SYLLABUS

for

Master of Philosophy (M. Phil.)

in

Botany

DEPARTMENT OF BOTANY
RAJIV GANDHI UNIVERSITY
RONO HILLS, ITANAGAR

RAJIV GANDHI UNIVERSITY
Course Curriculum

Master of Philosophy (Botany)

Eligibility:

In order to pursue M. Phil course in Botany, a candidate must have obtained a Master's degree in Botany/ Life sciences and/ or allied subjects with at least 60% marks, of a University/ Institution recognized as equivalent there to.

In service candidates (unless being teacher in recognized institutions located in Arunachal Pradesh & North East India , allowed study leave/ NOC for the purpose and fulfilling eligibility norms) shall not be eligible.

Admission:

Candidates seeking admission to the course shall be selected through written examination and interview. Total marks for examination and interview will be 150. There shall be two parts in the written test and each part shall comprise 50 marks. The first shall be common to all candidates and will evaluate the research ability of candidates. The second part shall consist of questions from Botany. Interview shall be of 50 marks.

No candidate shall be eligible for the course if he/ she is pursuing any other course/ programme in this University or in any other University/ Institution.

Course of Study:

The duration of course shall be spread over one and half academic year comprising three semesters. The first two semesters shall contain two theory papers each and third semester shall have dissertation. However, topic of dissertation will be selected by candidates after consultation with proposed supervisor and finally shall be approved by the Departmental faculty council.

Semester	Paper	Title of the paper	Internal evaluation (Marks)	External evaluation (Marks)	Total (Marks)
I	BOT 601	Research methodology	25	75	100
	BOT 602	Instrumentation and research techniques	25	75	100
II	BOT 603	Advances in plant sciences	25	75	100
	BOT 610 BOT 611	Optional (any one) 1. Microbiology 2. Floristics and ethnomedicobotany	25	75	100
III	BOT 620	Project work & Dissertation Viva-voce		150 50	200

Internal evaluation of papers shall be carried out through Laboratory/ field based experiments and library based assignments as well as through seminars in the respective papers.

In order to pass in the M. Phil examination, a candidate shall have to secure qualifying marks i.e. 45% in each theory paper and 50% in the dissertation independently. However, the aggregate of total marks secured should be at least 50%.

Medium of Instruction:

Medium of Instructions will be English and candidate will have to answer the question papers and write the dissertation in English.

Attendance:

Every candidate is required to attend a minimum of 75% lectures in each paper.

M. Phil., SEMESTER I

PAPER – BOT 601
RESEARCH METHODOLOGY

Examination Marks: 75
Internal Assessment Marks: 25
Total Marks: 100

An overview of research methodology: Research Concept, Steps involved, Identification, selection and formulation of research problem, justification, hypothesis; Literature collection- textual and digital resources (internet).

Data collection: Research design; Sampling techniques, Collection and documentation, presentation, analysis and interpretation of data.

Statistical analysis of data: Measurement of central tendency- Mean, median, mode; Measures of dispersion- Range, variance, standard deviation; Correlation coefficient, types of correlation. regression equation, biological significance of correlation and regression; Test of significance, chi-square test, analysis of variance, DMRT.

Computer application: MS office, excel, power point, statistical software (spss), remote sensing software.

Scientific writing: Forms of scientific writing- Article, notes, reports, review article, monographs, dissertations, popular science articles, bibliographies.
Formulation of outlines- Outline preparation, drafting title, sub titles, tables, illustrations; Formatting tables- title, body footnotes; Figures & graphs- structure, title and legends.

Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.

Books & References:

Kothri CR 1990. Research Methodology- Methods and Techniques. Vishva Prakashan, C.A. Division of wiley Eastern, New Delhi.

Gupta S 1999. Research Methodology and statistical techniques. Deep and Deep Publications, New Delhi.

Gurumani., N.,2007. Research methodology for biological sciences. MJP Publishers, Chennai.

Batschelet, E. 1991. Introduction to Mathematics for Life Scientists. Springer International Student Edn., Narosa Publishing House, New Delhi.

Forthofer, L. 1995. Introduction to Biostatistics, Academic Press, New York.

