

M. PHIL. COURSE WORK SYLLABUS

OF

Plant Biotechnology and Genetic Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Revised as per Ministry of Human Resource Development, UGC New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulation – 2016



Re-Accredited Grade 'A' by NAAC

DEPARTMENT OF BIOSCIENCES
SAURASHTRA UNIVERSITY
RAJKOT – 360 005

SAURASHTRA UNIVERSITY
DEPARTMENT OF BIOSCIENCES

M. PHIL. PROGRAMME IN PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

1. The M. Phil. Programme in Plant Biotechnology and Genetic Engineering and its Coursework syllabus of the Department of Biosciences, Saurashtra University is now revised as per the Ministry of Human Resource Development, UGC New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulation – 2016 (SU Ordinance Circular No. PGTR/PhD/1/254/2017, dated 25-1-2017).
2. M.Phil. Programme shall be for a minimum duration of two (2) consecutive semesters / one year and a maximum of four (4) consecutive semesters / two years (Clause 3.1).
3. The M.Phil. Coursework will be of one semesters (clause 3.1) having two theory courses 100 marks each. The coursework shall be treated as prerequisite for M. Phil. preparation (clause 6.2). The M. Phil. research work for Dissertation / Thesis will be spread over all the semesters as prescribed in the Circular. Though the Dissertation will commence in the beginning, it will be evaluated and grade points, if any, will be given at the end of the programme.
4. The eligibility criteria (clause 1), admission process (clause 4.1), number of intake (clause 4.2) and all other details of this programme will be as per above Circular.
5. Coursework Pattern: The credit assigned to the M.Phil. Coursework shall be a minimum of 08 credits and a maximum of 16 credits (clause 6). All candidates admitted to the M.Phil. Programme shall be required to complete the Coursework prescribed by the Department during the initial semesters (clause 6.5).
6. An M. Phil. candidate has to obtain a minimum of 55 % of marks or its equivalent grade in the UGC 7 point scale (or an equivalent grade / CGPA in a point scale wherever the grading system is followed) in the Course work in order to be eligible to continue in the programme and submit the Dissertation / Thesis (clause 6.8).
7. Evaluation and Assessment: The overall minimum credit requirement, including credit for the Course work, for the award of M.Phil. Degree shall not be less than 24 credits (clause 8.1).
8. Upon satisfactory completion of course work, and obtaining the required marks/grade prescribed in the clause 6.8, the M. Phil Scholar shall be required to undertake research work and produce a draft dissertation/thesis within the stipulated time for M. Phil. (Clause 8.2).
9. M.Phil. Scholars shall present at least one (1) research paper in a conference / seminar before the submission of the dissertation/thesis for adjudication, and produce evidence for the same in the form of presentation certificate/reprints (clause 8.4).
10. The M.Phil. Dissertation submitted by a scholar shall be evaluated by his/her Research Supervisor and at least one external examiner who are not in the employment of the same University/College. The panel of the examiners shall consist of four Experts suggested by the research supervisor of which one shall be nominated by the Vice-Chancellor to evaluate dissertation. The Viva-voce examination, based among other things, on the critiques given in the evaluation report, shall be conducted by PGBeh of them together, and shall be open to be attended by members of the RAC, all faculty members of the Department, other research scholars and other interested experts/researchers (clause 8.7).
11. Following the successful completion of the evaluation process and before the announcement of the award of the M.Phil. Degree, the University shall submit and electronic copy of the M.Phil Dissertation to the INFLIBNET, for hosting the same so as to make it (clause 10.1).

M. Phil Programme in Plant Biotechnology & Genetic Engineering : Structure & Evaluation System

The **M. Phil Programme in Plant Biotechnology & Genetic Engineering** being run in the Department of Biosciences, Saurashtra University, Rajkot, will be having the following structure, Teaching and Examination Scheme.

