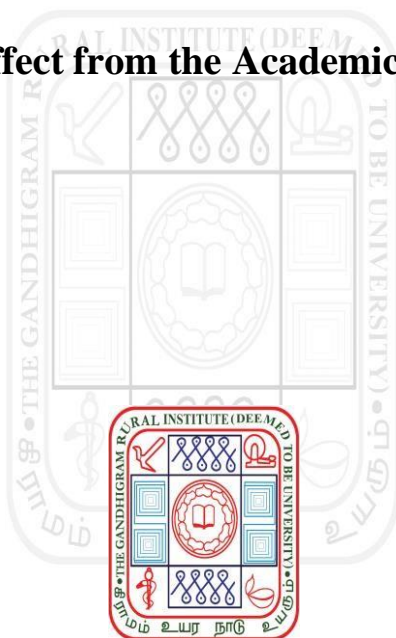


Ph.D., BOTANY Programme

(Syllabus with effect from the Academic year 2020- 2021)



**Department of Biology
Gandhigram Rural Institute (Deemed to be University)
(Ministry of Education Govt. of India)
Accredited with “A” grade (3rd Cycle)
Gandhigram – 624 302,
Dindigul District
Tamil Nadu, India**

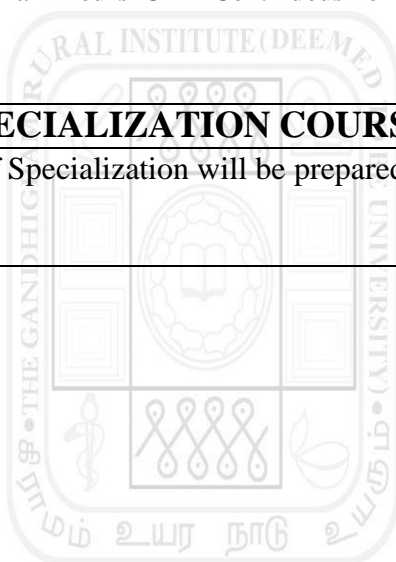
Ph.D. Botany Syllabus (Academic year 2020- 2021)

Ph.D., BOTANY –SCHEME OF EXAMINATION

Semester	Course Code	Course Title	C	L	E	ESE	Total marks
Core courses	21BOTR0101	Research Methodology	4	4	3	100	100
	21BOTR0102	<i>Basic Courses in the Subject Area*:</i> Advances in Botany	4	4	3	100	100
	21BOTR0103	Area of Specialization**	4	4	3	100	100
	21BOTR0104	Research and Publication Ethics	2	2	3	100	100
		Total	14				

C- Credits L-Lecture Hours E- Exam Hours CFA- Continuous Formative Assessment,
ESE – End Semester Exam

21BOTR0103	SPECIALIZATION COURSE	CREDITS: 4
** Detailed Syllabus for Area of Specialization will be prepared by the respective Doctoral Committee.		



21BOTR0101

RESEARCH METHODOLOGY

Credit: 4

Objectives:

To enable the students:

- To understand the working principles, construction and applications of the instruments used in the studies related to various disciplines of biological sciences.
- To expose the students on the basic understanding of research concepts and learn the art of thesis & paper writing, publication and scientific ethics.
- To apply a variety of statistical procedures and tests.
-

Learning outcomes:

On completion of the course, the scholars should be able to

- understand the working principle, operation system and importance of pH meter and various Microscopes.
- understand the working principle, operation system and importance of centrifuge, photometers and chromatography.
- understand the working principle, operation system and importance of molecular techniques.
- understand the overall concepts of Research and art of Thesis writing
- understand art of writing research articles, projects and publication
- Understand and critically assess data collection and its representation

Unit I : pH meter, microscopic and polarimetric techniques:

pH meter - types, basic principle, operation and application; Buffers-principle, standards and preparation of buffer; pH determination & pH indicators. Microscopy – Principle, operation and application - simple, compound, light-field, dark-field, phase-contrast, fluorescence, confocal and electron microscopy. Micrometry-principle and application. Polarimetry -principle and application.

