

SEMESTER – I

Core Paper - I

MICROBES AND INDUSTRY

Instructional Hrs. 75

Max.Marks: CIA 25; ESE -75

Sub. Code: 15BOPC101

Credits: 4

Objectives: To study the Classification - Characteristics & Structure of industrially important microbes. To study the isolation- Identification & Production of potential microbes in industries. To develop the skill of manufacturing industrial products.

UNIT I

15 Hrs.

Bacteria- Classification of Bacteria (Bergey's, 1923) – Morphology and Ultra structure – Bacterial culture and cultural characteristics – Isolation and maintenance of pure culture – Growth curve of bacterial population - Quantitative measurement of bacterial growth – *Economic importance of bacteria.*

UNIT II

15 Hrs.

Viruses- History of Viruses - Classification (Harrison *et al.*, 1971) – Structure of Virus- Double strand RNA and DNA viruses- Cauliflower Mosaic Virus – Wound Tumour Virus – Bacteriophages – Morphology – structure and replication – *HIV/AIDS Virus.*

UNIT III

15 Hrs.

Industrial microbiology- Scope of industrial microbiology - Development of industrial fermentation process – Screening - Detection and assay of fermentation products - Stock culture - Fermentation media - Inoculum preparation- **Scale up of fermentations**-**Increasing product yield.**

UNIT IV

15 Hrs.

Microbiology of soil and water- Rhizosphere and Mycorrhizae -Fermentation techniques – types of fermentation- microbial cells as fermentation products – *SCP* – *importance of microbial enzymes in industry* – commercial microbial enzymes – methods of industrial production of enzymes-Cellulolytic and Pectinolytic enzymes obtained from microbes.

UNIT V

15 Hrs.

Antibiotics – Classification – Source - Chemistry and Production of important antibiotics – Penicillin-Streptomycin - amino acids – Glutamic acid- Organic acids –Citric acid. *Vinegar* (Manufacture by microbial Oxidation transformations) - Manufacture of Vitamin B₁₂ – Bio fuels: Bioethanol and Biodiesel production .

Note: *Italics* denote self study topics.

Practicals

Microbiology

1. Inoculation of fungi and bacteria on selected media and maintenance of cultures.
2. Isolation of soil microbes (Bacteria and fungi) by dilution plating method using selective media.
3. Knowledge on antimicrobial activity by using antibiotics.
4. Gram Staining
5. Microbial screening – Photographs
6. Enzyme assay
7. SCP production

Reference Books

1. **Agarwal, A.K. and Parihar, P.**, "*Industrial Microbiology*", Shriya Computers and Printers, Jodhpur, 2006.
2. **Casida, L.E.**, "*Industrial microbiology*", Wiley Eastern Ltd., New Delhi, 1968.
3. **Chawla, D.S.**, "*Food feed and fuel from Biomass*", IBH, New Delhi, 1991.
4. **Patel, A.H.**, "*Industrial Microbiology*", Mac Millan India Ltd. New Delhi, 1984.
5. **Paul, A. Ketchum**, "*Microbiology*", John Wiley & Sons, USA., 1968.
6. **Pelczar, M.J. (Jr.), Chan, E.C.S. and Kreig, N.R.**, "*Microbiology*", Tata, Mc Graw Hill, New Delhi, 3rd Edition, 1993.
7. **Purohit, S.S.**, "*Microbiology - Microbiology Fundamentals and Applications*", Saraswathi Purohit for Students Press, India, 2003.
8. **Michael, Pelczar, J., Chan Jr. E.C.S. and Krief, N.R.**, "*Microbiology*", Tata Mc Graw- Hill(Ed), New Delhi, 1995.
9. **Smith, K.M.**, "*Viruses*", Cambridge University Press, 1974.

SEMESTER – I

Core Paper – II

PHYCOLOGY, BRYOLOGY AND LICHENOLOGY

Instructional Hrs.: 75

Sub. Code: 15BOPC102

Max. Marks: CIA 25; ESE -75

Credits:4

Objectives: To understand the Range of thallus- Structure- Reproduction methods and life cycle pattern of lower plants and to understand the role of Lichens in human welfare.

