytes. Morphology, anatomy and reproduction of selective members of bryophytes and pteridophytes will be studied.

This course covers both classroom and practical sessions. The students will be engaged in participatory and interactive activities.

Programme Outcome:

- Gather botanical knowledge of different groups of bryophytes and pteridophytes with preliminary knowledge of economic importance.

Bryology:

Introduction, general characteristics and adaptations to land habit, salient features of Hepaticopsida, Anthocerotopsida and Bryopsida.

Origin of Bryophytes. Amphibian nature of Bryophytes.

Broad outline of Classification according to Crandell-Stotler and Stotler (2008).

Life histories of *Riccia*, *Marchantia*, *Anthoceros*, *Sphagnum* and *Funaria*.

Origin of alternation of generations in Bryophytes (Homologous and Antithetic theory).

Evolution of Sporophytes in Bryophytes (Progressive and Regressive concept).

Role of Bryophytes in plant succession, pollution monitoring.

Economic importance of Bryophytes with special reference to *Sphagnum*.

Pteridology:

Introduction, general characteristics, Salient features of Psilophyta, Lycophyta, Sphenophyta and Filicophyta.

System of classification up to Division (Gifford & Foster, 1989).

Morphology, anatomy and reproduction of *Rhynia*, *Psilotum*, *Lycopodium*, *Selaginella*, *Equisetum*, *Marsilea* and *Pteris*

Colonisation and rise of early land plants.

Telome concept and its significance in the origin of different groups of Pteridophytes.

Enation theory and its significance in the origin of microphyll.

Apogamy, apospory, parthenogenesis; heterospory and seed habit, stelar evolution in pteridophytes.

Ecological and economic importance of Pteridophytes.



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Course: Practical Syllabus Major 5

Paper Name: Bryology and Pteridology

Paper Code: BOT-MAJ5L

Bryology and Pteridology

Study of the gametophytic and sporophytic structures of the following genera: *Riccia*, *Marchantia*, *Anthoceros* and *Funaria*. Spot identification of genera that are included in the theoretical syllabus. The bryophytes preferably to be stained with Bismarck Brown Staining (Single staining)

Study of morphology, anatomy and reproductive structures in *Lycopodium*, *Selaginella*, *Equisetum*, *Marsilea* and *Pteris*. Spot identification of the genera that are included in the theoretical syllabus. The non lignified tissue to be stained with Bismarck Brown Staining (Single staining) while lignified tissues are to be stained with Double staining method (preferably with Safranin and Fast Green Staining).

Field Study: Botanical excursion is (local and / or outstation) mandatory for each student. A field notebook supported with photographs taken during field study to be submitted giving comprehensive idea about different types of bryophytes and pteridophytes. No individual collection should be allowed (submission of dry and wet specimens is not required).

Preparation of digital herbarium.

References:

1. Biology of Bryophytes, 2005, Chopra, R. N. & P. K. Kumra, New Age International, New Delhi.
2. Bryophyte Biology (2nd Edition), 2009, Gofnet, B. & A. J. Shaw, Cambridge University Press.
3. Parihar, N.S. Introduction to Embryophyta (Vol. 1 Bryophyta), Central Book Distributors.
4. Shaw, A. Jonathan and Goffinet Bernard, Bryophyte Biology, 2009, Cambridge University Press.
5. Rashid, A. An Introduction to Bryophyta, 1998, Vikas Publishing House.
6. Chopra, R.N. & Kumar, P.K. Biology of Bryophyta, Latest Ed., Wiley Eastern.
7. Puri, P. Bryophyte, Latest Ed., Atmaram & Sons.
8. Vashista, B.R. Bryophyta, Latest Ed., S. Chand & Company.
9. Spore, K.R. The Morphology of Pteridophyte, Latest Ed., Huchinson & Co. Ltd.
10. Rashid, A. An Introduction to Pteridophyte, Latest Ed., Vani Educational Books.
11. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
12. Morphology of Vascular Plants – Lower Groups. 1936. Eames, A. J. Tata McGraw Hill, New Delhi.
13. Morphology and Evolution of Vascular Plants. 1989. Giford E.M and Foster A.S W H Freeman and Company, New York.



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14. Hait, G., Ghosh, A. and Bhattacharya, K. A Text Book of Botany (Vols. I, II & III), 2007, New Central Book Agency.
15. Mitra, D., Guha, J. & Chowdhuri, S.K. Studies in Botany (Vols. I & II), Latest Ed., Das Printers.
16. Chatterjee, T., Santra, S.C. and Das, A. Practical College Botany, New Central Book Agency.

