Ph.D. Course Work (Botany) 2020-21

Ph.D. Course work — One Semester
Total credits 16

Paper	Code	Title	Credits
Paper I	BOT-CC- 141	Research Methodology	4 credits
Paper II	BOT-CC- 142	Fundamentals of Plant Science	4 credits
Paper III	BOT-EC- 143 BOT-EC- 144	(1) Applied Ecology (2) Applied Microbiology	4 credits
Paper IV	BOT-CC-143	Reviewing of published research in relevant field	4 credits

Course Code: BOT-C-141

Course Title: Research methodology

1. **Research problems:** Importance, aims and objectives, literature collection, methodology (Experiment design/field data collection). Data presentation and interpretation. Drawing the conclusions.
2. **Scientific paper writing**- Manuscript preparation and presentation.
3. **Computer applications**- Networking, Excel, SPS Programs, Computer modeling, PPT presentation, other Softwares related to respective research field.
4. **Statistical methods in Biology**- Mean, Variance, Standard derivation, Standard error, Chi-square and 't'-test.
5. **Physiological solution-** Solution, Buffer, pH etc.
6. **Principle of Microscopy**- Light microscope, Phase contrast, Electron microscope (SEM & TEM) and Fluorescence microscope.
7. **Principles and application of Chromatographic technique**-Gel filtration, Ion Exchange, High Pressure Liquid Chromatography (HPLC).
8. **Electrophoretic technique** and Application.
9. **Immunochemical technique**-ELISA.
10. **Spectroscopy**- Principle of Fluorescence, UV, Visible, NMR and Atomic Absorption Spectroscopy.
11. **Centrifugation** Technique and application.
12. **Estimation and extraction** of Carbohydrates, Lipids, Proteins, Nucleic Acids, Pigments, Phenolics, Phytohormons and Vitamins.

Essential readings:

1. Laboratory Techniques in Biochemistry and Molecular Biology by Peter C. van der Vliet & Shiv Pillai. (2008). Elsevier pub. ISBN 13: 978-0-08-054958-3
2. Principle and Technique of Biochemistry and Molecular Biology by Keith M. Wilson & John M. Walker (2010). Cambridge University Press.
3. Principles of Biochemistry By Michael M. Cox & David L. Nelson (Print Publication:2005; Online Publication: June 2012)

Additional readings:

4. Analytical Techniques in Biochemistry and Molecular Biology by Rajan Katoch (2011). Springer New York Dordrecht Heidelberg London. ISBN: 978-1-4419-9784-5 (Print), 978-1-4419-9785-2 (Online).
5. Biostatistics by S. Prasad.

Course Code: BOT-C-142

Course Title: Fundamentals of Plant Science

(1). Silent features of different plants groups:

1. Biological status of living beings.
2. Prokaryotes and eukaryotes.
3. Geological Time Table and Evolution.
4. **Algae:** fossil Algae, Diatomaceous Earth, Kelp, Algal bloom.
5. **Fungi:** History of Plant Pathology with reference to India, Ecological groups of fungi, fossil fungi, Mycological herbarium, Mycological Institutes, International Mycological Associations, Mycological literature.
6. **Bryophytes:** Origin and fossil history, Regeneration, Ecology, Distribution
7. **Pteridophytes:** Fossils, Reconstruction, Coal age, Tree ferns, Water ferns as synthetic group of plants.
8. **Gymnosperms:** Classification and characteristics of Gymnosperms present in University Botanical Garden, Sagar, Economic importance
9. **Angiosperms:** Artificial, Natural and Phylogenetic systems of classification, α β and ϒ taxonomy, recent trends in taxonomy, Botanical collections, Survey and Conservation, Botanical Nomenclature- Rules, Codes, Terminology, Typification, Author name and literature.

Instructors: Prof. A.N. Rai & Dr. Ashwani Kumar

(2). Genetics and Molecular Biology:

1. **Classical genetics:** Mendalian laws, Gene interaction, Chromosome theories of inheritance, Linkage and crossing over.
2. **Modern genetics:** DNA Replication in Prokaryotic and Eukaryotic systems, Genetic code, Transcription: Biosynthesis of RNA, Different types of RNAs. Translation: biosynthesis of proteins.
3. **Recombinant DNA technology and gene cloning techniques:** Restriction endonuclease, Vectors for gene cloning, Cloning in bacteria and eukaryotes, PCR, Gel Electrophoresis, Sequencing of nucleic acid, Southern, Northern, & Western blotting techniques, Human genome project. Applications of Biotechnology in agriculture and forestry.

