

SYLLABUS

Ph.D. Course work

in

BOTANY

**Department of Botany
School of Science**



UTTARAKHAND OPEN UNIVERSITY

Behind Transport Nagar

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Uttarakhand

Pre-Ph.D. COURSE WORK for Ph.D. Botany

Preamble

Research is a methodical and logical process of analyzing information to increase our understanding of the phenomenon under study. It adds to our existing knowledge of the phenomenon and helps to communicate that understanding to others.

Therefore the PhD programs of Uttarakhand Open University are designed to accomplish local and regional aspirations, fulfill national obligations and honour international commitments through high quality research in various disciplines. The pre-PhD course work, thus aims to provide scientific understanding of research to the researchers.

Important Points to be noted

This program admits a small core of research oriented students each year. Before undertaking the research work, Coursework is necessary as it provides an evidence of ability to conduct research. Therefore frame of the course work designed is as -

Course Work Assessment:**Table 1:** Subject code, Modules in the course and evaluation pattern of Ph.D. course work

Sub. Code	Modules included in the Course	Evaluation			Remarks
		Theory	Assign.	Project	
CW01	Module I: Introduction of Research	70 Marks	30 Marks		Policies regarding the evaluation system of the University as prescribed by Examination Section or decisions taken at a later date shall prevail.
CW02	Module II: Tools and Techniques for Data Collection Module III: Research Writing & Technological inputs in Research	70 Marks	30 Marks		
CW03	Module IV: Discipline Specific Research Methodologies Module V: Emerging Trends and Major Thrust areas in Discipline Specific Research Approaches	70 Marks	30 Marks		
CW04	Module VI: Formulating a Research Proposal			100 Marks (Project Evaluation -50) Presentation and Viva –50)	
CW05	Research and Publication Ethics (RPE)	70 Marks	30 Marks		

Table 2: Total Credit and course Administered pattern of Ph.d. course work

Sub. Code	Modules Name	Total Credit	Administered by/Compete d by	Evaluation Pattern
CW01	Module I: Introduction of Research	02	To be administered by Directorate of Research & Innovation	Paper shall be of Eighty (80) marks divided into two (02) Sections A and B. SECTION– A (Long- answer - type questions). SECTION – B (Short – answer Type questions)
CW02	Module II: Tools and Techniques for Data Collection	01	To be administered by Directorate of Research & Innovation	
	Module III: Research Writing & Technological inputs in Research	01		
CW03	Module IV: Discipline Specific Research Methodologies	02	Concerned Department	
	Module V: Emerging Trends and Major Thrust areas in Discipline Specific Research Approaches	02		
CW04	Module VI: Formulating a Research Proposal	02	Concerned Department (with the help of Directorate of Research and Innovation)	
CW05	Research and Publication Ethics (RPE)	02		

**Module IV: Discipline Specific Research Methodologies
(02 Credits: 60 Hrs.)**

UNIT–I: Research Methodology

Meaning of Research in Biological Sciences; Characteristics of Research, Research student and research supervisor; Process of research; Identification and criteria of selecting a research problem (Hypothesis); Formulation of objectives; Research plan and its components; Methods of Research and Difficulties in Biological research.

UNIT–II: Research Proposal and experimental design

Key elements- Objective, Introduction, Design or Rationale of work, Guidelines for design of experiments, Material and methods, Designing biological experiments, Compilation and documentation of data; Major research institutes related to plant sciences in India. A brief idea about government research agencies such as DBT, DST, ICMR, CSIR and UGC.

UNIT–III: Research Tools & Techniques (Microscopy, Micrometry, Microtomy and Cytological)

Principle and application of Light, Polarization, Phase Contrast and Fluorescent Microscope; Principle & material for TEM and SEM; Stage and Ocular Micrometers, Haemocytometer, Camera Lucida; Paraffin Microtomy, Sledge microtome, Hand microtome, Ultra microtome, Freezing edge microtome; Pre treatment, Fixatives and staining (single and double), Fixation for histological and histochemical study, Staining, Mounting, Procedures for making permanent slides of microtome sections and hand sections, Detailed schedule for making root tip squash and smear of anthers; Histochemical methods in Pharmacognosy and Forensic Botany, Organoleptic evaluation of market drugs.

UNIT–IV: Separation Principles and application of Chromatographic technique

General methods of Separation, Detection, Dialysis and Ultrafiltration, Thin Layer Chromatography (TLC), Paper chromatography, High Performance Liquid Chromatography (HPLC), Gas chromatography (GC), Ion–exchange chromatography; Electrophoretic techniques and Application; Centrifugation Technique and application.

UNIT–V: Spectroscopy

Principle of Fluorescence Different types of Spectroscopy. Visible, UV, IR, NMR, Flame Emission Photometry, Emission Spectroscopy and Atomic Absorption Spectroscopy.

