BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

M.Phil. BOTANY (FT / PT) PROGRAMME

(For the candidates to be admitted from the academic year 2018-19 onwards)

Eligibility : M.Sc. Botany/Plant Sciences/Plant Biology and Plant Biotechnology

PROGRAMME OBJECTIVES :

- To develop critical and analytical thinking towards research and teaching;
- To provide students with fundamental strength in analysing, designing and solving research related problems;
- To understand the principles and operations of various advanced instruments in their specific area of research; and
- To make researchers abreast in advanced areas of botany and the recent developments.

PROGRAMME STRUCTURE

Sem-ester	Course	Title of the Course	Exam. Hours	Credits	Marks		
					IA	UE	Total
I	Course - I	Research Methodology	3	4	25	75	100
	Course - II	Recent Advances in Botany	3	4	25	75	100
	Course – III	Teaching and Learning skills (Common Paper)	3	4	25	75	100
	Course - IV	Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE)	3	4	25	75	100
II	---	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	--	8	--	--	200
Total				**24**	**--**	**--**	**600**

PROGRAMME OUTCOMES :

After completion of this Master of Philosophy in Botany programme, students would acquire knowledge about

- Recent advances in their specific areas of research,
- Design and conduct experiments, analyse data and interpret the results,
- Principle and operation of basic and advanced instruments,
- Design and working on research projects,
- Recent developments in teaching and learning skills,
- Demonstration of professional responsibilities,
- Demonstration of ethical responsibilities, and
- Technological solutions in the field of botany.

*****

COURSE I

RESEARCH METHODOLOGY

Course Objectives :

This paper aims

- To impart knowledge on centrifugation techniques and uses of microscopy;
- To get familiarity on various techniques of Spectrophotometry, Electrophoresis and Separation techniques; and
- To design, carryout, analyse and publish data using biostatistics and other related techniques**.**

Unit 1 : Centrifugation and Microscopy

Centrifugation: Principle and types of centrifuges - Ultracentrifugation, density gradient centrifugation and continuous centrifugation.

Microscopy: Differential interference contrast (DIC), polarization, fluorescent microscopy, dark field and phase contrast microscopy - Electron microscope-SEM and TEM. Atomic force microscopy, Confocal and Scanning and tunnelling microscope.

Unit 2 : Spectrophotometry, Electrophoresis and Separation techniques

Spectrophotometry: Principle – Beer Lambert's Law. UV-IR, FT-IR, Atomic Absorption Spectroscopy, CD, Stop Flow, Mass, MALDI-TOF and NMR.

Electrophoresis: Principle of Gel electrophoresis, Agarose gel electrophoresis, Polyacrylamide gel electrophoresis (PAGE & SDS PAGE), capillary electrophoresis, two-dimensional electrophoresis, isoelectrofocussing and comet assay.

Chromatography: Principle, procedures and applications of TLC, PC, Gel Filtration and Ion exchange, Affinity Chromatography, GC, GLC, HPLC/FPLC and HPTLC.

Unit 3 : Molecular Biological Techniques

Molecular biological techniques: Isolation and amplification of nucleic acid – Genomic DNA (*Escherichia coli*), Plasmid DNA, total RNA, Polymerase Chain Reaction – Types and its applications.

Gene cloning techniques: Phosphatase treatment of cloning vectors, use of adapters and linkers in cloning – screening of recombinants – labelling of nucleic acids by radioactive methods – plaque and colony hybridization – Southern blot – Western blot – Northern blot – DNA finger printing and Microarray.

Unit 4 : Biostatistics

Biostatistics: Collection and presentation of experimental data - Design of experiments – Randomized Block Design (RBD) and Completely Randomized Block Design (CBD) – Measures of Central Tendency - Arithmetic Mean, Median, Mode, Position of averages, Geometric Mean, Harmonic mean and percentile – Measures of Dispersion - Range, Inter quartile range, variance, standard deviation and standard error.