Gupta, S.C. and Kapoor, V.K. 2002. Fundamentals of Mathematical Statistics, (11th Edn.). Sultan Chand & Sons, New Delhi.

Snedecor,GW and Cochran,WG. 1967. Statistical methods.Oxford & IBH Pub.New Delhi.

Zar, J. H. 2006. Biostatistical Analysis: Prentice-Hall.

Gomez and Gomez

John W. Creswell. 2009. Research Design: Qualitative, Quantitative, and Mixed method approaches. Sage Publication, USA.

Gerry P. Q. and Michael J. K. 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press.

Richard Colin Campbell. 1989. Statistics for Biologists. Cambridge University Press.

Jim F., Lou C. and Phil J. 1998. Practical Statistics for Field Biology. John Wiley & Sons.

Calvin D. 2003. Choosing and Using Statistics: A Biologists Guide. Blackwell Publisher.

M. Phil., SEMESTER I

PAPER – BOT 602
INSTRUMENTATION AND RESEARCH TECHNIQUES

Examination Marks: 75
Internal Assessment Marks: 25
Total Marks: 100

Culture techniques: Isolation, purification, culturing and preservation of algae, bacteria, fungi, actinomycetes, viruses and Micropropagation techniques.

Field techniques: Collection and preservation techniques of of specimens (algae, fungi and higher plants); Ecological methods.

Analytical techniques: Principle and applications of UV-Vis, IR, FTIR, AAS, AES, CD and NMR spectroscopy.

Microtechniques: Fixation, microtomy and staining; Specimen preparation for observation.

Microscopy: Principle and applications of Phase contrast, DIC, Fluorescence, SEM, TEM,
Separation techniques: Chromatography- principle and application of paper chromatography, TLC, Column chromatography (Gel filtration and Ion exchange, Affinity chromatography, GC, HPLC)

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

Electrophoresis: Principle, Agarose gel and polyacrylamide gel and two dimensional electrophoresis.

Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.

Books & References:

Becker, J.M., Caldwell, G.A. and Zachgo, E.A. 1996. Biotechnology:A Laboratory Course, 2nd Edn. Academic Press, Inc., San Diego,California.

Wilson, K. and Walker, J. 1997. Practical Biochemistry: Principles and Techniques. Cambridge University Press, Cambridge.

Dixon et al. Plant cell culture-A practical approach. IRL Press, Oxford.

SS Bhojwani and MK Razdan. Plant tissue culture. Elseiver, Amsterdam.

M.K.Razdan. 1993. An introduction to plant tissue culture. Oxford & IBH Pub.Co. New Delhi.

Kalyan Kumar De. 1992. Plant tissue culture, New Central Book Agency, Calcutta.

Cordon, M.H. and R. Macrae, 1987. Instrumental analysis in the Biological Science, Blackie and Son Limited, London.

Frederick D. 1989. Separation and Purification Techniques in Biotechnology. Elsevier Publication

Woon-Fong Leung. 2007. Centrifugal Separations in Biotechnology. Elsevier Publication

M. Phil., SEMESTER II

PAPER – BOT 603
ADVANCES IN PLANT SCIENCES

Examination Marks: 75
Internal Assessment Marks: 25
Total Marks: 100

Advance molecular techniques and Genome mapping: Ribotyping, AFLP, T-RFLP, DGGE, FISH, Blotting techniques, PCR, Real time PCR, DNA/RNA microarray.
Nucleic acid and protein sequencing.

Plant Biotechnology: Vectors mediated and direct gene transfer methods; application of plant genetic engineering in agriculture and industry; micropropagation of plants and production of secondary metabolites; plant genome project.

Microbes and soil fertility: Biofertilizers; nitrogen fixing organisms (symbiotic, non-symbiotic and associative); phosphatae solubilizers; Mycorrhiza (ecto & endo) and their role in plant nutrition
Microbes in plant protection: biofungicides, bioinsecticides; Concept of organic farming

Biodiversity: Pattern and levels of biodiversity, assessment of biodiversity, national biodiversity act 2002 and rules 2004; strategies of biodiversity conservation; concept of hot spot; Agrobiodiversity: concept and significance

Plant Ecology: Plant in environment monitoring, Energy plantation, carbon sequestration, EIA & EMP, environmental related legislations and acts.

Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.

Books & References:

Hammond, P.Mc Garvey and V.Yusibov. 2000. Plant biotechnology. Springer Verlag.
S.B.Primrose, R.M.Twyman and R.W.Old. 2001. Principles of genemanipulation, Blackwell Science.
J.Sambrook, E.F.Fritsch and T.Maiatis. 2000. Molecular cloning: Alaboratory manual, Cold Spring Harbor Laboratory Press, New York..
S.B.Primrose. 1994. Molecular biotechnology, Blackwell Scientific Pub. Oxford.
J.Hammond, P.McGarvey and V.Yusibov. 2000. Plant biotechnology. Springer Verlag.
A. Slater, N.Scott and M.Fowler. 2003. Plant biotechnology. The genetic manipulation of plants. Oxford University Press.
Khan, T.I. and Shishoda, Y.S. (1998). Biodiversity conservation and sustainable development., Pointer Publ., Jaipur
Agarwal, K.C. 1996. Biodiversity. Agrobotanical Publishers, India.
C. Neal Stewart Jr. 2008. Plant Biotechnology and Genetics: Principles, Techniques and Applications. Wiley Publisher
Nigel Halford. 2006. Plant Biotechnology: Current and Future Applications of Genetically Modified Crops. Wiley Publisher
Bhowjwani, S.S. 1990. Plant Tissue Culture: Application and Limitations. Elsevier
Lizabeth A. Allison. 2007. Fundamental Molecular Biology. Wiley-Blackwell
David Clark. 2009. Biotechnology, Elsevier Publication
Richard J. Reece . 2004. Analysis of Genes and Genomes. Wiley
NIIR Board. 2004. The Complete Technology Book on Biofertilizer and Organic Farming. National Institute of Industrial Research
NIIR Board. 2004. The Complete Technology Book on Vermiculture and Vermicompost. National Institute of Industrial Research

M. Phil., SEMESTER II

PAPER – BOT 610
MICROBIOLOGY

Examination Marks: 75
Internal Assessment Marks: 25
Total Marks: 100

Basic Microbiology: Taxonomy including nomenclature and species concept, trends in identification and characterization of microbes; Maintenance of stock culture; microbes and plant diseases.

Industrial Microbiology: Basic function of fermentors (bioreactors), design of fermentors, Microbes in production of alcoholic beverages, organic acids, amino acids, enzymes, vitamins, steroids and vaccines.

Microbes and Energy Production: Production of non conventional fuel by microbes: methane (biogas), hydrogen, alcohols and algal hydrocarbons; microbes in petroleum augmentation and recovery.

Environmental Microbiology: Bioremediation through microbes: management of organic contaminants, microbial degradation of xenobiotics and hydrocarbons; waste disposal and management; Biomining (microbial leaching and extraction).

Food Microbiology: Fermented foods; food spoilage, food borne pathogens and food poisoning; SCP; cultivation of edible mushrooms.

Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.

Books & References:

Martin D.,Stanley F., Eugene R., Karl-Heinz S.,Erko S. The Prokarotes: Hand Book on Biology of Bacteria. Springer, Singapore.

Edward A. Brige. 1992. Modern Microbiology – Principles andapplication, WMC Brown Publishers, USA.

Gerard J, Tortora, Berdell R, Funke, Christine, Case L. 2001.Microbiology – An introduction, Benjamin cummings, USA.

Patel, A.H. Industrial Microbiology.

Stanbury PF, Whitaker. 1995. Principles of fermentation technology, Pergamon Press, Oxford.

Prescott JP, Harley, Klein DA. 2002. Microbiology, Mc Graw Hill, Boston.

Pelzer MJ, Chan ECS, Kreig NR. 1993. Microbiology, Mc Graw Hill Inc., New York.

Alexander N.Glazer and Hiroshi Nikaido. 1998. Microbial biotechnology. W.H.Freeman & Co., USA.

