



UTTARANCHAL
UNIVERSITY

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Arcadia Grant, P.O. Chandanwari, Premnagar, Dehradun,
Uttarakhand-248007, INDIA

Detailed Course Structure & Syllabus of

**Pre Ph.D. (Biotechnology)
Course Work
(As per CBCS system)**

Session: 2019-20 (Even Semester)



Course Structure & Syllabus of Pre Ph.D. (Biotechnology)
Session: 2019-20 (Even Semester)

EVALUATION SCHEME
Pre Ph.D. (Biotechnology)
Course Work

Course Structure & Syllabus of Pre Ph.D. (Biotechnology)
Session: 2019-20 (Even Semester)

Scheme of Pre-Ph.D. Course Work

S. No	Course Code	Course Name	Credits	Evaluation - Scheme							
				Period			Sessional			Examination	
				L	T	P	CT-I	CT-II	Total	ESE	Sub. Total
1.	RM-101	Research Methodology & Computer Application	5	4	1	0	20	20	40	60	100
2.	BT-102	Discipline Specific Electives (Biotechnology)	5	4	1	0	20	20	40	60	100
3.	RLS-103	Review of Literature & Seminar Presentation	5	0	0	10	20	20	40	60	100
4.	RPE-104	Research & Publication Ethics	2	2	0	0	20	20	40	60	100
Total			17	10	2	10	80	80	160	240	400

List of Electives

S. No.	Course Code	Course Name
1	BT-102 (i)	Advanced Bio-Analytical Techniques
2	BT-102 (ii)	Environmental Biotechnology
3	BT-102 (iii)	Plant Biotechnology



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RM 101: RESEARCH METHODOLOGY

Course Objectives:

1. To Equip the Students with the Concept and Methodology of Research.
2. To provide knowledge about type of research, preparation of reports and thesis, designing of Research using Scientific Methods like statistical methods and computer skills.

UNIT-I

Introduction to Research: Definition, Nature and significance, Role and Objectives; Types of Research: Doctrinal and non-doctrinal research methods; Scientific Research Process: Overview, Problem identification and formulation of research statement. Types and nature of various research design, Research design decisions, Types and nature of various research designs. Structures of experimental research designs.

UNIT-II

Data Collection: sources of secondary data methods of primary data collection: personal interview, questionnaire method, observation method questionnaire Vs. schedules; Data Processing: Editing, Coding Organization and Presentation; Attitude Measurement and scaling: Measurement Scales, Sources of Errors in Measurement, Techniques of Developing Measurement Tools, Classification and Testing (Reliability, Verification and Validity) Scales, Designing Questionnaires. Data collection methods in qualitative research.

UNIT-III

Sampling, Sampling Methods, Sampling Plans, Sampling Error, Sampling Distributions: Theory and Design of Sample Survey, Census Vs Sample Enumerations, Objectives and Principles of Sampling, Types of Sampling, Sampling and Non-Sampling Errors. Sampling design process. Sample size determination, Sampling design process, Sample size determination.

UNIT-IV

Statistical Tools / Methods for research – Univariate and Bivariate Analysis. Hypothesis and Hypothesis Testing: Parametric & Non-Parametric Tests, Use of Various Statistical Tools on SPSS F-Test, t-Test, z-Test, ANOVA, Kruskal-Wallis Test, Chi Square Test, Run Test, Wilcoxon's signed rank test, Man Whitney's U-test, K-S median test

UNIT-V

Interpretations and Report Writing: Meaning, Techniques, Precautions and Significance of Report Writing & interpretation, Precautions in Writing Research Reports. Limitations of RM: Ethics in Research, Philosophical Issues in Research. Use of Internet for Research Work and



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Exploring Various Websites and Search Engines for Collecting Quality Literature Review and Secondary Data.

Text Readings

1. William G. Zikmund, "Business Research Methods", Orlando: Dryden Press.
2. C. William Emory and Cooper R. Donald, "Business Research Methods", Boston, Irwin.
3. Fred N Kerlinger, "Foundations of Behavioural Research", New Delhi: Surjeet Publications.
4. Naresh Malhotra, Marketing Research : An Applied Orientation, Pearson publication David Nachmias and ChavaNachmias, "Research Methods in the Social Sciences", New York: St.Marlia's Press.
5. C. R. Kothari, "Research Methodology: Methods and techniques", New Delhi: Vishwa Prakashan.