Correlation and Regression: Correlation coefficient – Types of correlation – Regression – Simple and linear regression – Biological significance of correlation and regression – Tests of significance: Basis of statistical inference – Student's 't' test for mean, difference of means and test for correlation and regression coefficients – Chi-square test – Analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT).

Unit 5 : Data Collection, Analysis and Research Publications

Data collection and analysis – Web browsing and searching – Electronic biological databases – NCBI, PubMed, Sequence and Structure databases. Ethics in publication – Checking for Plagiarism - Research Publications, Preparation of manuscripts – full paper, short communications and LCD preparations. Review paper, Thesis writing, Bibliography, Index card and Proof reading.

References:

1. Batschelet, E. 1991. Introduction to Mathematics for Life Scientists. Springer International Student Edn., Narosa Publishing House, New Delhi.
2. Becker, J.M., Caldwell, G.A. and Zachgo, E.A. 1996. Biotechnology: A Laboratory Course, 2nd Edn. Academic Press, Inc., San Diego, California.
3. Cannel, J.P. 1998. Natural Products Isolation. Humana Press, New Jersey, USA.
4. Chirikjian, J.G.1995. Biotechnology: Theory and Techniques Vol. I. Plant Biotechnology, Animal Cell Culture, Immunobiotechnology. Jones and Bartlett Publishers, London, England.
5. Gibas, C. and Jambek, P. 2001. Developing Bioinformatics Computer Skills. Shroff Publishers, Mumbai.
6. Forthofer, L. 1995. Introduction to Biostatistics, Academic Press, New York.
7. Green, M.R. and Sambrook, J. 2012. Molecular Cloning A Laboratory Manual Vol. 1. (4th Edn.). Cold Spring Harbor Laboratory Press, New York.
8. Gupta, S.C. and Kapoor, V.K. 2002. Fundamentals of Mathematical Statistics (11th Edn.). Sultan Chand & Sons, New Delhi.
9. Gurumani, N. 2006. Research Methodology for Biological Sciences. MJP Publishers. A Unit Tamil Nadu Book House, Chennai.
10. Harborne, J.B. 1998. Phytochemical Methods. Chapman & Hall, London.
11. Jordan, D.W. and Smith, P. 2002. Mathematical Techniques. Oxford University Press, New Delhi.
12. Kothari, CR, Garg G. 2018. Research methodology – methods and techniques. New Age International Publishers, Kochi.

13. Kumar, R. 2014. Research Methodology: A step by step guide for Beginners. SAGE Publications India Pvt. Ltd., New Delhi.
14. Le, C.T. and Eberly, E.N. 2016. Introductory Biostatistics. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
15. Primrose, S.B. and Twyman, R. B. 2006. Principles of gene manipulation and genomics (7th edn.). Blackwell Publishing, Oxford, UK.
16. Sharma, B.K 1996. Instrumental Methods of Chemical Analysis. Goel Publishing House, Meerut.
17. Snedecor, GW and Cochran, WG. 1967. Statistical methods. Oxford & IBH Pub. New Delhi.
18. Sokal, R. R. and Rohlf, F.J. 1987. Introduction to Biostatistics (Biology-Statistics Series). W.H. Freeman & Company, New York.
19. Wilson, K. and Walker, J. 1997. Practical Biochemistry: Principles and Techniques. Cambridge University Press, Cambridge.
20. Zar, J. H. 2006. Biostatistical Analysis: Prentice-Hall.

Course Outcomes :

After completion of this course, students would acquire knowledge on

- Centrifugation techniques,
- Microscopy,
- Spectrophotometry,
- Electrophoresis,
- Separation techniques,
- Molecular biological techniques,
- Biostatistical analysis, and
- Ethical guidelines in research, analysis and interpretation of data, writing of thesis, and preparation of manuscript for publication.