Charles W B. 2005. Food, Fermentation and Micro-organisms. Wiley-Blackwell

Robert W. Hutkins . 2006. Microbiology and Technology of Fermented Foods, Wiley-Blackwell

Y. H. Hui. 2006. Food Biochemistry and Food Processing. Wiley-Blackwell

Michael J. W. Neil L. M., John S. R. & Gary H. 2001. Industrial Microbiology: An Introduction, Wiley-Blackwell

Nicholas P. Cheremisinoff. 1997. Biotechnology for Waste and Wastewater Treatment. Elsevier Publication

Sally Smith. 2008. Mycorrhizal Symbiosis. Elsevier Publication

M. Phil., SEMESTER II

PAPER – BOT 611
FLORISTICS AND ETHNOMEDICOBOTANY

Examination Marks: 75
Internal Assessment Marks: 25
Total Marks: 100

Plant Taxonomy & Systematic: Plant: Taxonomy & Classification; Concept of Plant Systematics; Families, Genera and Species; Recent Approaches in Plant taxonomy in relation to Anatomy, Palynology, Embryology, Cytology and Molecular Taxonomy; Dendrograms and Construction of Phylogenetic tree.

Field Techniques and Floristic Studies: Herbarium and Field techniques- Traditional v/s modern Methods; Emergence of Digital Herbarium and Importance; Concept of Flora, Monographs and Manual, Revision and Review Work; Botanical Nomenclature and Key Construction.

Ethnobotany: Ethnobotanical Tools and Techniques; Quantitative Ethnobotany, Cultural Ethnobotany, Ethno and Economic Botany, Ethnomedicobotany in Global and Regional Perspectives; Current Concept of Biocultural Resources, IKS and Community & Farmers' Right; Conservation of RET medicinal plants in Indian Context.

Pharmacognosy and Ethnopharmacology: Concept of Pharmacognosy and Crude Drugs, Classification of Crude Drugs, Recent advances in Pharmacognosy Tools and Techniques; Pharmacognostic Study of 10 potential medicinal plants of India; Concept and Relevance of Ethnopharmacology and Ethnomedicine, Herbal Medicine and Community Healthcare in current context.

Phytochemistry: Concept and definition; Relevance and Current advances in phytochemistry; tools and techniques in phytochemistry study; Extraction methods of botanical drugs: Cool maceration, vacuum distillation; Soxlet distillation; qualitative and quantitative analysis of phytoconstituents through chemical reagents, TLC, GC-MS and HPLC methods.

Note: While setting the questions, paper setter may take care to cover entire part of paper. Ten (10) questions are to be set out of which students have to answer any five (5) questions.

Books & References:

A.K Pandey, Jun Wen and JVV Dogra 2006. Plant Taxonomy: Advances and Relevance. CBS Publishers and Distributors, New Delhi.

B. Patwardhan 2007. Drug Discovery and Development: Traditional Medicine and Ethnopharmacology. New India Publishing Agency, New Delhi.

D.K Majumdar, J.N Govil, V.K Singh & R.K Sharma 2005. Recent Progress in Medicinal Plants Vol. 7: Plants Bioactives and Traditional Medicines. SCI Tech Publishing Houston, USA.

E. E Jerald and S.E Jerald 2007. Textbook of Pharmacognosy and Phytochemsitry. CBS Publishers and Distributors, New Delhi

Gurcharan S. (1999): Plant Systematics – theory and practice. Oxford and IBH Publishing Co.Ltd, New Delhi.

Jain, SK and Goel, AK 1995. Proformas for field work. In: Jain, SK (Eds), *A manual of ethnobotany.* Scientific Publishers, Jodhpur (India).

Martin, G (1995): Ethnobotany: a methods manual. Chapman & Hall Co. London.

Sivarajan VV 1984. Introduction to the Principles of Plant Taxonomy. Oxford & IBH Pub. Co., New Delhi.

Surinder Singh, J.N Govil & V.K Singh 2003. Recent Progress in Medicinal Plants Vol. 2: Phytochemistry and Pharmacology. SCI Tech Publishing LLC, P.O Box No. 20656, Houston, Texas 77072, USA.

V.K Singh, J.N Govil and Gurdip Singh 2002. Recent Progress in Medicinal Plants Vol. 1: Ethnomedicine and Pharmacognosy. SCI Tech Publishing LLC, Houston, Texas, USA.