

SACRED HEART COLLEGE (AUTONOMOUS)

Department of BOTANY

MASTER OF SCIENCE IN BOTANY

Course plan

Academic Year 2016 - 17

Semester I

COURSE PLAN

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| PROGRAMME | M.Sc. BOTANY | SEMESTER | 1 |
| COURSE CODE AND TITLE | 16P1BOTT01- MICROBIOLOGY AND PHYCOLOGY | CREDIT | 4 |
| HOURS/WEEK | 6.5 | HOURS/SEM | Theory 27 + 45 hrs; Practical 9 + 36 hrs |
| FACULTY NAME | PRINCY MOL A. P. | | |

COURSE OBJECTIVES

To know the world of microbial diversity and their evolutionary relationships

To explain the reproductive behaviour in Algae and other microbes

To examine ecological significance of the lower groups of plants and protists

To examine economic significance of the lower groups of plants and protists

To develop a practice to collect and identify various algal forms

| SESSION | TOPIC | LEARNING RESOURCES | VALUE ADDITIONS | REMARKS |
|-----------------------------------|--|--|----------------------|---------|
| MICROBIOLOGY | | | | |
| Introduction to the course | | | | |
| 1 | History of Microbiology, Scope of microbiology. Microbial diversity: Microbial taxonomy and phylogeny | Lecture/ Interaction/ PPT | | |
| 2 | Major groups and their characteristics (Five kingdom system and three domain system of classification) | Lecture/ Interaction/ PPT | | |
| 3 | Microbes in everyday life. | Lecture/ Interaction/ PPT | | |
| MODULE I: Bacteria | | | | |
| 4 | (a) Bacterial morphology. Classification of Bacteria according to Bergey's manual of systematic bacteriology | Lecture/ Interaction/ PPT | e resource | |
| 5 | Modern trends in bacterial taxonomy- DNA barcoding. | Lecture/ Interaction/ PPT | e resource, video | |
| 6 | (b) Ultra structure of Gram positive and Gram negative bacteria; cell membrane, cell wall | Lecture/ Interaction/ PPT/ Audio visual learning/ Practical | e resource, video | |
| 7 | External structures-flagella, pili, fimbriae, capsule (glycocalyx) and slime, Internal/ cytoplasmic structures-Nucleoid, ribosome and endospores | Lecture/ Interaction/ PPT/Audio visual learning | e resource | |
| 8 | (c) Major groups of Bacteria: Spirochaetes, Rickettsias, Chlamydias, Mycoplasmas, Actinomycetes, Myxobacteria | Lecture/ Interaction/ PPT/Audio visual learning | e resource, video | |
| 9 | Archaeobacteria. Extremophiles - thermophilic, halophilic, acidophilic and alkalophilic bacteria. | Lecture/ Interaction/ PPT/Audio visual learning/ Assignment | e resource | |
| 10 | (d) Nutritional types - Photolithotrophs, chemolithotrophs | Lecture/ Interaction/ PPT | | |

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| 11 | Photoorganotrophs, and chemoorganotrophs. | Lecture/ Interaction/ PPT | | |
| 12 | (e) Bacterial Genetics: Organization and replication of genetic material in bacteria – bacterial chromosome, plasmid. | Lecture/ Interaction/ PPT | e resource | |
| 13 | Recombination in bacteria - conjugation, transformation and transduction. Sexduction. | Lecture/ Interaction/ PPT | e resource | |
| 14 | Application of bacteria in recombinant technology and genomics. | Lecture/ Interaction/ PPT/ Assignment | | |
| 15 | (f) Culture of microorganisms: Methods for isolating pure cultures, types of culture media, enrichment culture techniques, maintenance and preservation of pure cultures. | Lecture/ Interaction/ PPT/ Practical | e resource | |
| CIA I | | | | |
| MODULE II: Applied Microbiology | | | | |
| 16 | (a) Host-Microbe relationships and diseases | Lecture/ Interaction/ PPT | e resource | |
| 17 | (b) Food Microbiology: food spoilage and preservation methods, Microbiology of fermented foods, Microorganisms as source of food-SCP. | Lecture/ Interaction/ PPT/ Assignment | e resource | |
| 18 | (c) Agricultural Microbiology: Management of agricultural soils, bio-fertilizers, bio-pesticides. | Lecture/ Interaction/ PPT/ Assignment | e resource | |
| 19 | (d) Industrial Microbiology: Production of alcohol, vinegar, antibiotics, vitamins, steroids, vaccines, organic acids and amino acids. | Lecture/ Interaction/ PPT/ Assignment | e resource | |
| MODULE III: Viruses | | | | |
| 20 | (a) Nomenclature and classification | Lecture/ Interaction/ PPT | e resource | |
| 21 | Distinctive properties of viruses, morphology (symmetry) and a general account on different kinds of viruses. | Lecture/ Interaction/ PPT | e resource | |
| 22 | Capsid and their arrangements, types of envelops and their composition. Viral genome. | Lecture/ Interaction/ PPT | e resource | |
| 23 | (b) Structure of bacteriophages belonging to 'T' series. Lytic and Lysogenic phages. | Lecture/ Interaction/ PPT | e resource | |
| 24 | Ultra structure of TMV and HIV | Lecture/ Interaction/ PPT | e resource | |

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| 25 | (c) Sub viral particles – prions, viroids, virusoid | Lecture/ Interaction/ PPT | e resource | |
| 26 | (d) Pathogenesis of viral infection: Stages of infection | Lecture/ Interaction/ PPT | e resource | |
| 27 | Epidemiology and transmission of HIV and HPV, Viral oncogenesis | Lecture/ Interaction/ PPT/ Assignment | e resource | |
| PRACTICAL | | | | |
| 28 | Preparation and sterilization of various microbial culture media and inoculation. | Lab work | | |
| 29 | Differential staining of bacteria using Gram stain. | Lab work | | |
| 30 | | | | |
| 31 | Isolation of Rhizobium from root nodules. | Lab work | | |
| 32 | Isolation of microbes from soil: Serial dilution - pour plate/spread plate method. | Lab work | | |
| 33 | | | | |
| 34 | | | | |
| 35 | Streak out a bacterial culture on an agar plate and isolation of colonies. | Lab work | | |
| 36 | Antibacterial assay - disc diffusion/agar well method. | Lab work | | |
| PHYCOLOGY | | | | |
| MODULE I - Introduction | | | | |
| 37 | History of algal classification. Detailed study of the classification by F. E. Fritsch | PPT/ Lecturing | | |
| 38 | Brief account on the classification (Upto groups and divisions) by Edward Lee (2008). Gene sequencing and algal systematics | PPT/ Lecturing | | |
| 39 | Centers of algal research in India. Contributions of Indian phycologists – M. O. P. Iyengar, G.S. Venkataraman, T. V. Desikachary | PPT/ Lecturing | | |
| 40 | Centers of algal research in India. Contributions of Indian phycologists – M. O. P. Iyengar, G.S. Venkataraman, T. V. Desikachary | PPT/ Lecturing | | |
| MODULE II - General features of Algae | | | | |
| 41 | Habit, habitat and distribution of Algae | PPT/ Lecturing | Original Video and Photos | |