UNIT- I

15 Hrs.

ALGAE : Classification of Algae (Fritsch, 1945)- Range of thallus- *Pigmentation*- Reproduction and life cycle patterns of Cyanophyta- Chlorophyta and Charophyta..

UNIT -II

15 Hrs.

Comparative study of the range of structure – reproduction and life cycle pattern of Bacillariophyta- Phaeophyta- Rhodophyta – Phylogeny and Inter relationship. *Economic importance of Algae.*

UNIT-III

15 Hrs.

BRYOPHYTES Classification (Reimers -1954) Origin– Distribution – Structure – Reproduction and life cycle of Takakiales- Calobryales- Jungermanniales- Metzgeriales- Sphaerocarpaceles- Monocleales and *Marchantiales.*

UNIT-IV

15 Hrs.

Distribution- structure- reproduction and life cycle of Anthocerotales- Sphagnales- Andreaeales- Funariales- Polytrichales – Fossil Bryophytes- *Economic importance.*

UNIT -V

15 Hrs.

LICHENS : Classification of Lichens (Hale, 1969)- Occurrence and Inter-relationship of Phycobionts and Mycobionts- Structure and Reproduction in Ascolichens- Basidiolichens and Deuterolichens- Lichens as indicators of Pollution. *Economic importance of Lichens .* Origin and evolution of lichens- Fungi as insect symbionts.

Note: Italics denote Self Study Topics.

Practicals :

Phycology: Gloeocapsa- Lyngbya- Pediastrum- Vaucheria, Pithophora- Zygnema ,Coleochaete, Bulbochaete- Nitella- Padina- Turbenaria- Batrachospermum- Ceramium- Amphiroa and Gelidium

Bryology: Targionia- Lunularia- Reboulia- Aneura- Sphagnum and Bryum.

Lichenology : Fruticose Lichen

References :

1. **Bold, H.C., and Wynne, H.J.,** *“Introduction to the Algal structure and reproduction”*, Prentice Hall, Engle wood Cliffs, New Jersey, 1978.
2. **Chapman, V.J. and Chapman, P.J.,** *“The algae”*, The English language book society and Macmillan Publications, 1973.
3. **Fritsch, F.E.,** *“Structure and reproduction of the Algae”*. Vol. I,II& III, 1935-1945.
4. **Lee, R.E.,** *“Phycology”*, Cambridge University Publications, London,1987.
5. **Parihar, N.S.,** *“An introduction to bryophytes”* Vol. III. Central book Depot. Allhabad, 1967.house Pvt.
6. **Vashishta, B.R., Sinha,A.K. and Adarshkumar,** *“Botany for degree students – Bryophyta”*, S. Chand & Company Ltd., New Delhi, Revised Edition, 2008. 8.
7. **Frank Cavers** .The Inter Relationships of the Bryophyta, S.R.Technico Book house.1981
8. **Watson E.V.,** The Structure and life of Bryophytes. Hutchinson University Library, London,1971.
9. **Prempuri,** Bryophytes; Morphology Growth and Differentiation. Atma Ram and Sons,1986.
10. **Foster,A. S. and Gifford, E. M.** Comparative Morphology of Vascular Plants. W.H. Freeman and Co.1973.

SEMESTER – I

Core Paper – III

MYCOLOGY AND PHYTOPATHOLOGY

Instructional Hrs.:75

Sub. Code:15BOPC103

Max. Marks: CIA 25; ESE -75

Credits:4

Objectives: To understand the range of thallus- Structure- Reproduction methods and life cycle pattern of Fungi and to understand plant – pathogen interaction

UNIT -I **15 Hrs.**

FUNGI : Classification of fungi (Alexopoulos , 1969). Cell wall composition; mode of nutrition- Phycomycetes (Chytridiomycetes- Hypochytridiomycetes- Oomycetes - *Zygomycetes*)

UNIT -II **15 Hrs.**

Range of Structure- Reproduction and Interrelationship of Myxomycetes- Ascomycetes (Hemiascomycetidae, Plectomycetidae, Hymenoascomycetidae & Loculoascomycetidae).