Unit II : Centrifuge, Photometric and Chromatographic techniques:

Centrifugation-types, principle and application. Photometry - Principle, operation and application-colorimeter, spectrophotometer, flame photometer, bomb calorimeter, UV-Visible spectroscopy, atomic absorption spectroscopy, mass spectroscopy and FTIR spectroscopy. Chromatography– types, principle and application: paper chromatography, thin layer chromatography, column chromatography, Ion Exchange, GC-MS and HPLC.

Unit III: Molecular techniques:

Electrophoresis - Principle and applications, paper electrophoresis, agarose gel-Polyacrylamide gel electrophoresis (PAGE and SDS- PAGE) and immuno electrophoresis. Molecular techniques- Microarray, MALDI-TOF, Amino acid sequencing-DNA sequencing

Ph.D. Botany Syllabus (Academic year 2020- 2021)

(Enzymatic & Chemical methods) Blotting techniques-southern, northern and western blottings and PCR techniques. RAPD, RFLP and ARDRA techniques.

Unit IV : Research, Thesis writing, Publication and Project Writing:

Research –definition, objectives, types and importance – Research methods in biological Sciences –Research process – Literature survey – sources – scientific databases – Research report writing – Parts of thesis and Dissertation – Writing scientific paper-Publication on research journals – Standards of research journals – peer review – impact factor –citation index. Proof correction – proof correction marks –Methods of proof correction. Writing chapters in books. – Preparation of Research proposal and funding agencies – Research fellowships

Unit V : Statistical Methods

Sample Methods – Sampling Techniques, Determination of Sample size- Merits and demerits of sampling – student's test, chi-square test – Correlation Techniques – Simple correlation and Regression – Multiple correlation and Regression Analysis – Types of data – Measures of central value- Variability of Measures, Skewness measures and ANOVA- Computational Tools: SPSS, MATLAB and DMRT.

References:

1. N.Gurumani.2019. An Introduction to Biostatistics. MJP Publishers, Chennai
- 2.Pranab Kumar Banerjee.2018. Introduction to Statistics. S.Chand Publishing Company Ltd. New Delhi
3. P.Mariappan.2013. Biostatistics. Pearson,Chennai
- 4.P.S.S.Sundar Rao and J.Richard.2012. Introduction to Biostatistics and Research Methods.PHI Learning Pvt. Ltd. New Delhi.
- 5.David.T Plummer (2009). An Introduction to Practical Biochemistry, Tata Mc Graw Hill Pub.Co.Ltd, New Delhi.
- 6.N.Gurumani (2009).Research Methodology for Biological Sciences. MJP Publishers,Chennai.
- 7.K.Kannan (2003). Hand book of Laboratory Culture media, reagents, stains and buffers. Panima Publishing Corporation, New Delhi
8. Glick, B.R and Pasternak.J.J.,(2003). Molecular Biotechnology, ASM Press, Washington.DC.
- 9.P.Asokan (2002).Analytical biochemistry-Biochemical techniques. First Edn. China Publications, Melvishoram, Vellore.
10. Rajbir Singh (2002).Chromatography 1st Edition Mittal Publications, New Delhi.
11. Keith Wilson and John Walker (2002). Practical Biochemistry-Principles and techniques. 5thEd.Cambridge Univ.Press, London.
12. James. D.Watson, Michael Gilman,JanWitKoeski and Mark Zuller(2001). Recombinant DNA. IInd Ed. Scientific American Book. New York.

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13. S.Palanichamy and M.Shanmugavelu.(1997). Research methods in biological sciences. Palani Paramount Publications, Palani.
14. Jeyaraman.J.(1981).Laboratory Manual in Biochemistry. New Age International Publishers, New Delhi.