Course: Theory syllabus for Major 6

Paper Name: Gymnosperms, Palaeobotany & Palynology.

Paper code: BOT-MAJ6

Programme Objective:

The Major 6 offers essential knowledge and technical skills to the students to study the Gymnosperms, Palaeobotany and Palynology. They also will gain the knowledge in classification, evolutionary trends in Gymnosperm as well as affinities with Pteridophytes and Angiosperms. Morphology, anatomy and reproduction of selective members of gymnosperms will be studied.

In paleobotany, major events of plant life through geological time scale, Gondwana flora, fossil formation, fossilizations process, types of fossil and dating of fossils is discussed. Fundamentals of palaeogeography, palaeoecology and palaeoclimatology also studied.

The basic ideas of palynology are also discussed in this paper.

Programme Outcome:

- Gather botanical knowledge of different groups of gymnosperms.
- Basic ideas of fossils, fossilization and fossil flora as well as preliminary knowledge of palynology.

Gymnosperms:

Characteristic features and classification of Gymnosperms (Bhatnagar & Moitra (1996) up to orders. Evolutionary trends in Gymnosperm, affinities with Pteridophytes and Angiosperms,

Morphology, reproduction and life cycle and economic importance of *Cycas*, *Pinus*, *Gnetum*, *Ephedra* and *Ginkgo*.

Polyembryony and pollination drop with special reference to *Pinus*.

Economic importance of Gymnosperms. (Wood, resin, essential oil & drugs).

Ecological importance of Gymnosperms (Avenue Trees, soil allopathy)

Palaeobotany:

Major events of plant life through geological time scale and Gondwana Flora.

Fossilizations process and conditions favouring fossilization

Types of fossils - micro and megafossils, dating of fossils.

Fundamentals of palaeogeography, palaeoecology and palaeoclimatology.



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Importance of fossil study.

Palynology:

Definition, scope and economic importance.

NPC classification. Pollen morphology, Melissopalynology

Course: Practical syllabus of Major 6

Paper name: Gymnosperms, Palaeobotany & Palynology

Paper code: BOT-MAJ6L

Study of morphology, anatomy and reproductive structure of *Cycas*, *Pinus*, *Gnetum* and *Ephedra*, through temporary and permanent slides. Lignified tissues are to be stained with Double staining method (preferably with Safranin and Fast Green Staining).

Study of anatomy and modes of preservation of the following fossil specimen:

- (a) *Lepidodendron* (T.S. of stem) (b) *Calamites* (T.S of stem) (c) *Lyginopteris* (T.S. of stem).
(d) *Lepidodendron* (seed) (e) *Glossopteris* (leaf) (f) *Vertebraria* (Root).

Melissopalynological studies of local honey samples.

Study of pollen morphology of *Datura* / *Hibiscus*.

Field Study: Botanical excursion (Local and /out station mandatory), submission of field note book, field photographs of collected specimen is required.

Preparation of digital herbarium.

References:

1. Bhatnagar,S.P & Moitra,A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
2. Ganguly H.C & Kar A.K. College Botany, Volume II. (Latest edition) New Central Book Agency, Kolkata, India.
3. Mitra J.N, Mitra D & Chaudhari S.K, Studies in Botany, Volume I (Latest edition), Moulik Library, Kolkata, India.
4. Vashishtha P.C, Sinha A.K & Kumar Anil, Botany for degree students-Gymnosperms (Latest edition), S.Chand , Delhi, India.
5. Johri B.M & Biswas C, The Gymnosperms, Springer.
6. K.U Kramer & Green P.S, The Families and Genera of Vascular plants- Pteridophytes and Gymnosperms (Latest edition), Springer.
7. Stewart W.N & Rathwell G.W, Palaeobotany and the Evolution of Plants (Latest edition), Cambridge University Press.
8. Taylor Thomas N, Taylor Edith L. & Krings Michael, Palaeobotany- The Biology and Evolution of Fossil Plants (Latest edition), Academic press, Elsevier.
9. Mishra S.R. Textbook of Palaeobotany (Latest edition) , Discovery Publishing House.



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10. Textbook of Palynology(Latest edition) by Kashinath Bhattacharya , New Central Book Agency Publications.
 11. Santra S.C, Chatterjee T.P &Das A.P. College Botany Practical Volume –II(Latest edition), New Central Book Agency Publications.



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