UNIT -II I **15 Hrs.**

Range of Structure - Reproduction and Interrelationship of Basidiomycetes and *Deuteromycetes*. Heterothallism - *Economic importance of fungi*.

UNIT IV **15 Hrs.**

Plant Pathology: Classification of plant diseases –Principles of plant disease control- cultural, biological and chemical - Effect of environment on disease development. Causal organism, Symptoms, Disease cycle and control measures of Black wart of Potato, *Blight of Paddy* & Powdery mildew disease of Cucurbitis.

UNIT V **15 Hrs.**

Pathogenesis: Penetration and entry - Enzymes in plant disease – cell wall degrading enzyme. *Toxins*, Effect of infection on physiology of host (general account) -Defense mechanism

Note: *Italics* denote Self Study Topics.

Practicals :

Mycology : Albugo- Saprolegnia- Phyllachora- Alternaria and Puccinia

Phytopathology:

1. Estimation of total chlorophyll in infected and healthy plants.
2. Biological control by Tobacco leaf extracts- turmeric- neem oil- Pongamia oil.
3. Anatomical studies of infected regions.
4. Comparison between infected and uninfected plants with reference to total carbohydrate and protein.

References:

1. **Lee, R.E.**, *“Phycology”*, Cambridge University Publications, London,1987.
2. **Alexopoulos, C.J.** and **Mims C.W.**, *“Introductory Mycology”*, Wiley Eastern PVT., LTD., New Delhi, Second Edition, 1962.
3. **Ainsworth, S.C.**, **Sparrow, F.E.** and **Sussman, A.D.**, *“The fungi and advanced treatise”*, Vol. I, II, III, IVA & IVB.
4. **Vashishta, B.R.**, **Sinha, A.K.**, *Fungi Botany for degree students .S.Chand&co,New Delhi,2007.*
5. **Mehrotra, R.S** and **Aneja, K.R.** An introduction to Mycology. New age international Pvt.Ltd.Mumbai,1998.
6. **Agrios, George, N.**, *“Plant Pathology”*, Academic Press, Sandiego, London. 1988.
7. **Aneja, K.R.**, *“Experiments in Microbiology, Plant Pathology and Tissue culture”*, Wishwa Prakashan, New Delhi,1996.
8. **Baker, F** and **Cook, R.J.**, *“Biological control of plant pathology”*,S. Chand And Company LTD., New Delhi, 1979.
9. **Bilgrimi, K.S.** and **Dube, H.C.**, *“A text book of Modern Plant Pathology”*, Vikas Publishing House, PVT., LTD., Kanpur,1980.
10. **Mehrotra, R.S.**, *“Plant Pathology”*, Tata Mc Graw Hill Publishing Company Ltd. , New Delhi,1996.

SEMESTER – I

Core Paper – IV

PTERIDOPHYTES , GYMNOSPERMS AND PALAEOBOTANY

Instructional Hrs.:75

Sub. Code:15BOPC104

Max. Marks: CIA 25;ESE -75

Credits:4

Objectives: To know structural variation in gametophytes, sporophytes, of Pteridophytes and Gymnosperms

UNIT I 15 Hrs.

Classification of Pteridophytes (Reimer's (1954)- Telome concept -Apospory - Morphology - anatomy and reproduction of - Psilotales. Selaginellales – Isoetales -Marattiales

UNIT II 15 Hrs.

Morphology- anatomy and reproduction of – Ophioglossales – Osmundales - Filicales – Salviniales - Sorus evolution.

UNIT- III 15 Hrs.

Classification of Gymnosperms (Sporne, 1965). *Cycadales* . General account of Ginkgoales- Coniferales (Cupressaceae- Podocarpaceae- Araucariaceae- Pinaceae)

UNIT-IV 15 Hrs.