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BT 102(i) ADVANCED BIO- ANALYTICAL TECHNIQUES

Course Objective

1. Development of scientific, computational and analytical knowledge reading various tools and techniques in the field of applied science.
2. Demonstrate the principles and working of bio-analytical techniques associated with various techniques like chromatography, electrophoresis, centrifugation, etc
3. Demonstrate the scientific knowledge regarding handling of molecular techniques in the laboratory.

UNIT I CHROMATOGRAPHIC TECHNIQUES

Chromatography - Principle and application. Types of chromatography - Adsorption chromatography, Partition chromatography, Gas chromatography, liquid chromatography, Paper & Thin layer chromatography, Gel filtration chromatography, Ion exchange chromatography, Affinity chromatography, HPLC (High Performance/Pressure Liquid chromatography).

UNIT II ELECTROPHORETIC TECHNIQUES

Electrophoresis - General principle and application electrophoresis, Gel electrophoresis (Native, Denaturing & Reducing), Disc Gel electrophoresis, Slab Gel electrophoresis, Isoelectrofocussing (IEF), Isotachophoresis

UNIT III CENTRIFUGATION TECHNIQUES

Centrifugation: Basic principles. Common centrifuges used in laboratory (clinical, high speed & ultra-centrifuges). Sedimentation rate, Sedimentation coefficient. Types of rotors. Types of centrifugation: Preparative, differential & density gradient.

UNIT IV MICROSCPIC AND SPECTROSCOPIC METHODS

Principle of Microscopy. Types of microscopy- Light, phase contrast, Fluorescence and Confocal microscopy, Scanning and Transmission Electron microscopy. Spectroscopic methods: principle and applications of UV-visible, IR, NMR, ESR. X-ray crystallography. Mass Spectrophotometry, MALDI-TOF, ESI (Electron spray ionization).

UNIT V MOLECULAR TECHNIQUES

Blotting techniques- Southern, Western and Northern; CRISPER Technology, RAPD, RFLP, AFLP, SSR markers. Gene sequencing methods.



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Recommended Books:

1. Sharma, V.K.: Techniques in Microscopy and Cell Biology Tata McGraw Hill, 1991.
2. Alberts et al.: Molecular Biology of the cell (2nd ed.), Garland, 1989.
3. Biochemical Technique: Theory & Practical J.F. Robyt& B.J. White \$ 30.95. Waveland Press, Inc.
4. Wilson & Walker: Practical Biochemistry (4th ed) University of Hertfordshire Cambridge University Press



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BT 102 (ii): ENVIRONMENTAL BIOTECHNOLOGY

Course Objectives

1. Acquire skills to undertake the environmental problems and implication of scientific principles to design new models with respect to recent trend of biotechnology.
2. Interpret and propose solutions for effective management of different types of pollution, waste management, biodegradation and Biotransformation.
3. Identify underlying principle of environmental monitoring and sample analysis.

UNIT I ENVIRONMENTAL BIOTECHNOLOGY

Concept, Definition and explanation for various terms components of environment Air pollution and its control through Biotechnology (deodorization, reduction in CO₂ emission, bioscrubbers, biobeds, biofilters etc). Water pollution and its controls: Sources of water pollution. Environmental Impact Assessment (EIA) Need of EIA; Scope and objectives; Types of environmental impacts; Steps involved in conducting the EIA Studies.

UNIT II ENVIRONMENTAL MONITORING AND SAMPLE ANALYSIS

Sampling of air and water pollutants; Monitoring techniques and methodology, pH, Dissolved Oxygen (DO); Chemical oxygen demand (COD); Biological Oxygen Demand (BOD); Speculation of metals, monitoring & analysis of CO, NO₂, CO₂, SO₂ ; Pesticide residue; Phenols and petrochemicals. Instruments used in chemical analysis of environmental samples

UNIT III WASTE MANAGEMENT AND TREATMENT

Effluent treatment systems Sewage and waste water treatments systems; Primary, secondary and tertiary treatments; Biological treatments - aerobic versus anaerobic treatments. Biofilms in treatment of waste water; Bioreactors for waste water treatments; Reactors types and design. Solid waste management of municipal and biomedical waste Basic aspects of solid waste management; Aerobic and anaerobic treatments of solid wastes; Composting; Vermiculture; Biogas generation; Biomedical wastes, Types of biomedical wastes; Hazards caused by biomedical wastes; Treatment strategies for biomedical wastes.



