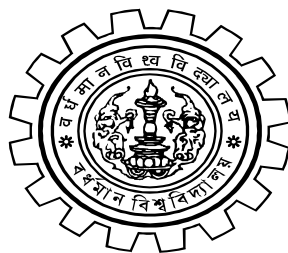


**ENVIRONMENTAL SCIENCE
THE UNIVERSITY OF BURDWAN**



**M. PHIL SYLLABUS (CBCS)
[w. e. f. 2021]**

**DEPARTMENT OF ENVIRONMENTAL SCIENCE
THE UNIVERSITY OF BURDWAN
BURDWAN-713104**

COURSE STRUCTURE FOR M.PHIL. IN ENVIRONMENTAL SCIENCE

Semester	Course Code	Course Title	Credit Value	Marks Distribution
Semester- I	MPHIL 101	Research Methodology	4	50
	MPHIL 102	Research and Publication Ethics (RPE)	2	25
	MPHIL 103	Compulsory/Optional Paper	4	50
	MPHIL 104	Term Paper(s) & Related Seminar Presentation(s)	4	50 (25+25)
	Sub Total		14	175
Semester- II	MPHIL 201	Compulsory/Optional Paper- I (Advanced Level)	4	50
	MPHIL 202	Compulsory/Optional Paper- II (Advanced Level)	4	50
	MPHIL 203	Term Paper(s) & Related Seminar Presentation(s)	4	50 (25+25)
	Sub Total		12	150
Semester- III & IV	MPHIL 301	Dissertation	12	150
		<i>Viva-Voce</i>	4	50
	Sub Total		16	200
	Grand Total		42	525

Semester - I
MPHIL 101
[Compulsory]
[Research Methodology]

Lectures: 60

Credit: 4

I.	Basic Concept on research methodology	[4]
II.	Defining Research Problems	[4]
III.	Research Design	[5]
IV.	Sampling design	[5]
V.	Statistical analysis and processing of experimental data	[6]
VI.	Interpretation and Report Preparation	[5]
VII.	Basic instrumentation techniques	[6]
VIII.	Computer applications on research methodology	[5]
IX.	Developing Research Projects & Proposals	[5]
X.	Geospatial analysis techniques	[8]
XI.	Techniques of EIA and use of computer and expert systems in EIA	[7]

Books Recommended

An Introduction to Mathematical Statistics by Gupta and Kapoor Sultan Chand Publishers, New Delhi.
 Research Methodology — Methods and Techniques by Kothari, C R: New Delhi, Wiley Eastern Ltd., 1990

Quinn, G. and Koegh, M (2002) Experimental design and data analysis for biologist (Cambridge University Press) 537p.

Holmes, D., Moody, P., Diana, D. and Trueman, L (2016) Research methods for the biosciences. 3rd Edition. (Oxford University Press) 488p.

Legendre P. and Legendre, L (2012) Numerical Ecology. (Elsevier) 1006p.

Gotelli, N.J. and Ellison, A.M (2012) A Primer of Ecological Statistics. 2nd edition (Oxford University Press) 614p.

Zar JH (2010) Biostatistical Analysis 5th edition (Pearson Education) 944 p.

MPHIL 102
[Compulsory]
[Research and Publication Ethics (RPE)]

Lectures: 30

Credit: 2

I: Philosophy of ethics: Introduction of philosophy: Definition, Nature and scope, concept, branches; Ethics: Definition, moral philosophy, nature of moral judgements and reactions

II: Scientific conduct: Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconducts: Falsification and Fabrication, and Plagiarism (FFP); Redundant publications: Duplicate and overlapping publications, Salami Slicing; Selective reporting and mispresentation of data

III: Publication ethics: Publication ethics: Definition, introduction and importance; Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.; Conflicts of interest; Publication misconduct: Definition, concept, problems that lead to unethical behavior and vice-versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals

IV: Open access publishing: Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright & self-achieving policies; Software tool to identify predatory publications developed by SPPU; Journal finder/journal suggestion tool viz., ZAME, Elsevier journal Finder, Springer journal suggester, etc.