*****

COURSE II

RECENT ADVANCES IN BOTANY

Course Objectives :

Students will learn

- Molecular taxonomy principles and methods and plant genome organization, gene expression and genetic engineering;
- Application of plant tissue culture in secondary metabolite production and other related fields; and
- Basic knowledge about Nanobiotechnology and its applications.

Unit I : Molecular Taxonomy

Molecular markers – Random Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP), Amplified Fragment Length Polymorphism (AFLP), Internal transcribed spacer (ITS), Inter Simple Sequence Repeats (ISSR), Simple Sequence Repeats (SSR), Chloroplast markers – matK, ndh*F*, rbcL, trnH-psbA - SCAR (Sequence Characterized Amplified Region), SSCP (Single-Strand Conformation Polymorphism) - DNA Barcoding - Applications in molecular systematics.

Unit II : Plant Genome Organization and Expression

Organization of chloroplast and mitochondrial genome. Nucleus-encoded and chloroplast-encoded genes for chloroplast proteins. Targeting of proteins to mitochondria – Regulation of prokaryotic and eukaryotic gene expression and gene silencing – Genetic Code, Protein Synthesis – Initiation and their regulation – Elongation and Elongation Factors – Aminoacyl-tRNA synthetase, translation, inhibitors, post–translation modification of proteins.

Unit III - Applications of Tissue Culture

Secondary Metabolites – Types – Mevalonate pathway, Malonate pathway and Shikimic acid pathway. Secondary metabolite production through *in vitro* culture – biotransformation of high value metabolites - Biofermentors – Types and design – Industrial scaling – Upstream and downstream processing. Food vaccines, bioplastics, plantibodies, plantigens - Application of tissue culture techniques in agriculture, horticulture and forestry.

Unit IV : Genetic Engineering in Plants

Selectable markers, reporter genes and promoters used in plant vectors – Plant transformation technology – Ti and Ri Plasmids, Mechanism of gene transfer in plants – Direct gene transfer methods – Electroporation, microprojectile bombardment methods, microinjection. Transgenic plants – virus resistance, pest resistance, herbicide resistance, resistance to fungi and bacteria.

Unit V : Nanobiotechnology

Nanoparticles – definition and historical background. Principles and properties of nanoparticles and nanomaterials. Biological synthesis – biomimetics – Microbial nanoparticle production – Magnetosomes – Bacteriorhodopsins- Nanoproteomics – Role of biomolecules – reducing and/or capping agents: proteins, viruses and carbohydrates. Nanomaterials and their applications.

References:

1. Anis, M. and Ahmad, N. 2016. Plant Tissue Culture: Propagation, Conservation and Crop Improvement. Springer, Singapore.
2. Belluci, S. (Ed.). 2009. Nanoparticles and Nanodevices in Biological Applications. The INFN Lectures – Vol. 1. Springer-Verlag, Berlin.
3. Chawla H.S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Chrispeels, M.J. and Sadava, D.E. 2002. Plants, Genes and Crop Biotechnology. Jones and Bartlett Publisher, Boston.
5. Govil, CM, Aggsrwal A and Sharma J. 2017. Plant Biotechnology and Genetic Engineering. PHI Learning Pvt. Lted., New Delhi.
6. Hillis, D.M., Moritz, C. & Mable, B.K. (Eds.). 1996, Molecular Systematics. Sinaver Associates, Inc., Publishers, Massachusetts, Sunderland, USA.
7. Lea, P.J. and Leegood, R.C. (Eds.). 1999. Plant Biochemistry and Molecular Biology. Wiley, New York.
8. Mirkin, C.A. and Niemeyer, C.M. (Eds.) (2007). Nanobiotechnology II: More Concepts and Applications. John Wiley & Sons, New York.
9. Murata M. (Ed.). 2016. Chromosome and Genomic Engineering in Plants. Humana Press. New York.
10. Murty, B.S., Shankar, P., Raj, B., Rath, B.B. and Murday, J. 2013. Textbook of Nanoscience and Nanotechnology. Springer-Verlag, Berlin.
11. Nicolini, C.A. 2009. Nanobiotechnology and Nanobiosciences. Pan Stanford Publishing Pte. Ltd., Singapore.
12. Plummer, D.T. 2004. An Introduction to Practical Biochemistry, 3rd edition. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
13. Primrose, S.B. 1991. Molecular Biotechnology, 2nd edition. Blackwell Scientific Publications, London, UK.
14. Primrose, S.B. and Twyman, R. B. 2006. Principles of gene manipulation and genomics (7th edn.). Blackwell Publishing, Oxford, UK.
15. Simpson. M.G. 2018. Plant Systematics, 3rd edition. Academic Press Inc., San Diego, USA.
16. Slater, A., Scott, N. and Fowler, M. 2003. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press, Oxford, UK.
17. Westhoff, P., Jeske, H., Jurgens, G., Kloppstech, K. and Link, G. 1998. Molecular Plant Development: From Gene to Plant. Oxford University Press, Oxford, UK.