Web resources:

- 1.PubMed search engine for database of references and abstracts on life sciences and biomedical topics: <https://en.wikipedia.org/wiki/PubMed>.
- 2.Plagiarism Software: Online plagiarism checker for checking articles: <https://www.plagiarismsoftware.net/>and www.arkund.com/en/



21BOTR0102

ADVANCES IN BOTANY

Credit 4

Objectives

To enable the students

- To have comprehensive knowledge on diversity of plants.
- To understand the physiology and mechanisms of plants
- To understand the various aspects of plant development and reproduction
- To understand the economic importance of plants

Learning outcomes

The course will provide a comprehensive knowledge on diversity, physiological mechanism, development and reproductive aspects of plants on satisfying the requirements of this course, students will have knowledge and skills on

- Identification of diversity of different life forms
- The physiological, developmental and reproductive aspects of plants
- Identification of different economical important plant species.

UNIT I

Plant ontology photosynthesis:

Bridging Plant Anatomy and Genomics in the Digital Era, tools, ontology procedure and applications. Advances in photosynthesis and respiration. Photosystems, Photophysics of light absorption, excitation energy transfer; C4 photosynthesis and regulations; X-ray crystallography of proteins to the morphology of organelles and intact organisms. Genetic engineering of photosynthesis and artificial photosynthesis.

UNIT II

Plant Tissue Culture:

Applications of plant cell, tissue and organ culture, Media types, preparation; callus formation, organogenesis. Somatic embryogenesis, somaclonal variation, embryo culture, artificial seeds .Production of secondary metabolites from plant cell cultures - Processes for enhancing the production of secondary metabolites. Hairy root culture Technology for production of chemicals; methods and protocol.

UNIT III

Plant Genomics

Cytology: Architecture of prokaryotic and eukaryotic cells and tissues. Biomembranes and the subcellular organization of eukaryotic cells. Introduction to Genomics, Transcriptomics, Proteomics, Metabolomics and single cell genomics. Genome sequencing, Whole genome shotgun sequencing, Physical mapping of genomes, Clone-by-clone sequencing, New generation sequencing technologies, Bioinformatics tools to analyse genomes, Examples of sequenced genomes (yeast, *Arabidopsis* and rice)

UNIT IV

Proteomics

Protein isolation and identification methods SDS -PAGE, Isoelectric focussing, 2D gel electrophoresis, Peptide sequencing, Mass Spectrometry methods used in proteomics, Peptide data bases, Immunological methods to study protein functions, Protein-protein and Protein-DNA interactions, Comparative proteomics, subcellular proteomics, quantitative proteomics

UNIT V

Application of Plant biotechnology

Application of Plant biotechnology for the production of quality oil, Industrial enzymes, paper, biodegradable plastics, antigens (edible vaccine) and antibodies. Production of crops resistance to abiotic and biotic stresses, crop quality improvement, nutrient enhancement, nitrogen fixation, nutrition up-take, production of male sterile lines, plantibodies, vaccines, plant secondary products, biofuel, bioplastics and plants as bioreactors

References

1. Torr, J. D. 2006. Genetic Engineering-Current Controversies. Green haven Press.
2. Magnien, E. & De Nettancourt, D. 1985. Genetic Engineering of Plants and Micro-Organisms Important for Agriculture. Springer Verlag.
3. Gerald Karp 2013. Cell and Molecular Biology: Concepts and Experiments. 7th Edition, Wiley, NJ, USA.
4. Geoffrey M. Cooper & Robert E. Hausman 2013. The Cell: A Molecular Approach, 6th Edition, Sinauer Associates, Inc., Sunderland, USA.
5. Harvey Lodish, Arnold Berk, Chris A. Kaiser & Monty Krieger 2012 Molecular Cell Biology. 7th Edition, W. H. Freeman, NY, USA.
6. Stephen R. Bolsover, Elizabeth A. Shephard, Hugh A. White & Jeremy S. Hyams 2011. Cell Biology: A Short Course Wiley-Blackwell, NJ, USA.
7. Doods, J. H. and Roberts, L. W. 1985. Experiments in Plant Tissue culture, Cambridge University Press.
8. George, E. F. 1993-96. Plant propagation by Tissue culture-2 vols. Exegetics Ltd.