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UNIT IV BIOTRANSFORMATION AND BIODEGRADATION

In situ and Ex situ bioremediation. Biodegradation; Factors affecting process of biodegradation; Methods in determining biodegradability (Hydrocarbon degradation); Contaminant availability for biodegradation. Xenobiotics; Use of microbes (bacteria and fungi) and plants in biodegradation and Biotransformation. Heavy metal and oil spill bioremediation Sources of heavy metal pollution.

References:

1. Environmental Biotechnology, T.R.Srinivas, [1st Ed. ed.] New Age International Pvt Ltd Publishers (2008)
2. Environmental Biotechnology, R.A.Sharma, Pointer Publishers (2007)
3. Environmental Biotechnology: Textbook by Indu Shekhar Thakur



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BT 102(iii) PLANT BIOTECHNOLOGY

Course Objectives

1. Comprehend concept, tools and techniques of plant tissue culture along with factors affecting growth of micro propagated plants.
2. Identify applications of tissue culture techniques in agriculture science.
3. Understand the implementation of genetic engineering in production of transgenic plants.
4. Analyse utilization of micropropagation techniques for conservation of endangered plant species.

UNIT - I

Early attempts in tissue culture of plants. Concept of totipotency. Sterilization procedures. Design of laboratory and commercial tissue culture facility. Media for *in vitro* culture; Types of media – Solid, liquid and commercial pre-packed media; Media composition – Macronutrients, Micronutrients and growth regulators; Preparation of media; Selection of suitable explants.

UNIT - II

Direct and indirect organogenesis. Callus culture - initiation and maintenance of callus. Haploid culture. somatic embryogenesis and synthetic seed production. Haploid culture: Androgenesis & Gynogenesis. Embryo culture & Embryo rescue, Protoplast culture & protoplast fusion – Cybrids, Symmetric & Asymmetric hybrid. Somatic embryogenesis and Somaclonal variation, cryo-preservation.

UNIT - III.

Components of plant genetic engineering, Ti & Ri plasmids, Binary vector, expression vector, cointegrated vector. Transformation: Vector mediated and vector less DNA transfer (Particle bombardment, electroporation, microinjection) in plants. Application of plant cell & tissue culture: Transgenics, secondary metabolites, Industrial enzyme, edible vaccine.

UNIT - IV

Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance, abiotic stress tolerant plants, BT gene, Application of Plant Transformation for productivity and performance, Study of biopesticides used in agriculture.

References

1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
2. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.



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3. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
4. H.S.Chawla, Plant Biotechnology, S.Chand Publications.
5. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.



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RLS-103: REVIEW OF LITERATURE AND SEMINAR PRESENTATION

Course Objectives:

Main objective of this course is to develop presentation skills in the scholars and knowledge about review of literature so that they can review properly in the concerned field.

Review of Literature and Seminar

Presentation-Candidate/Research Scholar has to go through the review of literature in the concerned field of research. Review of literature guidelines will be given by the concerned faculty/Dean of Department/School/College. Research Scholar has to give prepare presentation on review of literature in the concerned field/ topic assigned by the department (DRC) periodically during course work.

There will be minimum 3 presentations of review of literature during pre-Ph. D course work. Final presentation would be required at the time of end term/semester examination on proposed synopsis. General guidelines would be issued by Dean-Research for seminar presentation.



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RPE-104: RESEARCH PUBLICATION & ETHICS

Course Objectives-

Its objective is to provide knowledge about ethics and code of research publication with concept of plagiarism.

Unit 1: Philosophy and Ethics

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions

Unit 2: Scientific conduct

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

RPE 03: Publication Ethics

1. Publication ethics: definition, introduction and importance
2. Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types
5. Violation of publication ethics, authorship and contributor ship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

Practice

Open Access Publishing

Uttaranchal University-Syllabus of Pre Ph.D. (Biotechnology) (Session: 2019-20 (Even Semester))



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1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/ Journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester, etc.