Course Outcomes :

After completion of this course, students would gain knowledge on recent developments and applied aspects of botany in

- Molecular Taxonomy,
- Plant Genome Organization and Expression,
- Plant Tissue Culture Applications in Agriculture,
- Plant Tissue Culture Applications in Horticulture,
- Plant Tissue Culture Applications in Forestry,
- Plant Genetic Engineering,
- Nanoparticles, and
- Nanomaterials and their Applications.

*****

COURSE III

Teaching and Learning Skills

Course Objectives :

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and Research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I : Computer Application Skills

Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations-- **ICT for Professional Development**:Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

Unit II : Communications Skills

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written; Non-verbal communication – Intrapersonal, interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and Writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III : Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation - Versatility of Lecture technique – Demonstration: Characteristics, Principles, planning Implementation and Evaluation – Teaching-learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV : E- Learning, Technology Integration and Academic Resources in India

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching- learning processes; frameworks guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-Sodh Sindhu; virtual labs; eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V : Skills of Teaching and Technology based assessment

Teaching skills: Definition, Meaning and Nature- Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills- **Technology for Assessment:** Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; e-rubrics, etc.); online assessment (open source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, found in: www.namahn.com/resources/ .../note-e-learning.pdf, Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002.
5. Jereb, E., & Šmitek, B. (2006). Applying multimedia instruction in e-learning. Innovations in Education & Teaching International, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age International Publishers, New Delhi.
7. Learning Management system : https://en.wikipedia.org/wiki/Learning_management_system , Retrieved on 05/01/2016
8. Mangal, S.K (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
9. Michael, D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New york.

10. Pandey, S.K (2005) Teaching communication, Commonwealth Publishers, New Delhi.
11. Ram Babu, A abd Dandapani, S (2006), Microteaching (Vol.1 & 2), Neelkamal Publications, Hyderabad.
12. Singh, V.K and Sudarshan K.N. (1996), Computer Education, Discovery Publishing Company, New York.
13. Sharma, R.A., (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
14. Vanaja, M and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.

Course Outcomes

After completing the course, the students will:

- Develop skills of ICT and apply them in Teaching Learning context and Research.
- Be able to use ICT for their professional development.
- Leverage OERs for their teaching and research.
- Appreciate the role of ICT in teaching, learning and Research.
- Develop communication skills with special reference to Listening, Speaking, Reading and Writing.
- Learn how to use instructional technology effectively in a classroom.
- Master the preparation and implementation of teaching techniques.
- Develop adequate skills and competencies to organize seminar / conference / workshop / symposium / panel discussion.
- Develop skills in e-learning and technology integration.
- Have the ability to utilize Academic resources in India for their teaching.
- Have the mastery over communication process through the web.
- Develop different teaching skills for putting the content across to targeted audience.
- Have the ability to use technology for assessment in a classroom.

*****