V: Publication misconduct

A. Group discussion: Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: Examples and fraud from India and abroad

B. Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools

VI: Databases and research metrics

A. Databases: Indexing databases; Citation databases: Web of science, Scopus, etc.

B. research Metrics: Impact Factor of journal as per journal Citation report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrics

MPHIL 103-1
(Compulsory Optional)
[Ecomodelling, Biofarming, Environmental Chemistry & Ecotoxicology]

Lectures: 60**Credit: 4**

- | | | |
|-------|--|-----|
| I. | Quantitative ecological techniques | [6] |
| II. | Modelling approach in environmental management | [7] |
| III. | Groundwater geochemistry - Aquifer geochemical system, solution, redox and gas exchange processes; Water-rock interactions | [7] |
| IV. | Adsorption chemistry | [7] |
| V. | Green chemistry and environmental protection | [6] |
| VI. | Biotransformation, detoxification, and biodegradation | [6] |
| VII. | Biofertilizer, role of plant growth promoting rhizobacteria | [7] |
| VIII. | Composting and vermicomposting | [7] |
| IX. | Introduction to Toxicodynamics; Toxicokinetics; Toxicology in the clinical laboratory and safe handling of chemicals | [7] |

Books Recommended

Groundwater Geochemistry - Fundamentals and applications to contamination by William J. Deusch; Lewis Publishers, New York, 1997
 Environmental Meteorology - B. Padmanabha Murthy; I.K. International Pvt. Ltd., New Delhi, 2004
 Environmental Biotechnology - S.K. Agarwal; Indian Book Co. 1998

OR

Paper – III: MPHIL 103-2
(Compulsory Optional)
[Environmental Analysis, Management & Toxicology]

Lectures: 60**Credit: 4**

- | | | |
|-------|---|-----|
| I. | Fundamental management of mineral biofertilizer | [7] |
| II. | Fundamentals of environmental chemistry | [7] |
| III. | Air, water and soil chemistry | [7] |
| IV. | Instrumental methods on environmental analysis | [7] |
| V. | Fundamentals of ecotoxicology | [5] |
| VI. | Interactions and connections of environmental toxicology | [6] |
| VII. | Mechanism of toxic action | [7] |
| VIII. | Introduction to Quantitative Structure Activity Relationship (QSAR) | [7] |
| IX. | Urban air pollution models; Environmental Indices | [7] |

Books Recommended

Environmental chemistry By A.K. De; The New Age International Publisher; 6th Ed. 2006
 Environmental Chemistry with Green Chemistry by Asim kr Das; Books and Allied (P) Ltd. 2010
 Environmental Toxicology - Ed. Volume by Jhon H Duffus and Howard G J Worth - RSC Publishing, 2006.
 Introduction to Environmental Toxicology by Wayne G Landi and Ming-Ho Yu - Lewis Publishers, 2004.

MPHIL 104
Term Papers (two) and Related Presentations **Credit: 4**

Semester – II
Compulsory Optional Paper (Advanced level)
MPHIL 201-1

[Forestry, Geosciences, Environmental Resources and Remote Sensing]

Lectures: 50

Credit: 4

- I. Forest Resources: Forest classification of India, mangrove forest, grassland of India, nutrient dynamics and conserving mechanisms of forests; Some important events of interacting populations in forest, grassland ecosystems – fire, grazing, symbiosis, commensalisms, mutualism, epiphytes, parasitism, cannibalism and insectivorous plants [15]
- II. Geochemistry and analytical techniques: Atmospheric environment, continental environment and marine environment
Analytical methods for environmental samples: principle and application of ICP-AES, Electrophoresis, XRF, XRD [10]
- III. Environmental resources: A) Water Resource: Groundwater distribution in India, flow pattern, well hydraulics, water wells, surface and subsurface investigation of groundwater, groundwater levels and environmental influence; Wastewater reuse systems, conservation of water resources, watershed management, water harvesting, climate change and water resource management
B) Soil resource: Micronutrients in soils and plants and micronutrient pollution; Climate change impact on soils, soils in relation to irrigation; Economic minerals in soils [15]
- IV. Remote sensing & GIS: optical and microwave, remote sensing, digital image processing and geographical information system; Application of remote sensing and GIS [10]