M. Phil. Programme in Plant Biotechnology & Genetic Engineering

Duration : Minimum of 2 Semesters and maximum 4 Semesters

Components of the Programme: (a) M. Phil. Course Work and (b) M. Phil. Dissertation

(a) **M. Phil. Course work** : Coursework completion certificate will be issued by the University (PGTR) mentioning Marks secured in each course, Total Marks secured, % of marks, Grade and Credit obtained, month and year, and other details.

(b) **M. Phil. Dissertation** : Notification and Certificate will be issued by the University after successful Viva-Voce, containing details.

Details of M. Phil. Course work:

Courses : 2 (one Core and one Elective) in First Semester.

Credit	: Each Course will be of 4 credits in 4 h/week/Sem.	08 Credits
	Dissertation: 20 hours/week/Sem. For 2 Sems.	20 Credits

Total 28 Credits

Marks : Each course 100 marks

200 Marks

Total 200 Marks

Evaluation and Examination Scheme:

1. The Evaluation (through RAC of the Department) and Degree award notification will be done by the University (PGTR) as it is done in the case of Ph.D. Award.
2. The Semester-end evaluation of each course will be based on the evaluation on assignments and/or seminar/presentations made by the M.Phil. Scholar before the RAC of the Department. The RAC of the Department will finalize the Grades of the candidate by a combined assessment as mentioned above and the final grades shall be communicated to the University (PGTR) by the RAC of the Department (clause 6.7).
3. **A completion certificate** of the **M. Phil. Course Work** will be issued by the University (PGTR) at the end of the first semester (200 marks, 18 Credits (Clause 6.5 and 6.8). The passing mark is 55% (clause 6.8) without which the Dissertation cannot be submitted.
4. M. Phil. Dissertation will commence in the beginning of the year but will be evaluated by External and Internal examiners in a Viva-Voce (clause 8.7) and grade points (20 for Dissertation and 28 for the entire M. Phil Programme) will be given in the M.Phil. Award Notification.
5. No Marksheet will be issued for Dissertation as the viva-voce examination contains no marks, But regular **M. Phil. Award Notification** (as issued for Ph.D. Award Notification) will be issued by the University (PGTR) after successful Viva-Voce examination (Like Ph.D. Notification) of the M.Phil. Dissertation.
6. The **M. Phil Degree Award Notification** will contain (a) M.Phil. Coursework marks and grade with month and year of passing, (b) Year of M. Phil Awarded, Total M.Phil. Credit earned (28), Title of the Dissertation, Month, date and year of M.Phil. Degree Awarded.

**DEPARTMENT OF BIOSCIENCES
SAURASHTRA UNIVERSITY**

**M. Phil. Programme
in
PLANT BIOTECHNOLOGY & GENETIC ENGINEERING**

M.Phil. Programme Structure

As per Ministry of Human Resource Development, UGC New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulation – 2016, (SU Ordinance Circular No. PGTR/PhD/1/254/2017, dated 25-1-2017)

**CHOICE BASED CREDIT SYSTEM (CBCS)
(Total 28 Credits)**

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Mode of Semester-end Evaluation	Total Marks
SEMESTER – I					
PGBE. 101	Course-1. Research Methodology (Core)	04	04	Evaluation by the RAC of the Department based on assignments and/or seminar/presentations	100
Course – 2 (Elective) – any One					
PGBE -102	Techniques in Plant Biotechnology	04	04	Evaluation by the RAC of the Department based on assignments and/or seminar/presentations	100
PGBE -103	Plant Molecular Biology and Allied Aspects	04	04		
PGBE -201	DISSERTATION	10	20	--	--
	Semester Total Marks	18	28	Coursework completion certificate will be issued by PGTR	200
SEMESTER – II					
PGBE-201	DISSERTATION	10	20	Evaluation by External and Internal examiners in a Viva-Voce. M.Phil. completion Notification and Certificate will be issued by PGTR	NIL
	Grand Total	28	48	60	200