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| 42 | Major characteristics of Cyanophyceae | PPT/ Lecturing | Original Video and Photos | |
| 43 | Major characteristics of Chlorophyceae | PPT/ Lecturing | Original Video and Photos | |
| 44 | Major characteristics of Chlorophyceae | PPT/ Lecturing | Original Video and Photos | |
| 45 | Major characteristics of Xanthophyceae | PPT/ Lecturing | Original Video and Photos | |
| 46 | Major characteristics of Bacillariophyceae | PPT/ Lecturing | Original Video and Photos | |
| 47 | Major characteristics of Dinophyceae | PPT/ Lecturing | Original Video and Photos | |
| 48 | Major characteristics of Phaeophyceae | PPT/ Lecturing | Original Video and Photos | |
| 49 | Major characteristics of Rhodophyceae | PPT/ Lecturing | Original Video and Photos | |
| 50 | Range of thallus structure | PPT/ Lecturing | Original Photos | |
| 51 | Algal components: Cell wall, flagella, eye-spot. | PPT/ Lecturing | | |
| 52 | Algal components: pigments, pyrenoid, photosynthetic products. | PPT/ Lecturing | | |
| 53 | Reproduction in algae: Vegetative, asexual and sexual reproduction | PPT/ Lecturing | | |
| 54 | Major patterns of life cycle and post fertilization stages in Phaeophyceae and Rhodophyceae | PPT/ Lecturing | | |
| 55 | Fossil algae | PPT/ Lecturing | | |
| MODULE III & IV - Algal ecology and Economic importance of Algae | | | | |
| 56 | Ecological importance of Algae. Primary productivity. | Lecture | | |
| 57 | Ecological importance of Algae. Algae in symbiotic association, Ultraviolet radiation absorption by algae | PPT/Lecture | | |
| 58 | Algae as food, fodder, biofertilizer, medicine, industrial uses and other useful. | PPT/Lecture | | |
| 59 | Algae in experimental studies. (SCP, Biofuel, Live feeds, EPS.) | PPT/Lecture | | |

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| 60 | Harmful effects of algae: Algal blooms, causative organisms, symptoms and toxins of major toxic algal blooms (Amnesic Shellfish Poisoning [ASP]) | PPT/Lecture | | |
| 61 | Harmful effects of algae: Algal blooms, causative organisms, symptoms and toxins of major toxic algal blooms: Paralytic Shellfish Poisoning [PSP] and Cyanophycean toxins) | PPT/Lecture | | |
| MODULE V - Algal biotechnology | | | | |
| 62 | Methods and techniques of collection, preservation and staining of Algae. | PPT/Lecture/ Demo | | |
| 63 | Methods and techniques of collection, preservation and staining of Algae. | PPT/Lecture/ Demo | | |
| 64 | Algal culture: Importance, methods; Algal culture media. | PPT/Lecture/ Demo | | |
| CIA II | | | | |

| ASSIGNMENTS AND SEMINARS | | | |
|---------------------------------|--|--|---------|
| | Topic | Nature of Assignment | Remarks |
| MICROBIOLOGY | | | |
| 1 | Archaeobacteria | Review report on recent research works in the respective fields of Microbiology | |
| 2 | Bacteria in recombinant technology and genomics | | |
| 3 | Food Microbiology | | |
| 4 | Agricultural Microbiology | | |
| 5 | Industrial Microbiology | | |
| 6 | Viral oncogenesis | | |
| PHYCOLOGY | | | |
| 7 | Algal Diversity - Thallus nature, Habitat difference, Habit; Association with other plants and animals | Visit to an Algal research station. Prepare and submit a report of the field work/research station visit | |

REFERENCES

1. Fritsch F. E, 1945. Structure and Reproduction of Algae. Vol.1: Cambridge University Press, London.
2. Anand N, 1989. Culturing and cultivation of BGA. Handbook of Blue Green Algae.
3. Lee Robert Edward, 2009. Phycology. 4th Edn. Cambridge University Press, New Delhi.
4. Sharma O.P, 2004. Text Book of Algae, Tata Mc. Graw Hill Co.
5. Vasishta B R, Sinha A.K, Singh V.P, 2004. Botany: Algae. S. Chand & Co. Ltd. New Delhi.
6. Chapman, V. J, 1962. The Algae.: Macmillan& co. Ltd, London
7. Christian Hoek, 1995. Algae: An Introduction to Phycology, Cambridge University Press.

8. John J & Francis M.S, 2013. An Illustrated Algal Flora of Kerala, Vol.I: GCS Books, Cochin.
9. Andersen R A (Ed) 2004. Algal Culturing Techniques, Elsevier.
10. Fritsch F. E, 1945. Structure and Reproduction of Algae. Vol.1: Cambridge University Press, London.
11. Das S K, Adhikary S B (2014). Freshwater Algae of Eastern India. Astral International.
12. Reynolds C S (2006). Ecology of phytoplankton, Cambridge University Press
13. Black, J. G. (2008). Microbiology: Principles and Explorations (8th edn.), John Wiley & Sons, INC, New York
14. Prescott, L. M., Harley, Klein (2002). Microbiology (5th Edition).
15. Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley, and Klein's Microbiology (7th Edition), Mc Graw Hill
16. Madigan, M. T., Matinko, J. M., Bender, K. S., Buckley, D. H. and Stahl, D. A. (2017). Brock Biology of Microorganisms (14th edn.), Pearson India Education Services Pvt. Ltd.
17. Bauman, R. W. (2017). Microbiology with diseases by Taxonomy (4th edition), Pearson India Education Services Pvt. Ltd.
18. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. (2007). Microbiology (5th edn.). Tata McGraw Hill, New Delhi
19. Salle, A. J. (1943). Fundamental Principles of Bacteriology (2nd edn.), McGraw Hill Book Company, Inc., New York
20. Harvey, R. A., Cornelissen, C. N. and Fisher, B. D. (2007) Lippincott's Illustrated Reviews: Microbiology (3rd edn.), Lippincott Williams and Wilkins

