



Course Structure and Examination Pattern For **M.Phil And Ph.D Programme**

The syllabus has been prepared in accordance with Ordinance no. 35 of Mahatma Gandhi Central University, Motihari, Bihar, dealing with M.Phil and Ph.D. programme.

1. Candidate admitted to M.Phil Programmes shall be required to complete course work of **8 to 16** credits in first semester. In second semester he/she shall submit the dissertation of **12** credits.
2. The candidate admitted to Ph.D. programmes shall have to complete course work of 12 credits in first semester.
3. A student shall be allowed to appear at the course-end examination if he/she has attended 75% or above of the total theoretical/practical classes held during the semester.
4. As per clause 7.8 of ordinance no. 35, UGC seven point grading system shall be followed for calculating Grade point average. Candidate has to obtain a minimum of 55% of marks or its equivalent grade in the course work in order to be eligible to continue in the programme.
5. Medium of Instruction and examination shall be English.
6. Assessment and evaluation shall comprise of an
Internal assessment: 20 marks and
End Semester examination: 80 marks
7. Awarding of grades to M.Phil/Ph.D candidates based on their performance shall be done as per the applicable ordinances and regulations for undergraduate and Post graduate programs study. Semester Grade Point Index (SGPI) shall be also calculated based on the ordinances and regulations applicable for programmes other than research.



MAHATMA GANDHI CENTRAL UNIVERSITY

(Established by an Act of Parliament)

TempCamp Office, Zila School Campus, Motihari, District: East Champaran, Bihar – 845401

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Details of courses Title, their code and associated credits for MPhil:

S.No.	Course Title	Course Code	Type of Course	Credits
I	Research Methodology	BOTY 5001	Compulsory	4
II	Analytical Techniques in Plant Sciences	BOTY 5002	Compulsory	4
III	Optional (Any one subject)			
1	Plant Virology	BOTY 5003	optional	4
2	Molecular Stress Biology of Plant	BOTY 5004	optional	4
3	Plant Microbe-Interactions	BOTY 5005	optional	4
4	Cytogenetics and Plant Breeding	BOTY 5006	optional	4
IV	Dissertation			
1	Thesis work			10
2	Viva-voce			2
			Total	24

Details of courses Title, their code and associated credits for PhD:

S.No.	Course Title	Course Code	Type of Course	Credits
I	Research Methodology	BOTY 5001	Compulsory	4
II	Analytical Techniques in Plant Sciences	BOTY 5002	Compulsory	4
III	Optional (Any one subject)			
1	Plant Virology	BOTY 5003	optional	4
2	Molecular Stress Biology of Plant	BOTY 5004	optional	4
3	Plant Microbe-Interactions	BOTY 5005	optional	4
4	Cytogenetics and Plant Breeding	BOTY 5006	optional	4
			Total	12



Detailed Course Contents for M.Phil/Ph.D. in Botany

Course title: Research Methodology

Course Code: BOTY 5001

Unit I: Basics of Research Methodology

Scientific research, role of researcher in different stages of a project, steps in scientific research- identification, selection and formulation of research problem, formulation of hypothesis, literature survey; research plan, conducting research; sampling techniques, sample size, collection and types of data, limitation of data collection and sampling methods.

Unit II: Scientific writings and publication:

Scientific writings: original articles, review, letters, short communication etc., format of scientific papers (Abstract, Introduction, material and methods, results and discussions, conclusions, bibliography/ references appendices, supplementary material, key words), review of articles, peer review, blind review, impact factor, H- index, i10-citation)

Unit III: Basic biochemical Calculations and Biostatistics

Solution; expression and interconversion of concentrations of solutions; buffers: preparation of buffers, buffer capacity, Henderson-Hasselbach equation, Proteins; determination of protein contents, molecular weight, calculation of enzyme activity and specific activity, Nucleic acids: determination of contents and concentration

Data analysis - variables, numerical, categorical Central measures (mean, median, mode); Dispersion measures (range, standard deviation, standard error and coefficient of variation), probability, co-relation and regression, Binomial and normal distribution and normal distribution, parametric and non-parametric tests t-test, f-test, chi-square test and ANOVA.

Unit IV: Ethics, IPR and Patents

Ethical research, ethical issues in research (animal ethics committee and ethical issues on the usage of GM plants), originality, innovation, citation, referencing, Plagiarism, assessing the impact of research contribution.

Intellectual properties and types, Indian and US patent, Procedure of filing patents.