DEPARTMENT OF BIOSCIENCES
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M. Phil. Programme
in
PLANT BIOTECHNOLOGY & GENETIC ENGINEERING
M.Phil. Course Work Syllabus

SEMESTER – I

Course – 1 : RESEARCH METHODOLOGY
(CORE COURSE)

PBGE.--101: Research Methodology (Core)

Unit – 1. Research Design, Methodologies, Research Ethics

- 1.1 Basic Research Designing, Setting up Objectives of the Study and Hypotheses to be tested.
- 1.2 Setting up Experimental Design and Experimental Protocol
- 1.3 Setting up detailed methodologies, sampling methods, Strategies for execution of the protocols
- 1.4 Designing protocol for statistical validation. Research Ethics

Unit – 2. Scientific Documentation & Report Writing

- 2.1 Scientific literature collection: Types of research literature, Sources. Review of literature
- 2.2 Documentation of collected literature, Reference Index, Database generation.
- 2.3 Basics of Bibliographic Citations, Different Bibliographic styles
- 2.4 Scientific Report Writing, Various aspects, Thesis, Report and Paper writing.

Unit – 3. Quantitative Methods in Biology: Biostatistics

- 3.1 Significance tests: Student's 't' test: Hypotheses, acceptance and rejections, significance levels.
- 3.2 Analysis of Variance: General principles, completely randomized and random-block design ANOVA.
- 3.3 Regression and correlation – bivariate analysis.
- 3.4 Chi-Square and its applications.

Unit – 4. Computer Applications in research

- 4.1 Data Analysis, Data sorting and validation of data.
- 4.2 Use of different software packages for data analyses. Statistical analyses using software
- 4.3 Expression of data, Tables and Graphics
- 4.4 PowerPoint Presentations

Course -2 : Elective (any ONE of the following)

PBGE-102 : Techniques in Plant Biotechnology

Unit 1 : Propagation Techniques

- Choice of Propagation Methods
- Propagation Structure, Equipment and Media
- Seed and Vegetative Propagation
- Layering, Grafting and Budding Techniques
- Bonsai Techniques
- Greenhouse Technology
- Hydroponics
- Wormiculture and Biofertilizers
- Biological Control of Pests
- Factors Regulating Propagation

Unit: 2 Tissue Culture Techniques

- Basics of Plant Tissue Culture
- Plant Material Selection
- Culture Medium Selection, Preparation and Manipulation
- Material Preparation
- Callus Induction and Subculturing
- Protoplast Isolation, Culture and Selection of Hybrids
- Anther Culture and Production of Haploids
- Organ Culture and Organogenesis
- Preparation of Artificial Seeds
- Somaclonal Variation
- Production of Secondary Metabolites

Unit: 3 Genetic Engineering in Plants

- Evolution of Genetic Engineering
- Basic techniques and Instrumentation related with genetic engineering
 - DNA and RNA Isolation
 - Gene Mapping and Blot Techniques (Northern, Southern etc.)
 - PCR and DNA Fingerprinting Techniques (RAPD, AFLP etc.)
 - Sequencing
- cDNA
- Gene Cloning Techniques
- Protein Isolation and Purification
- Agrobacterium-mediated transformation
- Microprojectile bombardment-mediated transformation and Target tissue preparation
 - Microcarrier preparation and DNA delivery

Unit: 4 Plant Hormones and Its Regulation

- Phytohormones and Plant Growth Regulators
- Synthetic and Natural Plant Growth Regulators
- Role of Phytohormones in Growth and Development
- Mode of Action and Regulation (Auxin, Gibberellins, Cytokinins, Abscisic Acid, Ethylene, Brassinosteroids, Jasminoids etc.)
- Signal Transduction (Definition and Overview, Receptors, Second Messengers and mechanism of action)
- Phytohormones and Its Applications in Plant Biotechnology