21. Ananthanarayan, R. & Paniker, C. K. J. (editor) (2005) Ananthanarayan and Paniker's Textbook of Microbiology (7th edn.)
22. Brooks, G. F., Carroll, K. C., Butel, J. S. Morse, S. A. and Mietzner, T. A. (2010) Jawetz, Melnick & Adelberg's Medical Microbiology (26th edition), McGraw Hill
23. Betsy, T. and Keogh, J. (2005) Microbiology DeMYSTiFieD a self teaching guide, McGraw Hill, New York
24. Kleyn, J. and Bicknell, M. (2003) Kleyn – Bicknell: Microbiology Experiments: A Health Science Perspective (4th edn.), McGraw Hill Companies
25. Lerner, K. L. and Lerner, B. W. (2003). World of Microbiology and Immunology (1st edn.), Thomson Gale, New York
26. Alexander, S. K., Strete, D. and Niles, M. J. (2003). Laboratory exercises in Organismal and Molecular Microbiology

27. Kannan, N. (2002). Laboratory manual in general Microbiology, Panima publishing corporation, New Delhi
28. Sharma, K. (2009). Manual of Microbiology – Tools & Techniques (2nd edn.), Ane Books Pvt. Ltd., New Delhi
29. Mudili, J. (2007). Introductory Practical Microbiology, Narosa Publishing House, New Delhi

COURSE PLAN

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|-----------------------|--|-----------|---|
| PROGRAMME | M. Sc. Botany | SEMESTER | 1 |
| COURSE CODE AND TITLE | MYCOLOGY AND CROP PATHOLOGY (16P1BOTT02) | CREDIT | 4 |
| HOURS/WEEK | 4 | HOURS/SEM | Theory 27 + 45 hrs; Practical 9 + 36 hrs |
| FACULTY NAME | Lesly Augustine | | |

| COURSE OBJECTIVES |
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| To enable the students to collect, preserve, identify and classify different micro and macro fungi. |
| To have a better understanding on different classification systems and their applications |
| To enrich the significance of mycotic diseases |
| To have advanced learning about fungal associations, their usefulness and harmfulness |
| To develop advanced theoretical and practical knowledge about phytopathogens and their control. |

MYCOLOGY (Theory 45hrs; Practical 36 hrs)

| SESSION | TOPIC | LEARNING RESOURCES | VALUE ADDITIONS | REMARKS |
|-------------------------------|---|--------------------|-----------------|---------|
| Introduction to Course | | | | |
| | Introduction to the Course | PPT/Lecture | video | |
| | General characters of fungi. | PPT/Lecture | Seminar | |
| | Economic importance of fungi. | PPT/Lecture | Seminar | |
| | Ecological importance of fungi. | PPT/Lecture | Seminar | |
| MODULE I | | | | |
| 1 | General characters of Fungi and their significance | PPT/Lecture | | |
| 2 | Principles of classification of fungi | PPT/Lecture | | |
| 3 | Classifications by G C Ainsworth (1973) | PPT/Lecture | | |
| 4 | Classifications by C. J. Alexopoulos | PPT/Lecture | | |
| 5 | Classification of true fungi (down to the level of class) according to the current „AFTOL“ scheme (Hibbett et al. 2007) | PPT/Lecture | Article reading | |
| 6 | Brief account of DNA barcoding in fungi. | PPT/Lecture | | |
| MODULE II | | | | |
| 7 | Mycelial structure and reproduction of Myxomycota | PPT/Lecture | video | |
| 8 | Mycelial structure and reproduction of Acraciomyctes | PPT/Lecture | | |

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| 9 | Mycelial structure and reproduction of Hydromycomycetes | PPT/Lecture | | |
| 10 | Mycelial structure and reproduction of Myxomycetes | PPT/Lecture | | |
| 11 | Mycelial structure and reproduction of Plasmodiophoromycetes | PPT/Lecture | | |
| 12 | Mycelial structure and reproduction of Mastigomycotina | PPT/Lecture | | |
| 13 | Mycelial structure and reproduction of Chitridiomycetes | PPT/Lecture | | |
| 14 | Mycelial structure and reproduction of Hyphochytridiomycete | PPT/Lecture | | |
| 15 | Mycelial structure and reproduction of Oomycetes. | PPT/Lecture | | |
| 16 | Mycelial structure and reproduction of Zygomycetes | PPT/Lecture | | |
| 17 | Mycelial structure and reproduction of Trichomycetes. | PPT/Lecture | | |
| 18 | Mycelial structure and reproduction of Ascomycotina | | | |
| 19 | Mycelial structure and reproduction of Hemiascomycetes | PPT/Lecture | video | |
| 20 | Mycelial structure and reproduction of Pyrenomycetes, | PPT/Lecture | video | |
| 21 | Mycelial structure and reproduction of Plectomycete | PPT/Lecture | | |
| 22 | Mycelial structure and reproduction of Discomycetes | PPT/Lecture | video | |
| | CIA-1 | | | |
| 24 | Mycelial structure and reproduction of Laboulbeniomycete | PPT/Lecture | | |
| 25 | Mycelial structure and reproduction of Loculoascomycetes | PPT/Lecture | | |
| 26 | Mycelial structure and reproduction of Basidiomycotina | | | |
| 27 | Mycelial structure and reproduction of Teliomycetes | PPT/Lecture | | |
| 28 | Mycelial structure and reproduction of Hyphomycetes | PPT/Lecture | | |
| 29 | Mycelial structure and reproduction of Gastromycetes | PPT/Lecture | | |
| 30 | Mycelial structure and reproduction of Deuteromycotina | | | |
| 31 | Mycelial structure and reproduction of Blastomycetes, | | | |
| 32 | Mycelial structure and reproduction of Hyphomycetes | | | |