General account of Taxales - Gnetales - *Angiospermic characters.*

UNIT-V 15 Hrs.

Fossils: *Types of fossils*- process of fossilization and importance of fossils - Detailed study of the fossil forms – Pteridohytes- Rhynia- Lepidodendron – Calamites – Sphenophyllum- Gymnosperms- Lyginopteris - Cordaites.

Note: *Italics* denote Self Study Topics.

Practicals :

Pteridophytes: Selaginella- Angiopteris- Osmunda- Dicranopteris- Lygodium- Pteris- Alsophila- Nephrolepis- Salvinia and Azolla.

Gymnosperms: Pinus, Gnetum, Cupressus- Podocarpus- Araucaria- and Ephedra.

Fossils: Rhynia- Sphenophyllum- Calamites

Gymnosperms: Lyginopteris, - Lagenostoma- Pentoxylon and Cordaites

References:

1. **Rashid.A. 2007.** An Introduction to Pteridophyta - Vikas publications, New Delhi.
2. **Sporne, K.R. (1975).** The Morphology of Pteridophytes, Hutchinson and Co., London
3. **Foster, A. S. and Gifford, E. M.** Comparative Morphology of Vascular Plants. W.H. Freeman and Co. 1973.
4. **Johri, R.M., Lata S, Tyagi K (2005),** A text book of Gymnosperms, Dominant Pub and Distributor, New Delhi
5. **John M. Coulter, and Chamberlin C.J.,** “ *Morphology of Gymnosperms*”, Central book Depot. Allahabad, 1917.
6. **Vasishta, P.C., Sinha, A.K. and Anilkumar,** Botany for Degree Students Gymnosperms. S. Chand & co, New Delhi. 2006
7. **Chester A. Arnold,** “ *An introduction to Palaeobotany*”, Agrobios (India) Jodhpur, 1947.

SEMESTER – II

Core Paper -V

ANATOMY AND EMBRYOLOGY

Instructional Hrs.: 90

Sub. Code: 15BOPC205

Max.Marks:CIA 25;ESE -75

Credits:4

Objectives: To study Histological and Pharmacognostical tools for identification of plants. To understand the anomaly existing in Dicot and Monocot angiospermic plants. To study the developmental stages in Angiosperms. Histological tools for identification of plants.

UNIT I

18 Hrs.

Tissues- Meristem – Types- Shoot apex- Root apex. Vascular cambium – origin – types – structure and Functions – Phylogenetic trends of specialization of xylem and phloem. Secondary xylem and *Secondary phloem*.

UNIT II

18 Hrs.

Epidermis – Types – wall structure – *stomata* – epidermal appendages – Periderm - Leaf Histology – ontogeny – Development of Dicot and Monocot Leaves – Leaf Abcission- Nodal Anatomy. Anatomy in relation to Taxonomy.

UNIT III

18 Hrs.

Anomalous secondary thickening - Sapindaceae – Bignoniaceae – Amarantaceae – Aristolochiaceae - Nyctaginaceae and Piperaceae – *Arborescent monocots*.

UNITIV

18Hrs.

Embryology- Anther – Morphology - Tapetum – ultra structure- types and functions. Male gametophyte-development. Female Gametophyte – Types- ultra structure – development – Synergids- Nutrition of embryo sac - *fertilization and double fertilization*.

UNIT V

18 Hrs.

Endosperm – Types and development. Endosperm haustoria – function - storage metabolites- Embryo – Development of a typical Monocot and Dicot embryo – **Polyembryony**- Apomixis and *Parthenocarpy*.

Note: *Italics* denote self study topics.