Journals and Web-resources:

1. <https://link.springer.com/journal/11240>
2. <https://www.journals.elsevier.com/journal-of-molecular-biology/>
3. <http://www.springer.com/life+sciences/journal/11008>
4. <http://www.sciencedirect.com/science/journal/00222836?sdc=1>
5. <http://www.scirp.org/journal/ajmb/>
6. <https://www.nature.com/nsmb/>
<https://www.gmb.org.br/>

Ph.D. Botany Syllabus (Academic year 2020- 2021)

21BOTR0103	SPECIALIZATION COURSE	CREDITS: 4
** Detailed Syllabus for Area of Specialization will be prepared by the respective Doctoral Committee.		



21BOTR0104

RESEARCH AND PUBLICATION ETHICS

Credits : 2

Objectives:

- To learn about nature, scope, and concept of philosophy and ethics
- To learn about scientific conduct and publication ethics
- To learn open access publishing, Misconduct, Databases and Research Metrics

Learning Outcomes

On completion of the course, the scholars should be able to

- Understand the scope and concepts in philosophy and ethics
- Recognize the scientific misconducts
- Realize the importance of publication ethics
- Understand open access publication
- Create awareness on the importance of scientific data bases and research matrices

Unit I

Philosophy and Ethics

Introduction to philosophy: Definition, nature and scope, concept, branches. Ethics: Definition, moral philosophy, nature of moral judgements and reactions.

Unit II

Scientific conduct

Ethics with respect to science and research- Intellectual honesty and research integrity- Scientific misconducts: Falsification, fabrication, and Plagiarism (FFP) – Redundant publications: duplicate and overlapping publications, salami slicing – Selective reporting and misrepresentation of data

Unit III
Publication Ethics

Publication ethics: Definition, introduction and importance- Best practices/standards setting initiatives and guidelines: COPE, WAME, etc- Conflicts of interest- Publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice versa, types- Violation of publication ethics, authorship and contributorship – Identification of publication misconduct, complaints and appeals- Predatory publishers and journals

Unit IV

Open Access Publishing

Open access publications and initiatives-SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies- Software tool to identify predatory publications developed by SPPU -Journal finder/ journal suggestion tools viz. JANE, Elsevier Finder, Springer Journal Suggester, etc

Unit V

Publication Misconduct, Databases and Research Metrics

Subject specific ethical issues, FFP, authorship- Conflicts of interest-Complains and appeals: examples and fraud from India and abroad- Use of plagiarism software like Turnitin, Urkund and other open source software tools. Databases-Indexing databases-Citation databases: Web of Science, Scopus etc- Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score- Metrics: h-index, i10 index, almetrics.

References

1. Bird, A. 2006. Philosophy of Science. Routledge.
2. Indian National Science Academy (INSA) 2019. Ethics in Science Education, Research and Governance. ISBN: 978-81-939482-1-7.
http://www.insaindia.res.in/pdf/Ethics_Book.pdf
3. Chaddah, P. 2018. Ethics in Competitive Research: Do not get scooped; do not get plagiarized. ISBN: 978-9387480865.
4. Beall, J. 2012. Predatory publishers are corrupting open access. *Nature*, 4089(7415), 179. <https://doi.org/10.1038/48917a>
5. Resnik, D. B. 2011. What is ethics in research & Why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
6. National Academy of Sciences, National Academy of Engineering and Institute of Medicine. 2009. On being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academy Press
7. MacIntyre, Alasdair. 1967. A Short History of Ethics. London