

PG & RESEARCH DEPARTMENT OF BOTANY
NEHRU MEMORIAL COLLEGE (AUTONOMOUS)
PUTHANAMPATTI-621 007
TIRUCHIRAPPALLI DISTRICT



SYLLABUS FOR
MASTER OF PHILOSOPHY IN BOTANY

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

NEHRU MEMORIAL COLLEGE (Autonomous), Tiruchirappalli-620 007

M.Phil., Botany– Part Time /Full Time -Course Structure

(For the candidates admitted from the academic year 2018-2019 onwards)

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

course	Title of the course	Hrs/ week	Credits	Exam Hrs.	Marks		Total
					Int	Ex t	
Semester - I							
CC-I	Research methodology	4	4	3	25	75	100
CC-II	Recent Advances in Botany	4	4	3	25	75	100
CC-III	Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE)	4	4	3	25	75	100
CC-IV	Teaching and Learning Skills (Common Paper)	4	4	3	25	75	100
Semester -II							
	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	-	8	-	-	-	200
	GRAND TOTAL		24				600

For each Course other than the Dissertation

Continuous Internal Assessment (CIA) - 25 Marks

Semester Examination (SE) - 75 Marks

Total - 100 Marks

NEHRU MEMORIAL COLLEGE (AUTONOMOUS)
DEPARTMENT OF BOTANY
(For those who join in 2018 onwards)

Course : M.Phil Botany

Class : M.Phil

Semester : I

Title of the Paper: **CC-I.Research Methodology**

Int Marks : 25

Ext Marks : 75

Max Marks : 100

Hours /week: 4

Credits : 4

CC-I. RESEARCH METHODOLOGY

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-oIR, 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 (CRD) – 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.

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DEPARTMENT OF BOTANY
(For those who join in 2018 onwards)

Course : M.Phil Botany	Int Marks : 25
Class : M.Phil	Ext Marks : 75
Semester : I	Max Marks : 100
Title of the Paper: CC-II. Recent Advances in Botany	Hours /week: 4
	Credits : 4

CC-II. RECENT ADVANCES IN BOTANY

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, ndhF, 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.
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3. Chawla H.S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
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Course : M.Phil Botany

Class : M.Phil

Semester : I

Title of the Paper: **CC-III (a) . SOIL MICROBIOLOGY**

Int Marks : 25

Ext Marks : 75

Max Marks : 100

Hours /week: 4

Credits : 4

CC-III . SOIL MICROBIOLOGY

UNIT – I:

Soil: Introduction – Physiochemical properties of Soil, Soil water, Structure. Soil Micro organisms: Bacteria, Actinomycetes, Fungi, Algae, Protozoa. Methods used for screening of Soil Microbiological Studies – Streak plate, Pour plate, Spread plate. Molecular methods in Soil microbiology.

UNIT – II:

Organic Matter Decomposition – Humus, Mineralization, Composting, Green manure, Vermicomposting. Organisms involved in organic matter formation – Rhizosphere, Root exudates, Plant growth promoting Rhizobacteria.

UNIT – III:

Biofertilizers: Bacteria, Algae, Fungi (VAM), Phosphate solubilizing micro organisms. Nitrogen fixation by free living bacteria, Mechanism of nitrogen fixation, Symbiotic bacteria, Actinorhizal plants, Isolation, Identification, Mass multiplication of Biofertilizers.

UNIT – IV:

Biopesticides – *Bacillus thuringiensis*, Genetic Engineering of Bt toxin, Baculovirus – Mode of Action, Resistance, Mass production. Interaction among Microbial population: Interaction within a single microbial population – positive and negative interaction, Interaction within a diverse microbial population – Commensalism, Synergism, Mutualism, Competition, Amensalism, Parasitism and Predation.

UNIT – V:

Biogeochemical Cycles – Carbon, Nitrogen, Oxygen, Phosphorous and Sulphur. Microbial degradation of Polysaccharides, Lignin, Biodetoriation. Microbial Interactions with Xenobiotic Compounds, Mineral nutrition to the plants, Macro and micro nutrients.

REFERENCES:

1. Microbiology by Prescott *et al.*, McGraw Hill International Edition.
2. Microbial Ecology by Atlas and Bartha, Pearson Education International Edition.
3. Molecular Biotechnology – Glick and Pasternak, ASM Press, London
4. Soil Microbiology by N.S.Subba rao, Oxford and TBH Publications, Delhi.
5. Biofertilizers for Sustainable Agriculture by A.K.Sharma, Agrobios Publication, Jodhpur.

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Course : M.Phil Botany

Class : M.Phil

Semester : I

Title of the Paper: **CC-III (b) . MOLECULAR GENETICS**

Int Marks : 25

Ext Marks : 75

Max Marks : 100

Hours /week: 4

Credits : 4

CC-III(b). MOLECULAR GENETICS

UNIT- I

Genetics – Historical introduction – Mendelian principles – DNA as a genetic material – Diplex DNA. Chemical composition, Physical structures of DNA, Circular and Superhelical DNA.

UNIT - II

DNA replication – Enzymes of replication – Rolling circle model – DNA damage and Repair. Mutation- Spontaneous – Origin of bacterial mutations – Mutagenesis – Spontaneous and Induced mutations – Physical and chemical agents. Mutant selection – Carcinogenicity testing.

UNIT - III

Genetic transfers in bacteria – Transformation – Transduction and Conjugation. Linkage and genetic maps. Phage genetics, Phage T mutants, Genetic recombination, Genetic mapping of T-4 Phage.

UNIT- IV

Genetic code – Relation between genes and proteins – DNA transcription – RNA translation – Polypeptide synthesis – Rate of Synthesis of Polypeptide Chain – Inhibitors of Protein Synthesis – Central Dogma.

UNIT- V

Regulation of gene activity – Operan model (Lac, Tryp), Autoregulation – translational regulation – RNA Processing – Nucleocytoplasmic mRNA Transport – mRNA Stability and Translation

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REFERENCES

1. Freifelder. D. 1995, Molecular Biology
2. Maloy, S.R. Cronan. J.E. Jr and David Freidfelder, Microbial genetics, 2 ed.
3. Benjamin Lewin. Genes VII. 1996.
4. Tamarin. R.H. 1996. Principles of Genetics. 5 ed.
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Course : M.Phil Botany	Int Marks : 25
Class : M.Phil	Ext Marks : 75
Semester : I	Max Marks : 100
Title of the Paper: CC-IV . Teaching and Learning skills	Hours /week: 4
	Credits : 4

CC-IV . TEACHING AND LEARNING SKILLS

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; erubrics, 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](http://www.namahn.com/resources/.../note-e-learning.pdf), Retrieved on 05/08/2011
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11. Singh, V.K and Sudarshan K.N. (1996), *Computer Education*, Discovery Publishing Company, New York.
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Course : M.Phil Botany

Class : M.Phil

Semester : II

Title of the Paper: **Projects work & Dissertation**

Int Marks : 00

Ext Marks : 200

Max Marks : 200

Hours /week: 0

Credits : 8