PBGE-103 : Plant molecular biology and allied aspects**Unit: 1 Cell and Molecular Biology**

- Cell and its Organelles-Structure and Function
- Plant Cell Membrane Ultrastructure and Function
- Basic Component of Plant Cell Wall
- Mechanism of Cell Elongation
- Regulation of Cellular Metabolism
- Enzyme and Enzyme Kinetics
- DNA Mutations, Repair and Recombination
- Chromosomal Aberration and Polyploidy

Unit: 2 Legal Issues in Plant Biotechnology

- Overview of Intellectual Property
- IPR: Indian and Global Scenario
- Related International Treaties and Agreements
- Patent
 - Criteria of Patentability
 - Indian Patent Act
 - Patenting of Biological Material
- Plant Variety Protection
- Farmer's and Breeder's Rights
- Biodiversity Act
- Protection of Traditional Knowledge

Unit: 3 Immunological Techniques

- Immune System and Types of Immunity
- Antigen-Antibody Types, Structure and Function
- Generation of Immune Diversity
- Basic Techniques for Plant Immunology
- Hybridoma Technology
- Plantibody
- Plant Diagnostics-Disease Screening and Identification of Plant Variety

Unit: 4 Plant System Biology and Bioinformatics

- Introduction to Bioinformatics

- Overview of Standard Operation and Application Softwares
- Internet Applications
- Data Analysis and Presentation
- General Awareness to Popular Softwares in Plant Biology
- Biological Data Bank
- Sequence Alignment and Homology
- Gene and Phylogenetic Predictions

	SEMESTER I (Paper: 1)
Unit: 1	Propagation Techniques
	<ul style="list-style-type: none"> • Choice of Propagation Methods • Propagation Structure, Equipment and Media • Seed and Vegetative Propagation • Layering, Grafting and Budding Techniques • Bonsai Techniques • Greenhouse Technology • Hydroponics • Wormiculture and Biofertilizers • Biological Control of Pests • Factors Regulating Propagation
Unit: 2	Tissue Culture Techniques
	<ul style="list-style-type: none"> • Basics of Plant Tissue Culture • Plant Material Selection • Culture Medium Selection, Preparation and Manipulation • Material Preparation • Callus Induction and Subculturing • Protoplast Isolation, Culture and Selection of Hybrids • Anther Culture and Production of Haploids • Organ Culture and Organogenesis • Preparation of Artificial Seeds • Somaclonal Variation • Production of Secondary Metabolites
Unit: 3	Genetic Engineering in Plants
	<ul style="list-style-type: none"> • Evolution of Genetic Engineering • Basic techniques and Instrumentation related with genetic engineering <ul style="list-style-type: none"> DNA and RNA Isolation Gene Mapping and Blot Techniques (Northern, Southern etc.) PCR and DNA Fingerprinting Techniques (RAPD, AFLP etc.) Sequencing • cDNA • Gene Cloning Techniques • Protein Isolation and Purification • Agrobacterium-mediated transformation • Microprojectile bombardment-mediated transformation and Target tissue preparation <ul style="list-style-type: none"> Microcarrier preparation and DNA delivery

Unit: 4 Plant Hormones and Its Regulation	
	<ul style="list-style-type: none"> • Phytohormones and Plant Growth Regulators • Synthetic and Natural Plant Growth Regulators • Role of Phytohormones in Growth and Development • Mode of Action and Regulation (Auxin, Gibberellins, Cytokinins, Abscisic Acid, Brassinosteroids, Jasminoids etc.) • Signal Transduction (Definition and Overview, Receptors, Second Messengers and mechanism of action) • Phytohormones and Its Applications in Plant Biotechnology
Seminar and Poster Presentation	
Project Work	

