

## DRAFT version of UG syllabus for Botany Major (Based on NEP)

### SEMESTER-I [22 credits]

#### ✓ Major Course -1 (MC-1) : Algae & Microbiology [ 04 Credit : F.M.-50]

This course is composed of two components – Theory & Practical, these two components will be treated as two separate papers under this course.

Internal assessment @ 20% of F.M. = 20% of 50 = 10

- Theory component paper of this course: **MC-1-T** of marks 25
- Practical component paper of this course: **MC-1-P** of marks 15

#### ❖ Topic content of MC-1-T

Algae	Microbiology
<p>[1] General characteristics ; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food , flagella ; methods of reproduction and uses. (Cyanophyta, Chlorophyta, Charophyta, Bacilariophyta, Phaeophyta &amp; Rhodophyta)</p> <p>[2] Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups)</p> <p>[3] Cyanophyta: cell structure and function with special reference to heterocyst &amp; akinete. Life history of – Anabaena sp.</p> <p>[4] Chlorophyta: cell structure and function with special reference to chloroplast types. Life history of – Oedogonium sp.</p> <p>[5] Charophyta: cell structure and function with special reference to corticated cells, globule and nucleolus of Chara sp. Life history of Chara sp.</p> <p>[6] Bacilariophyta (diatom): cell structure and function, cell division, auxospore formation &amp; classification with respect to cellular symmetry (pinnate &amp; centric diatoms)</p> <p>[7] Phaeophyta: cell structure and function. Life history of - Ectocarpus sp.</p> <p>[8] Rhodophyta: cell structure and function with reference to cell to cell connection and phycocolloids. Life history of – Polysiphonia sp.</p>	<p>[1] Introduction to microbial world: Discovery, general characteristics; Types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure: Flagella (ultrastructure) &amp; Pili; Cell wall – chemical structure and differences between Gram +ve &amp; Gram – ve bacteria; Bacterial genome and plasmid; Endospore - formation, structure and function.</p> <p>[2] Bacterial reproduction: Vegetative and asexual; Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced competence and DNA uptake, (b) Conjugation – F-factor, F+ x F–, Hfr x F–, concept of F', chromosome mobilization, (c) Transduction– Generalised and specialized.</p> <p>[3] Economic importance of bacteria: Industrial Production of Vinegar and Streptomycin (brief outline); Enzyme (Amylase, Protease); Plant Growth Promoting Rhizobacteria (PGPR): Biological nitrogen fixation and nodulation process in legumes. Role of PGPR in agriculture as Biofertilizer and Biopesticides. Concept of Bioplastics.</p> <p>[4] Viruses: Discovery, physiochemical and biological characteristics; classification (Baltimore), general, structure with special reference to viroids and prions; replication (general account).</p> <p>[5] DNA virus, (T-phage), lytic and lysogenic cycle; RNA virus (TMV). Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics.</p>



❖ Topic content of MC-1-P

Algae	Microbiology
[1] Preparation of semi-permanent slide using lactophenol as mounting medium and cotton blue as stain of – Anabaena sp., Oedogonium sp., Chara sp., Ectocarpus sp. & Polysiphonia sp. and camera lucida drawing of selected portion of thallus mentioning proper magnification.	[1] Preparation of heat fixed and single-stained bacterial smear of bacteria from curd. [2] Gram staining technique of bacteria using bacterial inoculum (mixed or pure culture). NOTE: Students will perform Gram staining procedure (differential staining) upto the Safranine step and comment on their observation based on supplied bacterial sample only. <u>Reference strain concept may be demonstrated but not mandatory for examination purpose.</u>

Suggested Readings

1. Bold, H.C. & Wynne, M.J. ....Introduction to Algae: Structure & Reproduction [Prentice Hall]
2. Ganguly, H.C. & Kar, A.K. ....College Botany Vol.-II [New Central Book Agency]
3. Hoek, C., Mann, D.G. & Jahns, H.M. 1995 ....Algae: an.... [Cambridge Univ. Press]
4. Kumar, H.D. & Singh, H.N. ....Introductory Phycology [East-West Press Pvt. Ltd]
5. Lee, R.E. Phycology [Cambridge Univ. Press]
6. Vashistha, B.R., Singh, A.K. & Singh, V.P. ....Algae [S. Chand & Co. Pvt. Ltd.]
7. Atlas, R.M. Principles of Microbiology [McGraw Hill]
8. Banerjee, A.K. & Banerjee, N. ...Fundamentals of Microbiology and Immunology [New Central Book Agency]
9. Pelczar, M.J., Chan, P.C.S. & Krieg, N.R. ....Microbiology [Tata McGraw Hill]
10. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L. & Painter, P.R. .General Microbiology [Macmillan Education Ltd.]
11. Tortora, G.J., Funke, B.R. & Case, C.L. .Microbiology - An Introduction [Dorling Kindersley India Pvt. Ltd. for Pearson Education]
12. Willey, M.J., Sherwood, L.M. & Woolverton, C.J. ....Prescott, Harley and Klein's Microbiology [McGraw Hill]