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| 33 | Mycelial structure and reproduction of Coelomycetes | PPT/Lecture | | |
| 34 | Types of fruiting bodies in fungi. | PPT/Lecture | video | |
| 35 | Types of fruiting bodies in fungi. | PPT/Lecture | videos | |
| 36 | Types of fruiting bodies in fungi. | PPT/Lecture | video | |
| MODULE III | | | | |
| 37 | Fungal associations and their significance | PPT/Lecture | | |
| 38 | Symbionts - Lichens, Mycorrhiza, Fungus-insect mutualism | Lecture | video | |
| 39 | Symbionts - Lichens, Mycorrhiza, Fungus-insect mutualism | PPT/Lecture | video | |
| 40 | Parasites - Common fungal parasites of plants, humans, insects and nematodes | PPT/Lecture | video | |
| 41 | Parasites - Common fungal parasites of plants, humans, insects and nematodes | PPT/Lecture | video | |
| 42 | Saprophytes - Fungal decomposition of organic matter, coprophilous fungi, cellulolytic fungi, lignolytic fungi. | PPT/Lecture | video | |
| 43 | Saprophytes - Fungal decomposition of organic matter, coprophilous fungi, cellulolytic fungi, lignolytic fungi. | PPT/Lecture | video | |
| 44 | Saprophytes - Fungal decomposition of organic matter, coprophilous fungi, cellulolytic fungi, lignolytic fungi. | PPT/Lecture | video | |
| 45 | Agricultural significance of Fungi | PPT/Lecture | video | |
| Practical | | | | |
| 46 | Critical study of the following types by preparing suitable micropreparations: Stemonitis, Physarum | Hands-on Session | | |
| 47 | Saprolegnia, Phytophthora | Hands-on Session | | |
| 48 | Albugo, Mucor, | Hands-on Session | | |
| 49 | Aspergillus, Penicillium | Hands-on Session | | |
| 50 | Pilobolous, Saccharomyces | Hands-on Session | | |
| 51 | Taphrina, Xylaria | Hands-on Session | | |
| 52 | Peziza, Phyllochora | Hands-on Session | | |
| 53 | Puccinia, Pleurotus | Hands-on Session | | |
| 54 | Auricularia, Polyporus, | Hands-on Session | | |
| 55 | Lycoperdon, Dictyophora | Hands-on Session | | |

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| 56 | Geastrum, Cyathus | Hands-on Session | | |
| 57 | Fusarium, Alternaria | Hands-on Session | | |
| 58 | Pestalotia, Tremella | Hands-on Session | | |
| 59 | Entoloma, Marasmius | Hands-on Session | | |
| 60 | Hexagonia, Ganoderma | Hands-on Session | | |
| 61 | Graphis, Parmelia, Usnea | Hands-on Session | | |
| 62 | Isolation of fungi from soil and water by culture plate technique. | Hands-on Session | Video | |
| 63 | . Estimation of mycorrhizal colonization in root | Hands-on Session | | |
| 64 | Collection and identification of common field mushrooms (5 types). | Hands-on Session | | |
| 65 | Field Visit | Experiential learning | | |
| 66 | Field Visit | Experiential learning | | |
| 67 | Field Visit | Experiential learning | | |
| 68 | Field Visit | Experiential learning | | |
| 69 | Field Visit | Experiential learning | | |
| 70 | Field Visit | Experiential learning | | |
| 71 – 72 | Revision | | | |

References

- C J Alexopoulos, M Blackwell, C W Mims (1996). Introductory Mycology (IV Edn).
- Jim Deacon (2006). Fungal Biology (IV Edn). Blackwell Publishing.
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- Hibbet et al. (2007). A higher-level phylogenetic classification of the fungi. Mycological Researcher 111 (2007) pp. 509-547.

CROP PATHOLOGY (Theory 27hrs; Practical 18 hrs)

| SESSION | TOPIC | LEARNING RESOURCES | VALUE ADDITIONS | REMARKS |
|--|--|--------------------|-----------------|---------|
| Introduction to Course | | | | |
| | Introduction to the Course | PPT/Lecture | video | |
| | A brief history of plant pathology, Koch's postulates, Concept of Disease | PPT/Lecture | Seminar | |
| | Classification of plant diseases based on (a) Major causal agents - biotic and abiotic, (b) General symptoms, (c) Occurance | PPT/Lecture | Seminar | |
| | | | | |
| MODULE I, Process of infection and pathogenesis (4 hrs) | | | | |
| 1 | (a) Disease triangle, Maz's Disease Pyramid (b) Development of disease in plants: disease cycle (survival or persistence of pathogen between crops and during unfavorable seasons, dissemination of the pathogen, inoculation, recognition between host and pathogen, entry of pathogen (prepenetration & penetration), colonization) | PPT/Lecture | vedio | |
| 2 | (c) Strategies used by pathogens to attack plants. (d) Mechanism of infection- Penetration and entry of pathogen into host tissue – mechanical, physiological and enzymatic. | PPT/Lecture | vedio | |
| 3 | (e) Host-parasite interaction (f) Role of biochemicals in pathogenesis: enzymes, toxins (Tabtoxin, Phaseolotoxin, Tentoxin, Cercosporin, Victorin, T Toxin, HC Toxin), growth regulators and polysaccharides. | PPT/Lecture | | |

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| 4 | (g) Detoxification of low molecular weight antimicrobial molecules produced by plants, suppression of plant defense responses, Pathogenicity and virulence factors in viruses and viroids (h) Physiology of Parasitism: Effect of pathogens on the following processes of the host plant – photosynthesis, transpiration, translocation of water and nutrients, respiration, cell membrane permeability, transcription and translation, growth and reproduction. | PPT/Lecture | | |
| Module 2: Defense mechanism in plants (4 hrs) | | | | |
| 5 | (a) Non-host resistance, horizontal resistance, vertical resistance | PPT/Lecture | | |
| 6 | Pre-existing defense mechanisms: structural and biochemical (Inhibitors released by the plant in its environment, inhibitors present in plant cells before infection, Defense through lack of essential factors) | PPT/Lecture | | |
| 7 | Post-Infection/Induced/Dynamic defense mechanisms: structural (cell wall defense structures, histological defense structures) and biochemical (Defense through Production of Secondary Metabolites, Pathogen elicitors, Hypersensitive defense reaction) | PPT/Lecture | | |
| 8 | Post-Infection/Induced/Dynamic defense mechanisms: structural (cell wall defense structures, histological defense structures) and biochemical (Defense through Production of Secondary Metabolites, Pathogen elicitors, Hypersensitive defense reaction) | PPT/Lecture | | |
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| Module 3: Transmission of plant disease (2 hrs) | | | | |
| 9 | Mass action concept by Horsfall; Autonomous or direct or active dissemination (seed, soil & plant organs) & Passive or indirect dissemination (through animate & inanimate agents) Plasmodiophoromycetes | PPT/Lecture | | |
| 10 | Spread and transmission of plant diseases by wind, water, seeds and vectors. | PPT/Lecture | | |