PGBE-102 : General Plant Biotechnology & Genetic Engineering

Unit – 1. Plant Ecology – I

- 1.1 Biological diversity, Nature of community, Community change, Community metabolism, Primary production, Habitat and niche
- 1.2 Quantification of plant biodiversity, 'k' and 'r' selection
- 1.3 Species interaction and keystone species, Extinction, rare and endangered species
- 1.4 Nutrient cycles

Unit – 2. Plant Physiology – I

- 2.1 Growth and development: Patterns of growth development, growth kinetics and growth indices.
- 2.2 Photomorphogenesis and plant development: Phytochrome forms and their functions.
- 2.3 Photoperiodism and physiology of flowering: Long day plants, short day plants, induction cycle, florigen concept.
- 2.4 Water relation to plants: The components of water potential, units of water potential and their measurements.
- 2.5 Mineral nutrition: Trace and tracer elements, nutrient deficiency symptoms and some function of essential elements.

Unit – 3. Plant Physiology – II

- 3.1 Energy input in plants: Principles of light absorption by plants, Emerson enhancement effect.
- 3.2 CO₂ fixation: C₃, C₄ and CAM pathways for CO₂ fixation.
- 3.3 Photosystems: Distribution of light energy between PS I and PS II.
- 3.4 Hormones and growth regulators: Types of hormones and their influence on growth and development.
- 3.5 Agricultural applications of plant growth hormones.

Unit – 4. Plant Technology

- 4.1 Selection criteria for explants.
- 4.2 Selection criteria for culture media.
- 4.3 Basic tissue culture techniques.
- 4.4 Applications of tissue culture in Horticulture.
- 4.5 Transgenic plants and their role in agriculture.

PGBE-103 : Desert Ecology

Unit – 1: Plant communities

- 1.1 Concept of community and continuum, Community metabolism: primary production
- 1.2 Factors limiting primary productivity, Community change, Biogeochemical cycle
- 1.3 Population growth, carrying capacity, population regulation
- 1.4 Species interactions, ecological niche, ecotypes

Unit – 2: Desertification

- 2.1 Causes of desertification
- 2.2 Changes in vegetation and biomass
- 2.3 Changes in physical and chemical properties of soil
- 2.4 Measures to combat desertification
- 2.5 Adaptations of plants to arid conditions

Unit – 3: Saline soil

- 3.1 Nature and properties of salt affected soils
- 3.2 Plants in relation to salinity
- 3.3 Mangroves
- 3.4 Mechanisms of salt injury in plants
- 3.5 Salinity and metabolic processes

Unit – 4: Mechanisms

- 4.1 Intra – and inter cellular compartmentation of ions
- 4.2 Mechanisms of salt resistance
- 4.3 Sodium-calcium interactions under salinity stress
- 4.4 Salinity and plant mineral nutrition
- 1.5 Strategies for increasing salt resistance

PGBE-104 : Advances in Plant Biology

Unit: 1. Plant Growth and Development

- 1.1 Phytohormones auxins, GA, KiN, ABA and Ethylene. Their structure and derivatives in Plants.
- 1.2 Methods of estimation of these hormones.
- 1.3 Physiological roles of auxins, GA, KiN, ABA and Ethylene.
- 1.4 Other Growth regulating substances like polyamines, brassinosteoroids, Jasminoids etc.

Unit - 2. Plant Propagation techniques

- 2.1. Choice of techniques
- 2.2. Hydroponics
- 2.3. Bonsai
- 2.4. Horticulture and floriculture

Unit - 3. Molecular marker techniques in Plants

- 3.1. Importance of molecular marker techniques
- 3.2. Various techniques like RAPD, AFLP, SNP etc.
- 3.3. Advantages and limitations of these techniques

Unit: 4. Plant tissue Culture Techniques

- 4.1. Plant Material Selection

- 4.2. Culture Medium Selection, Preparation and Manipulation
- 4.3. Callus Induction and Subculturing
- 4.4. Protoplast Isolation, Culture and Selection of Hybrids
- 4.5. Production of Secondary Metabolites