Suggested Readings:

1. Statistical Methods: S P Gupta
2. Research methodology methods and statistical techniques: Santosh Gupta
3. Research Methodology and Techniques: C R Kothari
4. Biochemical Calculations: Irwin Segel



Course Title: Analytical Techniques in Plant Sciences
Course Code: BOTY 5002

UNIT I: Microscopic and Spectroscopic Techniques:

Microscopy: Resolution and magnification, Resolving Power, Light Microscope, Phase contrast Microscope, Fluorescence Microscope, Confocal Microscope, Micrometry. Transmission Electron Microscope and Scanning Electron Microscope.

Spectroscopy: Electromagnetic spectrum, UV/Vis-spectrophotometry, Lambert Beer Law, molar extinction coefficient, fluorescence spectroscopy, CD spectroscopy, Principles of NMR and X-Ray crystallography, Raman spectroscopy FT-IR, and MALDI

UNIT II: Isolation and Fractionation Techniques

Partition and absorption chromatography, TLC, gel filtration, Ion exchange GC-MS, HPLC.

Electrophoresis and centrifugation: Agarose gel electrophoresis, native and denaturing PAGE, 2-D electrophoresis, centrifugation; ultracentrifugation, isopycnic centrifugation and their applications.

UNIT III: Molecular biological Techniques:

Enzymes involved in molecular work, PCR, RT-PCR, Molecular Probes, DNA fingerprinting, southern blotting, northern blotting, western blotting. Techniques of Plant transformation, vectors for plants, Transgenic development, transient expression of genes in plants and PTGS.

UNIT IV: Cell and Tissue culture Techniques:

Fungal culture media, Protoplast and Spore culture, Plant cell and tissue Culture, Somatic embryogenesis.

Suggested Readings:

1. Principles and techniques of Biochemistry and molecular Biology : Wilson/Walker 7th edition, Cambridge university press.
2. Plant tissue culture: theory and Practices: S SBhojwani



Course Title: Plant Virology
Course Code: BOTY 5003

UNIT I

Introduction: History, definition, classification and nomenclature, Structure: Components of virus: nucleic acid, proteins and other components, architecture of ssRNA virus, ds RNA, DNA virus, enveloped and non-enveloped virus and their geometry.

UNIT II

Genome composition, organisation and expression: Replication, Transmission and movement- Generalised outline of the replication of small ssRNA virus, the strategies of plant viral genomes, replication, Mechanism of replication of virus with ssRNA genome (monopartite, bipartite, tripartite), DNA viruses, reoviridae, enveloped viruses, viroids, regulation of replication, control mechanism, mixed virus assembly in vitro and in vivo. Origin and evolution of viruses.

UNIT III

Plant virus interaction: RNA silencing, movement of virus within plants, mechanism of Plant virus interaction in permissive and non-permissive host.

Plant to plant movement: Direct passage in living higher plants, transmission by organism other than higher plants, mechanical transmission, role of insects. Plant virus viromics, Involvement of genomes of virus, host and vector.

Effect on plant metabolism: Effect of virus on nucleic acid, protein, carbohydrate, cell wall components, respiration, photosynthesis, transpiration, enzymes and hormones.

Disease development: effect on growth, differentiation and development, limitation of virus infection, factors influencing the course of infection and disease.

UNIT IV

Assay, detection and diagnosis of viruses, epidemiology and control of plant viruses, plant viruses as technology, Disease symptoms in plants, host range, Ecology and economic importance of viruses.

Suggested Readings:

1. Field's virology, David W Knipe and Peter M. Howley, 6th edition, Wolter Kluwer press
2. Principles of Virology: 2 Vol set, by S. Jane Flint, Lynn W. Enquist, Vincent R. Racaniello, Glenn F. Rall, Anna-Marie Skalka.
3. Plant Virology, Roger Hull, 5th edition
4. Plant virology R E F Mathew, 2nd edition, academic press.



Course Title: Molecular Stress Biology of Plants
Course Code: BOTY 5004

Unit I: Stress physiology: Biotic and Abiotic stress; Physiological and Biochemical responses to environmental stress; Stress and secondary metabolite production; Role of natural products in stress, effect of stress on metabolic profile of plants.

Unit II: Hormones and Signal Transduction: Hormonal regulation of plant growth and development, Signal transduction cascades for stress response proteins.

Unit III: Lipids and Antioxidant to combat stress: Protein and lipid biosynthesis; Lipids: structural and storage lipids and their functions. Antioxidative and non antioxidative defence system.