| Module 4: Effect of environmental factors on the development of plant diseases (2 hrs) | | | | |
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| 11 | Effect of, temperature, moisture, wind, light, soil pH, host plant nutrition | PPT/Lecture | | |
| 12 | Effect of, temperature, moisture, wind, light, soil pH, host plant nutrition, | PPT/Lecture | | |
| Module 5: Plant disease management (4 hrs) | | | | |
| 13 | (a) Prophylatic methods - Exclusion, eradication and protection. | PPT/Lecture | | |
| 14 | (b) Therapeutic Method; Chemical means of disease control – common fungicides, antibiotics and nematicides. pesticides, and bactericides, types of pesticides based on toxicity- red, blue, yellow, green labels and residual effect. Method of application, different types of sprayers and their working. | PPT/Lecture | | |
| 15 | (c) Biological means of disease control - (Psuedomonas, Trichoderma, Bruvaria, PGPR, VAM)control of fungal plant pathogens by mycofungicides. (d) Production &use of disease resistant hybrids | PPT/Lecture | Group discussion | |
| 16 | (e) Immunization of plants against pathogens – defense through plantibodies, induction of plant defenses by artificial inoculation with microbes or by treatment with chemicals (f) Transgenic approaches to disease resistance. Defense through genetically engineering disease resistant plants – Biotechnological approaches to disease resistance | PPT/Lecture | Group discussion | |
| Module 6: Major diseases in plants (10 hrs) | | | | |
| 17 | (a) Cereals: Rice - blast disease, bacterial blight; Wheat - black rust disease. | PPT/Lecture | | |
| 18 | (b) Vegetables: Chilly - leaf spot; Ladies finger - vein clearing disease, mosaic disease; Tomato - Damping off, Serpentine leaf miner, fusarium wilt; Cucurbita-Epinauca disease; Root knot in vegetables. | PPT/Lecture | | |
| 19 | (c) Fruits: Banana - bacterial leaf blight, leaf spot, Pseudo stem borer; Mango - Anthracnose; Fruit borer; Citrus - bacterial canker;Papaya – mosaic, mealy bug disease, | PPT/Lecture | | |
| 20 | (d) Spices: Ginger - rhizome rot; Pepper - quick wilt; Cardamom - marble mosaic disease. | PPT/Lecture | | |

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| 21 | (e) Oil seeds: Coconut - grey leaf spot, bud rot disease. | | | |
| 22 | (f) Rubber yielding: Hevea braziliensis - abnormal leaf fall, powdery mildew. | PPT/Lecture | | |
| 23 | (g) Sugar yielding: Sugarcane - red rot; root knot nematode. | PPT/Lecture | | |
| 24 | (h) Cash crops: Arecanut - nut fall disease. | | | |
| 25 | (i) Beverages: Tea - blister blight; Coffee - rust. | PPT/Lecture | | |
| 26 | (j) Ornamental plants: Anthurium – Bacterial wilt; Rose – Fungal Black Spot; Mite attack; Orchids- bud fall | PPT/Lecture | | |
| CIA - II | | | | |
| Practical | | | | |
| 27 | Make suitable micropreparations and identify the diseases mentioned with due emphasis on symptoms and causative organisms. | Hands-on Session | | |
| 28 | Make suitable micropreparations and identify the diseases mentioned with due emphasis on symptoms and causative organisms. | Hands-on Session | | |
| 29 | Make suitable micropreparations and identify the diseases mentioned with due emphasis on symptoms and causative organisms. | Hands-on Session | | |
| 30 | Make suitable micropreparations and identify the diseases mentioned with due emphasis on symptoms and causative organisms. | Hands-on Session | | |
| 31 | Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method. | Hands-on Session | | |
| 32 | Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method. | Hands-on Session | | |
| 33 | Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method. | Hands-on Session | | |
| 34 | Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method. | Hands-on Session | | |
| 35 | Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method. | Hands-on Session | | |
| 36 | Collection and preservation of specimens from infected plants. Submit 5 herbarium | Hands-on Session | | |

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| | sheets/live specimens along with a report. | | | |
| 37 | Collection and preservation of specimens from infected plants. Submit 5 herbarium sheets/live specimens along with a report. | Hands-on Session | | |
| 38 | Collection and preservation of specimens from infected plants. Submit 5 herbarium sheets/live specimens along with a report. | Hands-on Session | | |
| 39 | Tests for seed pathology – seed purity test. | Hands-on Session | | |
| 40 | Tests for seed pathology – seed purity test. | Hands-on Session | | |
| 41 | Tests for seed pathology – seed purity test. | Hands-on Session | | |
| 42 | Calculation of Spore load on seeds using Haemocytometer. | Hands-on Session | | |
| 43 | Calculation of Spore load on seeds using Haemocytometer. | Hands-on Session | | |
| 44 | Calculation of Spore load on seeds using Haemocytometer. | Hands-on Session | | |

References

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2. Gareth Johnes (1987). Plant pathology: principles and practice.
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7. Rangaswamy, A Mahadevan (1998). Diseases of crop plants in India.
8. B P Pandey (2001). Plant Pathology.
9. George N Agrios (2006). Plant pathology (V Edn). Elsevier Academic Press.

COURSE PLAN

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|-----------------------|--|-----------|------------------------------------|
| PROGRAMME | M.Sc. BOTANY | SEMESTER | 1 |
| COURSE CODE AND TITLE | 16P1BOTT03: Ecology, Environmental Biology, Phytogeography & Research Methodology | CREDIT | 4 |
| HOURS/WEEK | 6 | HOURS/SEM | Theory 72 hrs; Practical 36 hrs |
| FACULTY NAME | Dr. Giby Kuriakose & Mr. Anto Joseph | | |

COURSE OBJECTIVES

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| To explain the basics of ecology and environmental science. |
| To discover the theoretical and practical knowledge on ecology and environmental science. |
| To demonstrate with different mathematical and statistical models and indices to explain natural phenomena and theoretical principles with which several ecological processes are explained. |
| To identify global environment problems and discover the methods of conservation managements of natural ecosystems and rare, endemic and threatened species in the Western Ghats. |
| To explain origin of the Western Ghats and diversity and conservation in the Western Ghats. |
| To define biodiversity, phytogeography, ecosystem functioning etc. and integrate scientific aptitude and apply methodologies to pursue scientific researches. |

| SESSION | TOPIC | LEARNING RESOURCES | VALUE ADDITIONS | REMARKS |
|---|---|----------------------------|-----------------|---------|
| Module 1 Introduction to Ecology | | | | |
| 1 | Definition, history and scope of ecology, sub divisions of ecology | Lecture/ Interaction/ PPT | | |
| 2 | Ecology vs environmental science. Interdisciplinary nature of environmental science | Lecture/ Interaction/ PPT | e-resources | |
| 3 | Scope of ecology; interdisciplinary aspects of ecology | Lecture/ Interaction/ PPT | | |
| 4 | Applications of ecology in different fields (EIA, Research, education, agriculture, healthy life, etc.) | Lecture/ Interaction/ PPT | e-resource | |
| Module-2. Autecological concepts | | | | |
| 5 | Characteristics of populations - ecological amplitude - population size and exponential growth. | Lecture/ / PPT | | |
| 6 | Limits of population growth, population dynamics | Lecture/ Interaction/ PPT/ | | |