Practicals

Anatomy

Study of anatomical features with the help of section – peelings and macerations included in the syllabus

Embryology

With the help of permanent slides/book diagrams to study

1. Stage in development of micro sporangium and male gametophyte.
2. Configuration of ovules 2, 4, nucleate embryo sac, mature embryo sac.
3. Types of endosperm
4. Stages in embryogeny globular, proembryo matured embryo of Dicot (dissection)
5. Pollen germinability

Reference Books

1. **Eames, A.J., and Daniel, M.C.**, “*An introduction to plant anatomy*”, TATA Mc Graw – Hill-Publishing House LTD.,1976.
2. **Pandey, B.P.**, “*Plant Anatomy*”, S. Chand and Company LTD., New Delhi,1978.
3. **Raghavan, V.**, “*Experimental embryogenesis in Vascular plants*”, Academic Press, London, 1976.
4. **Austin**, “*Fertilization*”, Prentice Hall of India, New Delhi,1968.
5. **Bhojwani S.S. and S.P. Bhatnagar**, “*The embryology of angiosperms*”, Vikas publishing House Pvt. Ltd, New Delhi, 1985.
6. **Johri, B.M.**, “*Experimental embryology of vascular plants*”, Narasu Publications house, New Delhi, 1982.
7. **Maheswari, P.**, “*Introduction to the embryology of Angiosperms*”, Mc Graw Hill Book Co. Inc., New York, 1958.
8. **Raghavan, V.**, “*Experimental embryogenesis in vascular plants*”, Academic Press, London, 1976.
9. **Shivanna, K.R. and B.M. Johri**, “*The angiosperm pollen structure and functions*”, Wiley–Eastern Ltd., 1985.

SEMESTER – II

Core Paper –VI

CELL BIOLOGY AND TISSUE CULTURE

Instructional Hrs.:90

Sub. Code: 15BOPC206

Max.Marks:CIA25;ESE-75

Credits:4

Objectives: To comprehend the structure of cell organelles. To understand the structure and replication of nucleic acid .To develop the skill of *in vitro* propagation and application in horticulture and forestry.

UNIT I

18 Hrs.

Cell Organelles- Cell-ultra structure - Cytoplasmic organelles - origin-structure and function of Mitochondria-Golgi apparatus- Plastids- Ribosome- Dictyosome - *Glyoxysome* and *Peroxisome*.

UNIT II

18 Hrs.

Plasma membrane- Ultra Structure and functions. Cell wall- primary- secondary and tertiary at microscopic and submicroscopic levels. Chemistry of cell wall- Structure and functions of nucleus- nuclear envelope and *nucleolus*- Chromosomes - Structure and function.

UNIT III

18 Hrs.

Cell divisions- *Mitosis*- mitotic apparatus and its significance. *Meiosis* and its significance. DNA – Structure (Watson and Crick model) - synthesis and replication - termination of replication -Role of Enzymes in DNA replication - Methylation and Repair mechanism. Types of DNA - Mitochondrial and chloroplast DNA. Types and synthesis of RNA.

UNIT IV

18 Hrs.

Tissue culture – Concepts and Applications – *Basic steps* (Preparation of media- sterilization – inoculation – incubation – regeneration - hardening and plantlet transfer) Type of cultures – **callus and suspension culture Meristem culture,** Protoplast isolation and culture - **Hybrids** and Cybrids- Somatic hybridization

UNIT V

18 Hrs.

Somaclonal variation- Somatic embryogenesis- Haploid production- and Embryo culture-**Synthetic seed** - Cryopreservation-Application of tissue culture in Agriculture- Horticulture and *Forestry*.

Note: *Italics* denote self study topics.

Practicals

Cell biology

1. Study of meiosis using smears.
2. Interpretation of micrographs from standard purchased materials or from transparencies.