Unit IV: Transgenic approaches for abiotic stress tolerance: Stress responsible Proteins - HSP, osmotin, PR, BSIPS, heavy metal, pesticide, salt, cold and UV light induced proteins; Functional genomics for stress and its modulation.

References:

1. L. Taiz and E. Zeiger (2002) Plant Physiology (Second Edition) Simauer Associates Inc Publishers Sunderlands, Massachusetts
2. H.W. Heldt (1997) Plant Biochemistry and Molecular Biology Oxford University Press
3. W.G. Hopkins (1985) Introduction to Plant Physiology John Wiley and Sons, Inc. New York
4. Methods in Enzymology Colowick and Caplan Academic Press, New York
5. Coombs, Hall, Long and Scurlik (1985) Techniques in Bioproductivity and Photosynthesis, Pergmon Press, Oxford
6. Hall, Scurlik, Bolhar, NordenKamf, Leagood and Long (1993) Photosynthesis and production in a Changing Environment. A Field and Laboratory Manual, Chapman and Hall Publication
7. Buchnan, B.B., Gruissem, W. and Jones, R.L. (2000) Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd., New Delhi.

Course title: Plant Microbe-interactions



COURSE CODE: BOTY 5005

Unit- I

Plant-microbe interactions: Concepts of plant-microbe interactions; Evolution of parasitism and symbiosis; Endosymbiosis; Molecular basis of plant microbe interactions and signalling; Rhizosphere; rhizodeposition.

Unit -II

Mycorrhizae: Ecto and Endomycorrhiza; AM fungi and their symbiosis mechanisms. Symbiotic genes of AM fungi. Nutritional effect of mycorrhizae.

Unit -III

Biological Nitrogen Fixation: *Rhizobium*-legume symbiosis and nitrogen fixation; Plant-Signaling mechanisms in Root Nodule symbiosis; Plant and bacterial factors in establishing Root Nodule symbiosis, Microbial biodegradation and bioremediation.

Unit –IV

Pathogenic plant microbe interaction: genetic and Molecular Basis, Pathogenesis, Role of enzymes and toxins in plant disease. Plant defense mechanisms against pathogens. Important diseases of agricultural crops by virus, phytoplasma, bacteria, fungi and nematode. Diagnosis and control of plant diseases.

Suggested Readings

- Research papers and review articles related to topics
- Agrios, G.N. Plant Pathology. Elsevier, 5th Edition, 2005
- Black, J.G., Black, L.J. Microbiology: Principles and Explorations . 9th Edition, 2015
- Chandra, S., Kehri, H. K. Biotechnology of VA Mycorrhizae: Indian Scenario. New India Publishing Agency, New Delhi. 2006.
- Dilworth, M. J., James, E. K., Sprent, J. I. , Newton, W. E. Nitrogen-fixing Leguminous Symbioses. Springer. 2008
- Pelczar, M. J., Chau, E. C. G. and Krieg, N. R. Microbiology. McGraw Hill, New Delhi. 5th Edition, 2001
- Willey J.M., Sherwood L.M., Woolverton C.J. Prescott's Microbiology. 9th Edition, 2014



Course Title: Cytogenetics and Plant breeding
Course Code: BOTY 5006

Unit-I

Chromatin organization and replication, Structural and numerical alterations of chromosomes, Role of allopolyploidy in plant evolution and speciation.

Unit-II

Mapping of genes on chromosomes: Physical and Genetic maps, Molecular gene map, linkage analysis, somatic cell fusion, In situ hybridization, Alien gene transfer through chromosome.

Unit-IV

Plant breeding and crop improvement: Objectives and scope of plant breeding, hybridization in self- and cross-pollinated crops, genetic basis of inbreeding depression, breeding for disease, drought and insect resistance plants.

Unit-IV

Hybridization and its role in crop improvement: Heterosis- theories and applications, Modern breeding methods.

Suggested Readings:

1. Arun Kumar Sharma and Archana Sharma, Chromosome technique, theory and practice 3rd edition, butterworth, London.
2. Ram J Singh, Plant Cytogenetics 3rd edition CRC Press Taylor and Francis group.
3. Ram J Singh Practical manuals on Plant Cytogenetics 2nd edition CRC Press Taylor and Francis group.
4. P.K. Gupta, Cytogenetics, Rastogi Publications New Delhi.
5. B.D. Singh Plant Breeding Principles And Methods Kalyani Publisher Lyall Bk Depot.
6. B.D. Singh Fundamentals of plant breeding Kalyani Publisher Lyall Bk Depot.
7. D. Peter Snustad, Michael J. Simmons Principles of Genetics 3rd edition John Willey and sons Inc.