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| 7 | Life history pattern, fertility rate and age structure | Lecture/PPT | | |
| 8 | Competition and coexistence, intra-specific interactions | Lecture/ Interaction/ PPT/documentary (audio visual) | Video, e-resource | |
| 9 | Scramble and contest competition model | Lecture/ PPT/ Assignment | Video, e-resource | |
| 10 | Mutualism and commensalism, prey-predator interactions | Lecture/ Interaction/ PPT | | |
| 11 | Genecology - ecads, ecotypes, ecospecies, coenospecies | Lecture/ Interaction/ PPT | e-resources | |
| 12 | k-selection and r-selection populations, Molecular ecology and conservation genetics | Lecture/ Interaction/ PPT | Video, e-resource | |
| Module-3. Synecological concepts | | | | |
| 13 | Ecological processes of community formation, ecotone, edge effect | Lecture/ Interaction/ PPT | Video, e-resource | |
| 14 | Special plant communities - quantitative, qualitative and synthetic characteristics of plant communities. Important Value Index (IVI). | Lecture/ Interaction/ PPT/ practical/problem solving | | |
| 15 | Species diversity and its measurements - characteristics of plant communities | Lecture/ Interaction/ PPT/ Practical/problem solving | e-resource | |
| 16 | Alpha diversity and Beta diversity; definition and measures Mergalef's index, Fishers Alpha | Lecture/ Interaction/ PPT/Problem solving | e-resource | |
| 17 | Shannon and Simpson diversity indices) of Alpha diversity with comparative data. | Lecture/ Interaction/ PPT/ Assignment/Problem Solving | | |
| 18 | Beta diversity, Jaccard's similarity/dissimilarity index, Sorenson's Index of similarity and Evenness index. | Lecture/ PPT/ Practical/Problem Solving | e-resources | |
| 19 | Ecological niche and Guild; functioning and significances in community studies. | Lecture/ Interaction/ PPT/ Assignment | | |
| 20 | Functional aspects of community; co-existence, resource partitioning, spatial correlates of communities | Lecture/ Interaction/ PPT/ | | |
| 21 | Inter specific interactions with examples, co evolution and coexistence. | Lecture/ Interaction/ PPT | | |
| 22 | Community network; competition, Predation, mutualism, symbiosis, commensalism and ammensalism. | Lecture/ Interaction/ PPT/ Assignment | | |

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| 23 | Dynamic community characteristics – cyclic replacement changes and cyclic no-replacement changes. | Lecture/ Interaction/ PPT | | |
| 24 | Modelling the interspecific interactions by using network analysis approach. | Lecture/ Interaction/ PPT/ Assignment | | |
| Module-4. Ecological Succession | | | | |
| 20 | The concept – autogenic and allogenic succession | Lecture/ Interaction/ PPT | | |
| 21 | primary and secondary, autotrophic and heterotrophic | Lecture/ Interaction/ PPT | e-resource | |
| 22 | Retrogressive changes or the concept of degradation | Lecture/ Interaction/ PPT | | |
| 23 | Concept of climax or stable communities, resilience of communities, ecological balance and survival thresholds. | Lecture/ Interaction/ PPT | e-resource | |
| Module-5. Biosphere and Ecosystem | | | | |
| 30 | Comparative study of the major world ecosystems | PPT/ Lecturing | | |
| 31 | Different aquatic and terrestrial ecosystems with regard to their productivity | PPT/ Lecturing | | |
| 32 | biodiversity, energy flow | PPT/ Lecturing/Documentary | | |
| 33 | food chains and trophic levels | PPT/ Lecturing | e-resources | |
| Module-6. Environmental Pollution and Management | | | | |
| 36 | Methods of Pollution Control - bioremediation, Phytoremediation | PPT/ Lecturing | Documentary | |
| 37 | bio-augmentation, bio-films, bio-filters | PPT/ Lecturing | | |
| 38 | bio-scrubbers and trickling filters | PPT/ Lecturing | | |
| 39 | Use of bioreactors in waste management | PPT/ Lecturing | Documentary | |
| Module-7. Climate Change and other Global Environmental Issues (| | | | |
| 40 | Environmental Pollution and Management: Pollution Control- bioremediation, phytoremediation, bioaugmentation, biofilms | PPT/ Lecturing | E-resources | |
| 41 | Environmental Pollution and Management: Biofilters, bio scrubbers and trickling filters. Use of bioreactors in waste management. | PPT/ Lecturing | E-resources | |

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| 42 | Climate change and other Global Environmental Issues: Factors responsible for climate change, Climate change mitigation | PPT/ Lecturing | | |
| 43 | Climate change and other Global Environmental Issues: Global conventions and protocols on climate change- El-Nino and La Nina phenomenon and its consequences | PPT/ Lecturing | E-resources | |
| 44 | Climate change and other Global Environmental Issues: Environmental laws and biosafety, environmental monitoring and bio indicators, environmental safety provisions in Indian constitution, major environmental laws in free India | PPT/ Lecturing | E-resources | |
| 45 | Climate change and other Global Environmental Issues: UNEP-IPCC, UNFCC, | PPT/ Lecturing | Field Visit | |
| 46 | Climate change and other Global Environmental Issues: Annual environment summits- 1973 Stockholm conference to 2015 Paris Conference- new developments of annual UNFCC meetings in the coming years- Future Earth Programme | PPT/ Lecturing | E-resources | |
| 47 | Environmental Pollution and Management: Pollution Control- bioremediation, phytoremediation, bioaugmentation, biofilms | PPT/ Lecturing | E-resources | |
| Module 8. Phytogeography | | | | |
| 48 | Definition, principles governing plant distribution, factors affecting plant distribution, theories of species distribution, different types of vegetation on the earth continuous and discontinuous distribution | PPT/ Lecturing | | |
| 49 | Phytogeography: b) Climate vegetation and botanical zones of Indi; Floristic provinces in the world. | Discussion | Field Visit | |

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| 50 | b) Climate vegetation and botanical zones of Indi; Floristic provinces in the world. | PPT/ Lecturing | | |
| 51 | Remote sensing of vegetational characteristics – principle, data acquisition; GIS and GPS and their application in vegetation studies | PPT/ Lecturing | | |
| 52 | Assessment Test | MCQ | Class Test | |
| 3.2 Conservation Biology - Biodiversity and its conservation | | | | |
| 53 | Conservation Biology- Biodiversity and its conservation. Definition- Genetic, Species and ecosystem diversity- alpha beta and gamma diversity. Concept of endemism and hot spots- role of IUCN- rare endangered and threatened species, key stone species, flagship species; | | | |
| 54 | Conservation Biology- Biodiversity and its conservation: reasons for biodiversity loss; red data book- basic principles of conservation- ex-situ and in-situ conservation techniques- principles | PPT/Lecture | E-resources | |
| 55 | Conservation Biology- Biodiversity and its conservation: methods and uses of remote sensing in conservation of natural resources | Lecture | Documentary | |
| 56 | Conservation Biology- Biodiversity and its conservation: International convention on biodiversity- CITES | Lecture | E- resources | |
| 57 | National wildlife conservation policy and action plan , national forest policy | PPT/Lecture | | |
| 3.3 The Western Ghats and the Mangroves | | | | |
| 58 | Importance, origin, geology, vegetation | PPT/Lecture | | |