✓ **Major Course -2 (MC-2) : Fungi, Lichens and Plant Pathology [ 04 Credit : F.M.-50]**

This course is composed of two components – Theory & Practical, these two components will be treated as two separate papers under this course.

Internal assessment @ 20% of F.M. = 20% of 50 = 10

- Theory component paper of this course: **MC-2-T** of marks 25
- Practical component paper of this course: **MC-2-P** of marks 15

❖ Topic content of MC-2-T

Fungi & Lichen	Plant Pathology
[1] Introduction to true fungi; General characteristics; Thallus organization; Cell wall composition;; Teleomorphic and Anamorphic; Degeneration of sex in fungi; Parasexuality; Nutrition; Life Cycle Patterns. [2] Classification ( Ainsworth 1973) up to sub-division diagnostic characters and examples. [3] Characteristic features; Ecology and significance; Thallus organisation; Reproduction; Life cycle with reference to Rhizopus, Ascombolus, Agaricus and Penicillium. [4] Symbiotic associations: Lichen – Occurrence;	[1] Introduction to plant pathology; Plant pathology in India and Global prospective; Concept of Disease in Plants and Types of Diseases. [2] Terms and definitions: Disease concept, Symptoms, Etiology, Inoculum and Infection, Pathogenesis, SAR and ISR, Disease triangle and disease cycle, Epidemic and Endemic, Sporadic and Pandemic Disease. Koch's postulate. [3] Mechanism of infection (Pre-penetration, Penetration and Post-Penetration), Plant defense responses with reference to Phytoalexins and PR proteins. Signal transduction leading to SAR and





<p>General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction and ecological role in pollution monitoring; Mycorrhiza-Ectomycorrhiza, Endomycorrhiza, Phosphate mobilization by AMF. Significance and role in Agriculture.</p> <p>[5] Applied Mycology: Role of fungi in biotechnology; Application of fungi in food industry. Fungi as Biocontrol agents; Mycotoxins.</p> <p>[6] Industrial production of Cheese, Ethanol, Baker's yeast, Amylase and Riboflavin.</p>	<p>ISR.</p> <p>[4] Concept of plant disease management: IPM, Chemical, Biological and Quarantine. Concept of crop rotation.</p> <p>[5] Symptoms, Causal organism, Disease cycle and control measures of: Bacterial diseases – Citrus canker, Viral diseases – Tobacco Mosaic Disease. Fungal diseases – Late blight of potato and Black stem rust of wheat.</p> <p>[6] Symptoms, Causal organism, Disease cycle and control measures of: Bacterial diseases – Citrus canker, Viral diseases – Tobacco Mosaic Disease. Fungal diseases – Late blight of potato and Black stem rust of wheat.</p>
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### ❖ Topic content of MC-2-P

<b>Fungi &amp; Lichen</b>	<b>Plant Pathology</b>
<p>[1] Study of asexual stage from temporary mounts, drawing and microscopic measurement: Rhizopus, Ascombolous / Peziza and Agaricus.</p> <p>[2] Study from permanent slides: Sexual stage in Rhizopus, Conidia of Penicillium, Aspergillus sp.</p> <p>[3] Isolation of AMF from soil through wet sieving and decanting method and comment on the type and nature of spore. (Demonstration)</p> <p>[4] Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates through museum specimen.</p>	<p>[1] Study from temporary mounts (Histopathology): Late Blight of Potato, Stem rot of Jute, Loose smut of wheat, Leaf rust of Justicia. (Histopathology): Late Blight of Potato, Stem rot of Jute, Loose smut of wheat, Leaf rust of Justicia.</p> <p>[2] Study from permanent slides: Uredial, Telial, Pycnidial and Aecial stages of Puccinia graminis,</p> <p>[3] Herbarium specimens of bacterial diseases; Citrus Canker; Viral diseases: TMV, Fungal diseases: Late and Early blight of Potato, Black stem rust of Wheat, Stem rot of Jute, Red rot of Sugarcane, leaf rust of Justicia, Tikka disease of Groundnut and White rust of Crucifers.</p>