UNIT–VI: Extraction and Estimation

Carbohydrates, Amino acids, Proteins, Lipids, Nucleic acids, Phenolics, Phytohormons, Vitamins and Pigments (Chlorophyll and Carotenoids).

UNIT–VII: Tissue Culture Techniques

Explant preparation, Sterilization, Media preparation, Various types of media, Cell culture, Cell suspension culture, Isolation of protoplasts, Protoplast culture, Protoplast fusion, Haploid production, Anther culture, Pollen culture, Embryo Culture, Somatic embryogenesis, Callus induction and Micropropagation.

UNIT–VIII: Sampling and sampling theory

Type of sampling/ design of experiment (RBD, CRD), Frequency distribution (Central tendency, mean, mode, median), Measurement of Dispersion (Deviation, Degree of freedom, confidence limit, standard error), Test for significance (Chi- square, 't' test, one way and two way analysis of variance), Correlation (Types, methods of studying correlation), Co-efficient of determination and non determination, partial and multiple correlations, Regression Analysis (Regression line, partial and co- linear Regression, multiple regression).

UNIT–IX: Plant identification Techniques

Plant identification: International code of Botanical Nomenclature: Salient features, important rules and recommendation; Identification keys; Herbarium Methodology: Collection, poisoning, drying and preservation of herbarium specimens, Important National and International herbaria; Ethnobotanical survey techniques.

UNIT–X: Computer:

Networking, Excel, PPT presentation, Preparation of graphs, chart, histogram, Web browsing (Major web sites for journals and scientific information) and other Softwares related to respective research field.

Module V: Emerging Trends and Major Thrust areas in Discipline Specific Research Approaches

(02 Credits: 60 Hrs.)

1. Modern trend in taxonomy and chemotaxonomy with special reference to Biosystematics.
2. Applications of microbiology in agriculture, industry and medicine; Microbes and Mycorrhiza and their significance.
3. Biodiversity assessment and conservation: Distribution pattern, endemism, resource utilization and conservation.
4. Ecosystems, structure and functioning: Diversity and Management with special reference to the Himalaya; Ecosystem services and goods; Ecosystem stability and management; Climate change- Adaptation, Resilience and Mitigation.
5. Pharmacognostic study of different types of plant drugs; Indigenous traditional drugs of India and their market Adulteration.
6. Genetic engineering and its implications: Gene isolation, enzymatic synthesis of gene, transgenic crops, PCR (Polymerase Chain Reaction).
7. Biotechnology: Scope and importance of biotechnology, tissue culture techniques in biotechnology, biotechnology in medicine and agriculture.
8. Food and Nutrition security: Ecological, socio-cultural, economic and demographic aspects of malnutrition; food security, traditional and socio-cultural aspects.
9. Physiological Effects and Mechanism and its physiological consequences; Importance of mineral nutrients in plant growth; Plant growth regulators and Plant Development.

Suggested Books for Module V:

1. E.P. Odum, (1983) Basic ecology W.B.Saunders,Philadelphia.
2. Odum, E.P. (2000). Fundamentals of Ecology. Thomson Asia Pvt. Ltd., Singapore
3. R. L. Smith, (1996). Ecology and Field Biology. Harper Collins College Pub. Inc. New York.
4. Mitra, Sandhya (1996) Genetic Engineering. Mc-Millian India Co. Ltd., New Delhi.
5. Gupta, P.K. (2001). Elements of Biotechnology. Rastogi Publications, Meerut, Pp:1-13.
6. Ricklefs, Robert, E. and Gary L. Miller (2009). Ecology (IVth edition). W.H. Freeman and Company, New York.
7. Chawala, H.S (2006). Introduction to Plant Biotechnology. Oxford and IBH Pub. Co.,

New Delhi.

8. Naik, V.N. (2001). Taxonomy of Angiosperms. Tata MC Graw- Hill Pub. Co. Ltd., New Delhi.
9. Moore, T.C.(1989). Biochemistry and Physiology of Plant Hormones [2nd Edition]. Springer-Verlag, New York,USA.
10. Salisbury,F.B. and Ross,C.W.(1992). Plant Physiology [4th edition]. Wadsworth Publishing Co, California, USA.
11. Hopkins, W.G. (1995). Introduction to Plant Physiology. John Wiley and Sons, Inc., New York, USA
12. Harold, A., (2003). Response of plants to multiple stresses, Academic Press Inc. UK.
13. Heldt, H.W. (2005), Plant Biochemistry, Academic Press, London.18.
14. Helgi Opik and Stephen Rolfe. (2005). The Physiology of Flowering plants. Cambridge University press, London.