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| 59 | (a) diversity, resources, Concept of hotspot (The Western Ghats as a biodiversity hotspot). | PPT/Lecture | E- resources | |
| 60 | (b)Conservation biology based on case studies from the Western Ghats. (c)Vegetation types of the Western Ghats. | PPT/Lecture | | |
| 61 | (d)Sustainable development based on the resources of the Western Ghats. (e)Mangrove ecosystem and its significance in the western coast of Peninsular India. | PPT/Lecture | E- resources | |
| PRACTICAL | | | | |
| 62 | Revision and Clarification Discussions | Group Discussion/Assignments | | |
| 63 | Revision and Clarification Discussions | Group Discussion/Short Assignments | | |
| 64 | Revision and Clarification Discussions | Group Discussion/Quick Assignments | | |
| 65 | Revision and Clarification Discussions | Group Discussion/MCQ | | |
| 66 | Revision and Clarification Discussions | Group Discussion | | |
| 67 | Revision and Clarification Discussions | Group Discussion | | |
| 68 | Revision and Clarification Discussions | Group Discussion | | |
| 69 – 72 | Revision | | | |
| PRACTICAL | | | | |
| 1 | Analysis of water quality (a) Dissolved (b) Dissolved oxygen (c) COD (d) Total dissolved minerals (e) Quantitative estimation of dissolved | Lab work | | |

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|-------------|---|-------------------------|--|--|
| | mineral anions and cations in water (f) Total alkalinity & Salinity (g) conductivity (h) Colorimetric/Spectrophotometric estimation of Nitrogen/Phosphorus in water samples. | | | |
| 2 | Quantitative and qualitative community analysis. Carry out a project on species structure and the frequency, abundance, density of different species and similarity index, basal area, IVI and evenness of different communities in a natural system. | | | |
| 3 | Statistical analysis of diversity indices by using apt softwares | | | |
| 4 | Phytoplankton counting using Sedgwick Rafter counter. | | | |
| 5 | Network analysis to find out the possible interspecific interaction in any local plant community | | | |
| 6 | Interpretation of GIS/remote sensing data for landscape differentiation | | | |
| 7-33 | Field visit to natural ecosystem and identification of trophic levels, food webs and food chains, plant diversity (species and community) | Field visit based study | | |
| CIA – Model | | | | |
| 34 | Revision | | | |
| 35 | Revision | | | |
| 36 | Revision | | | |

Assignments and Seminars

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|----|---|------------------|
| 1. | Analysis of water quality (a) Dissolved (b) Dissolved oxygen (c) COD (d) Total dissolved minerals (e) Quantitative estimation of dissolved mineral anions and cations in water (f) Total alkalinity & Salinity (g) conductivity (h) Colorimetric/Spectrophotometric estimation of Nitrogen/Phosphorus in water samples. | Hands on session |
| 2. | Physico-chemical analysis of soil: Total water soluble mineral ions | Hands on session |
| 3. | Phytoplankton counting using Sedgwick Rafter counter. | Hands on session |
| 4. | Determination of organic 'C' and organic matter (biomass) in different (at least 3) locations (forest, agro ecosystem and polluted area. | Hands on session |
| 5. | Interpretation of GIS/remote sensing data for landscape differentiation | Hands on session |
| 6. | Common environmental problems, their consequences and possible solutions | Hands on session |

1. Ahmedullah M, Nayar M P (1987). *Endemic plants of India*.
5. Clarke G L (1954). *Elements of Ecology*. John Wiley Pub.
6. Dash M C (1993). *Fundamentals of Ecology*. Tata McGraw Hill.
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11. IUCN (2007). *The 2000 IUCN red list of threatened species*. IUCN. England.
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17. Michael P (1984). *Ecological methods of field and laboratory investigations*. Tata McGraw Hill.
19. Odum E P (III Edn) (1991). *Fundamentals of ecology*. Saunders and Com
24. Stiling, P. (2001). *Ecology: Theories and Applications*. Prentice Hall.
28. Walter (1987). *Vegetation of the earth*. Springer Verlag.

COURSE PLAN

| | | | |
|-----------------------|--------------------------|-----------|----|
| PROGRAMME | MASTERS IN BOTANY | SEMESTER | 1 |
| COURSE CODE AND TITLE | 16P1BOTT04: CELL BIOLOGY | CREDIT | 3 |
| HOURS/WEEK | 4 | HOURS/SEM | 81 |
| FACULTY NAME | KIRAN GEORGE KOSHY | | |

COURSE OBJECTIVES

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| To design the model of a cell, Explain the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. |
| To understand how the cells interact among themselves and with the environment through signal molecules. |
| To explain about cytoskeleton, endomembrane system, protein trafficking and cell cycle. |
| To explain the process of cell damage and death |
| To develop basic knowledge to prepare for competitive examinations in life science. |

| SESSION | TOPIC | LEARNING RESOURCES | VALUE ADDITIONS | REMARKS |
|------------------|--|--------------------|-----------------|---------|
| MODULE I | | | | |
| 1 | (a) The chemical composition of membranes: Membrane lipids, proteins and carbohydrates. | PPT | video | |
| 2 | | PPT/Lecture | | |
| 3 | | PPT/Lecture | | |
| 4 | (b) Membrane lipids and membrane fluidity: Importance of membrane fluidity, mechanisms for maintaining membrane fluidity. | PPT/Lecture | e-resource | |
| 5 | | PPT/Lecture | | |
| 6 | (c) The dynamic nature of the plasma membrane- dynamic nature of lipids and proteins | PPT/Lecture | | |
| 7 | | Lecture | | |
| 8 | | Lecture | | |
| 9 | | Lecture | | |
| 10 | | Lecture | | |
| 11 | (d) Transport of molecule across cell membrane: Simple diffusion – factors affecting diffusion, Facilitated diffusion - Carrier proteins, properties of carrier proteins, uniport, antiport and symport, Channel proteins – ion channels, porins and aquaporins, Active transport – direct and indirect mechanisms, ATPases. | PPT/Lecture | | |
| 12 | | PPT/Lecture | | |
| 13 | | PPT/Lecture | | |
| 14 | | | | |
| MODULE II | | | | |
| 15 | (a) Extracellular matrix and its composition: collagens, elastin, | PPT/Lecture | | |
| 16 | | Lecture | | |
| 17 | | Lecture | | |