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### Suggested Readings

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.
2. Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.
4. Kershaw, K.A. (1985), Physiological ecology of lichens, Cambridge University Press, Cambridge.
5. Negi, H.R.; Kareem, A., Lichens: The Unsung Heroes.
6. Negi, Hans Raj, Lichens: A valuable bioresource for environmental monitoring and sustainable development, Resonance. India, 2003,8(1), 51-58
7. Seaward, M.R.D. (1977) (Ed.), Lichen ecology, Academic Press, London.
8. Sharma, P.D. (2011). Plant Pathology, Rastogi Publication, Meerut, India.
9. Agrios, G.N. (1997) Plant Pathology, 4th edition, Academic Press, U.K.
10. Melhotra R.S and Aggarwal-Ed. Plant Pathology, Mc.Graw Hill Education.



✓ **Minor Course -1 (MnC-1) : Biodiversity [ 04 Credit : F.M.-50]**

This course is composed of two components – Theory & Practical, these two components will be treated as two separate papers under this course.

Internal assessment @ 20% of F.M. = 20% of 50 = 10

- Theory component paper of this course: **MnC-1-T** of marks 25
- Practical component paper of this course: **MnC-1-P** of marks 15

❖ **Topic content of Paper- MnC-1-T**

1. **Microbes:** Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage); Lytic and Lysogenic cycle, RNA virus (TMV); Economic importance. Bacteria – Discovery, General characteristics and cell structure; Cell wall – chemical structure and differences between Gram +ve & Gram –ve bacteria; Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance with respect to uses of microbes as Biofertilizer, Bioplastic and Biopesticides.
2. **Algae:** General characteristics; Ecology and distribution; Range of thallus organization and reproduction; classification of Lee (only upto groups) with characteristic features of each group; Morphology and life-cycles of the following: Nostoc, Oedogonium, and Chara. Economic importance of algae.
3. **Fungi:** Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction. Classification according to Ainsworth 1973; True Fungi General characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) Ascobolus (Ascomycota), Agaricus (Basidiomycota). Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance.
4. **Introduction to Archegoniate:** Unifying features of archegoniates, Transition to land habit, Alternation of generations.
5. **Bryophytes:** General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of Marchantia, Anthoceros and Funaria. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of Sphagnum.
6. **Pteridophytes:** General characteristics, classification, Early land plants (Cooksonia and Rhynia). Classification (up to family), Heterospory and seed habit, stellar evolution. Ecological and economical importance of Pteridophytes. Morphology, anatomy and reproduction of Selaginella, Equisetum and Pteris. (Developmental details not to be included).
7. **Gymnosperms:** General characteristics; Classification (up to family), morphology, anatomy and reproduction of Cycas and Pinus (Developmental details not to be included). Ecological and economical importance.

❖ **Topic content of Paper- MnC-1-P**

1. Electron Micrographs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Observation of Bacterioids in root Nodule/Curd (Simple staining: Methylene blue).
3. Study of vegetative and reproductive structures of Nostoc, Oedogonium (Macrandrous), and Chara through temporary preparations and permanent slides.
4. Asexual stage from temporary mounts of Rhizopus, Ascobolous/ Peziza and Agaricus.
5. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
6. Type study using semi permanent mounts: Marchantia (antheridial and archegonial heads); Anthoceros (Sporophyte); Funaria (Capsule)





7. Type study using semi permanent mounts: Selaginella- morphology; Stem (T.S), Strobilus (L.S); Equisetum- morphology, internode (T.S), strobilus (L.S). Pteris- morphology, t.s. rachis (T.S), sporophyll (L.S), Morphological studies of Megasporephyll and Microsporephyll.
8. Cycas- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root (T.S) Leaflet (T.S)
9. Pinus- morphology (long and dwarf shoots, Needle (T.S), Morphological studies of Male and Female Cones

#### Suggested Readings

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

### ✓ Skill Enhancement Course (SEC-1): Medicinal Botany [Credit 3]

#### ➤ Theory Paper: SEC-1[F.M.=50]

#### ❖ Topic content of SEC-1

1. **History, Scope and Importance of Medicinal Plants.** Indigenous Medicinal Sciences; Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridoshaconcepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.
2. **Conservation of endangered and endemic medicinal plants.** Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.
3. **Ethnobotany and Folk medicines.** Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

#### Suggested Readings

1. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
2. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