(3). Fundamentals of Environmental Science:

1. **Ecology:** History and Development, Basic Principles, Kinds of Ecosystem, Understanding of Ecosystem concept and functions.
2. **Community**: Concept, Structure and Analysis

Essential Readings:

1. Watson, E.V. (1964). The structure and life of Bryophytes, Hutchinson University Library, Landon.
2. Parihar, N.S. (1968). An Introduction to Embryology Vol I-Bryophytes. Central Book Dept., Allahabad.
3. Rashid, A. (2000). An Introduction to Bryophytes to Bryophyta. Vikas Publishing House, Pvt. Ltd.
4. Parihar, N.S. (1968). An Introduction to Embryology Vol II-Pteridophytes. Central Book Dept., Allahabad.
5. Sporne, K.R. (1970). The morphology of Pteridophytes. Hutchinson University Library, London.
6. Bower, F.O. (2010). The ferns (filicales). 3 Vols. Cambridge University Press.
7. Bennet, S.S.R. (1979). An Introduction to Plant Nomenclature. International Book Distribution.
8. Rao, R.R. and Sharma, B.D. (1990). A manual of Herbarium collections. Botanical Survey of India, Calcutta.
9. Naqshi, A.R. (1993). An Introduction to Botanical Nomenclature. Scientific Publishers, Jodhpur.
10. Vasishta, P.C. (1996). Botany for Degree Students: Vol. V-Gymnosperms. S. Chand & Company.
11. Chamberlain, C.J. (1935). Gymnosperms: structure and evolution. Chicago, Ill., The University of Chicago Press.
12. E.P. Odum: Basic ecology W.B.Saunders,Philadelphia. (1971)
13. Pierce Benjamin A: Genetics A Conceptual Approach. (Latest Edition)
14. Daniel L Hartl and Elizabeth W. Jones: Genetics Principle and Analysis (Latest Edition)
15. Lodish: Molecular Cell Biology (Latest Edition)

Additional readings:

16. J.S. Singh, S.P. Singh and S.R. Gupta: Ecology, Environment and Resource conservation. Anamaya Pub. New Delhi (2008)
17. D.Miller-Dombois and H. Ellenberg: Aims and methods of vegetation ecology. Wiley N.Y. (1974)
18. R.L. Smith: Ecology and Field Biology. Harper Collins College Pub. Inc. New York.(1996).
19. Prescott, G.W. (1969). The Algae. Pub. Landon
20. Chapman, V.J. and Chapman, D.J. (1973). The Algae. Macmilan, Landon.
21. Dubey, H.C. (1994). An Introduction to fungi. Vikas Publishing House, Pvt. Ltd.
22. Kirk, P.M., canon, P.F., Minter, D.W. and Stalpers, J.A. (2008). Dictionary of Fungi (10^{th} Edition). CAB International, U.K.

Course Code: BOT-E-143

Course Title: Applied ecology

1. **Climate change**: Gaseous composition of Atmosphere, Global warming, Carbon Cycle, C Sequestration, Caron-credits, foot points and trading, International efforts for mitigation.
2. **Biodiversity and conservation** Definition, Importance, Distribution, IUCN categories, hotspots, conservation strategies
3. **Ecosystem stability:** Concept, ecology of plant invasion; environmental impact assessment, ecosystem restoration.
4. **Ecological management:** Concepts; sustainable development; sustainability indicators

Essential Readings:

1. E.P. Odum: Basic ecology W.B.Saunders,Philadelphia. (1983)
2. R.L. Smith: Ecology and Field Biology. Harper Collins College Pub. Inc. New York. (1996).

Additional Readings:

3. J.S. Singh, S.P. Singh and S.R. Gupta: Ecology, Environment and Resource conservation. Anamaya Pub. New Delhi (2008)
4. D.Miller-Dombois and H. Ellenberg: Aims and methods of vegetation ecology. Wiley N.Y. (1974)

Course Code: BOT-E-144

Course Title: Applied Microbiology

UNIT-l

Microbial diversity in different ecosystems (halophiles, mesophiles, thermophiles, acidophiles, alkalophiles, barophiles and other extremophiles).

Bioactive compounds from: Algae, Bacteria, Fungi and Actinomycetes

Biopesticides synthesis and application.

UNIT-II

Biofertilization processes - Decomposition of organic matter and soil fertility and vermicomposting, spent mushroom compost, mechanism of nitrogen fixation, phosphate solubilization and Iron biding bacteria.

Biofuels: techniques for production of fuels from microalgae, bacteria, cyanobactera, biomass,mushroom

Essential Readsings:

1. Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour edition, S.Chand Publishers, New Delhi.

2. Purohit SS (2005). Microbiology - Fundamentals and Applications. Student Edition Publishers, Jodhpur.

3. Pelczar & Kreig (2006). Microbiology 5th edition. Tata McGraw Hill, New Delhi

4. Powar & daginawala (2005). General Microbiology Vol.I & II 8th Edition, Himalaya Publishing 2. Purohit, S.S., P.R. Kothari and S.K. Mathur, 1993. Basic and Agricultural

5. Subba Rao, N. S. 1988. Biological nitrogen fixation: recent developments, Mohan Primlani for Oxford and IBH Pub. Co. (P) Ltd., India.

Additional Readings:

6. R.K. Gupta, Nasim Akhtar and Deepak Vyas (2015) Biotechnology: an Overview, Daya publication, New Delhi

7. Deepak Vyas , G.S. Paliwal, P.K. Khare and R.K. Gupta (2011) Microbial Boitechnology and Ecology Daya publication, New Delhi