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|-------------------|---|-------------|--------------------|--|
| 18 | proteoglycans, fibronectin, laminin, | Lecture | | |
| 19 | dystrophin. | Lecture | | |
| 20 | (b) Proteins in cell-cell interaction: | PPT/Lecture | | |
| 21 | cadherins, immunoglobulin super family, | PPT/Lecture | | |
| 22 | integrins, and selectins. | PPT/Lecture | | |
| 23 | (c) Cell-cell interactions: adhesion | PPT/Lecture | | |
| 24 | junction, tight junctions, gap junctions and | Lecture | | |
| 25 | plasmodesmata. | Lecture | | |
| 26 | | | | |
| MODULE III | | | | |
| 27 | (a) Structure of eukaryotic nucleus: Nuclear Envelope, Nuclear Pore Complex. | Lecture | | |
| 28 | (b) Transport into and out of the | Lecture | | |
| 29 | Nucleus: Nuclear-Localization Signals, Nuclear-Export Signals, Ran-GTP and Ran- Independent Mechanisms. | PPT/Lecture | | |
| 30 | (c) Bacterial Chromatin. Compaction of | PPT/Lecture | | |
| 31 | bacterial chromosome – Muk B and SMC | PPT/Lecture | | |
| 32 | proteins. (d) Structure of chromatin and chromosomes: histones and nonhistone proteins, nucleosome, higher levels of chromatin structure. Heterochromatin and Euchromatin. (e) Molecular structure of the Centromere and Telomere. | | | |
| MODULE IV | | | | |
| 33 | (a) Phases of cell cycle. | PPT/Lecture | | |
| 34 | (b) Cell cycle checkpoints: DNA damage | PPT/Lecture | | |
| 35 | checkpoints, Spindle assembly checkpoint | PPT/Lecture | | |
| 36 | | Lecture | Quiz | |
| 37 | (c) Master controllers of the cell cycle: Cyclins and cyclin dependent kinases | Lecture | Q & Ans Session | |
| 38 | (CDKs), Types of CDK and cyclins | PPT/Lecture | | |
| 39 | | PPT/Lecture | | |
| 40 | (d) Regulation of CDK Activity, | PPT/Lecture | | |
| 41 | Regulation of Cyclin Levels, CDK Inhibitors (CKIs) | PPT/Lecture | | |
| MODULE V | | | | |
| 42 | (a) Introduction: outline of | Lecture | | |
| | endomembrane system. | PPT/Lecture | | |
| 43 | (b) The endoplasmic reticulum: smooth and rough endoplasmic reticulum, synthesis of proteins on membrane-bound and free ribosomes and processing. | | | |
| 44 | | PPT/Lecture | | |

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| 45 | (c) The Golgi complex: glycosylation, movement of materials through the Golgi complex. | PPT/Lecture | | |
| 46 | (d) Types of vesicle transport and their functions. | PPT/Lecture | | |
| 47 | (e) Lysosomes. | PPT/Lecture | | |
| 48 | (f) Peroxisomes. | PPT/Lecture | | |
| 49 | (g) Plant cell vacuoles | PPT/Lecture | | |
| 50 | | PPT/Lecture | | |
| 51 | (h) Targeting of proteins to mitochondria, chloroplasts and peroxisomes. | PPT/Lecture | | |
| 52 | | PPT/Lecture | Video | |
| 53 | | PPT/Lecture | | |
| 54 | (i) The endocytic pathway: endocytosis and phagocytosis. | PPT/Lecture | | |
| MODULE VI | | | | |
| 55 | (a) Overview of the major functions of the cytoskeleton | | | |
| 56 | (b) Microtubules: microtubule structure and organization, microtubule dynamics, microtubule-based motor proteins: kinesins and dyneins. | Lecture | Debate | |
| 57 | (c) Microfilaments: microfilaments and actin structures, dynamics of actin filaments, actin-based motor proteins: myosins | PPT/Lecture | | |
| 58 | | PPT/Lecture | | |
| 59 | (d) Intermediate filaments: intermediate filament assembly and disassembly, types and functions of intermediate filaments. | PPT/Lecture | | |
| MODULE VII | | | | |
| 60 | (a) Cell signaling - modes of cell-cell signaling. | PPT/Lecture | | |
| 61 | (b) Signaling molecules and their receptors: Steroid hormones and the nuclear receptor superfamily, Nitric oxide and carbon monoxide, Neurotransmitters, Peptide hormones and growth factors, Eicosanoids, Plant hormones. | PPT/Lecture | | |
| 62 | | PPT/Lecture | | |
| CIA - II | | | | |
| 63 | (c) Cell Surface Receptors: G protein-coupled receptors, Receptor protein-tyrosine kinases, Cytokine receptors and nonreceptor protein-tyrosine kinases, Receptors linked to other enzymatic activities. | Lecture | Demo video | |
| 64 | | Lecture | | |
| 65 | | Lecture | Group discussion | |

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| | (d) Pathways of Intracellular Signal Transduction: cAMP pathway, Cyclic GMP, Phospholipids and Ca ²⁺ . | | | |
| MODULE VIII | | | | |
| 66 | (a) Programmed cell death | Lecture | | |
| 67 | (b) Extrinsic and Intrinsic Pathway of Apoptosis | PPT/Lecture | | |
| 68 | (c) Proteins involved in the Apoptotic Pathway | PPT/Lecture | | |
| 69 | | PPT/Lecture | | |
| 70 | | | | |
| 71 – 72 | Revision | | | |
| PRACTICALS | | | | |
| 73 | 1. Identification of different stages of meiosis from suitable plant material (Recorded by photomicrographs). MGU | Demonstration/ Hands on | | |
| 74 | 2. Identification of different stages of mitosis and study of morphology of metaphase chromosomes from Onion root meristems (Recorded by photomicrographs). MGU | Demonstration/ Hands on | | |
| 75 | | Demonstration/ Hands on | | |
| 76 | 3. Study of mitotic index from suitable plant material. 4. Study on chromosomal abnormalities in humans. | Demonstration/ Hands on | | |
| 77 | | Demonstration/ Hands on | | |
| 78 | | Demonstration/ Hands on | | |
| 79 | | Demonstration/ Hands on | | |
| 80 | | Demonstration/ Hands on | | |
| 81 | | Demonstration/ Hands on | | |
| 82 | | Demonstration/ Hands on | | |
| 83 | | Demonstration/ Hands on | | |

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

| | Date of completion | Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc) |
|---|--------------------|---|
| 1 | By October | Extracellular matrix |
| 2 | | Cytoskeleton |

References

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