Tissue Culture

Preparation of stock solution- sterilization- inoculation- nutrient media- organ culture- Morphogenesis- Induction of callus- synthetic seed preparation

References Books

1. **Archana Sharma**, "*Chromosomes*", Oxford and IBH Publishing Company , 2nd Ed., 1985.
2. **Freifelder, D.**, "*Molecular Biology*", Narosa publishing house, New Delhi, 2nd Ed.,1983.
3. **Verma P.S. and Agarwal V. K.**, "*Cytology*", Chand and company Ltd., Publications, New Delhi,1978.
4. **Young, W.J.**, "*Cytogenetics*", Prentice Hall India, Pvt. Ltd. 2nd Ed., 1988.
5. **Watson, J.D. and Benjamin W.A.** , "*Molecular Biology of the genes*", 3rd Ed.
6. **De Robertis, E.D. P., Wiktor, W. Nowinski & Francisco A. Saez** "*Cell Biology*" W.B Saunders Company, London and Toppon Company Ltd., Japan.
7. **Kumar, N.C.**, "*An Introduction to Plant Tissue and Cell Culture*", Emkay Publications, New Delhi, 1994.
8. **Razdon, M.K.**, "*Introduction to plant tissue culture*", second Edition. Oxford IBH Publishing co. PVT., LTD., New Delhi,1995.
9. **Singh, Seema Srivastava**, "*Plant tissue culture*", Campus books International, New Delhi, 2006.

SEMESTER – II

Core Paper -VII

GENETICS, GERMPLASM CONSERVATION AND PLANT BREEDING

Instructional Hrs.: 90

Sub. Code: 15BOPC207

Max.Marks: CIA 25; ESE -75

Credits:4

Objectives: To discern the genetical disorders in life forms. To understand the regulation of gene expression. To know the hybridization methods and techniques in crop plants.

UNIT I

18Hrs.

Interaction of genes – Lethal factors- Modifying factors- collaborative factors. Co dominance - Quantitative inheritance - sex determination in plants- Theories of sex determination (theory of Heterogametic&Genic balance)-Sex limited characters, *Sex influenced gene*.

UNIT II

18Hrs.

Gene mutation - Detection of mutation (CLB Method - Muller 5 method). *Physical and chemical mutagens* and their mode of action. Eugenics- Euthenics- genetic disorder of chromosomal and genic origin. Extrachromosomal inheritance - Uniparental inheritance in Chlamydomonas and Yeast. Male sterility in Maize.

UNIT III

18 Hrs.

Population genetics – gene frequency –Hardy Weinberg law, *Genetic drift*. Modern concept of genes- Structure of gene-IS Element and Transposons. Regulation of gene expression in Prokaryotes and Eukaryotes Artificial synthesis of gene.

UNIT IV

18 Hrs.

Germplasm conservation- World diminishing plant resources-*Threatened and endangered plants*. Red Data Books. The role of IBPGR (Rome, Italy) and NBPGR (New Delhi) in Germplasm Conservation - Patent and Intellectual Property Rights (IPR).

UNIT V

18 Hrs.

Plant breeding – Objectives, breeding methods in self-fertilized - cross fertilized and vegetatively propagated plants. Breeding plants for improving yield and quality and resistant to diseases. *Distant hybridization in Plant breeding*.

Note: *Italics denote self study topics.*

Practicals

Solving Problems involving:

1. Interactions of factors
2. Sex linked inheritance
3. Quantitative inheritance
4. Calculation of gene frequencies
5. Training in hybridization techniques

Reference Books

1. **Arnold, R.W.**, "*Principles of Plant Breeding*", John Willey & Sons, 1960.
2. **Gilber, N.W.**, "*Organellar Heredity*", Revan Press, New York, 1978.
3. **Gupta, P.K.**, "*Genetics*", Rastogi Publication, Meerut, India, 1994.
4. **King, R.C.**, "*A Hand book of Genetics*", Plenum Press, New York, 1994.
5. **Singh, B.D.**, "*Plant Breeding: Principles and Methods*", Kalyani Publishers, 2008.
6. **Singh, B.D.**, "*Genetics*", Kalyani Publishers, 2008.
7. **Swaminathan, M.S. and Jana. S.**, "*Biodiversity*", Mac Millan, India Press, Madras, 1992.
8. **Verma P. S. and Agarwal , V.K.**, *Genetics*, S. Chand & Co, New Delhi, 2006.