OR

Compulsory Optional Paper (Advanced level)
MPHIL 201-2

[Environmental Chemistry and Waste water Treatment]

Lectures: 50

Credit: 4

- I. Waste water treatment; Pre-treatment process of industrial and agricultural waste water, design of waste water treatment plant, bacterial growth, metabolism and genetics, microbiology of aerobic and anaerobic waste water treatment; Fixed film systems, activated sludge, physicochemical treatment processes *viz.*, equalization, coagulations, sedimentation, adsorption, ion-exchange, membrane filtration; advanced oxidation process, sludge treatment sludge handling and disposal [20]
- II. Basic of nuclear chemistry, biological effects of radiations, man-made and natural radiations, nuclear fission and nuclear reactor, application of radio-isotopes for medicine, agriculture and environmental sample analysis; Radiation hazards and its management [10]
- III. Environmental Engineering: Introduction and concept; Hydrology; Water quality management; solid waste management; Hazardous waste management; Ionizing radiation and radioactive waste [10]
- IV. Landfill Waste Pollution and Control: Principles of landfill practice, biological, physical and chemical processes within landfill, landfill gas, landfill leachate other landfill hazards [10]

Compulsory Optional Paper (Advanced level)

MPHIL 202-1

[Ecotoxicology and Environmental Biotechnology]

Lectures: 50

Credit: 4

- I. Ecotoxicology: Historical background, objectives and need of ecotoxicology; Scientific and technological goal of study of environmental contaminants; Emerging contaminants of concern *e.g.*, PBDE or BDE, halogenated and phenols, POPs, PCB, dioxins; Phenomenon of Chemical mutagenesis (10)
- II. Molecular effects: General cytotoxicity and histopathology; DNA modification; Oxidative stress and antioxidant response; Biochemical mechanism of toxicity; pharmaceutical toxicology, phytotoxicology (10)
- III. Community Ecotoxicology: Definition; biotic and abiotic factors; biomonitoring and the responses of communities to contaminants (10)
- IV. Environmental Microbiology: Microbial flora of soil, biogeochemical role of soil microorganisms, microbiology of domestic water and wastewater - determining sanitary quality (5)
- V. Industrial Microbiology: Microorganisms and industry, industrial uses of bacteria, yeasts, molds; Petroleum microbiology, microbiology and mining, deterioration and materials like paper, textiles and cordage, painted surfaces (5)
- VI. Environmental Biotechnology: Issues and scope of environmental biotechnology; Biodegradation of organic pollutants; Biotechnology for solid waste management, bioleaching and biomining for recovery of resources, biopesticides and integrated pest management (10)

OR

Compulsory Optional Paper (Advanced level)

MPHIL 202-2

[Environmental Impact Assessment and Environmental Management]

Lectures: 50

Credit: 4

- I. EIA: Concept of EIA, Origin of IA, supportive techniques of EIA like participatory assessment, hazard and risk assessment, technology assessment, life cycle assessment, eco-auditing, eco-labelling; Social impact assessment [10]
- II. Impact assessment process, techniques and methods: Phases, steps and stage of IA process: Screening, scoping; Ad-hoc methods, checklist methods, overlays methods, geographical information system, matrix methods, modeling methods, use of computer and expert systems [10]
Basic concept, principles and tools of environmental management, environment and development, Institutional framework, environmental strategies for Small and Medium-Sized Enterprises (SMEs), Good governance and work ethics, empowerment
Standards for environmental management, BS7750, ISO9000, ISO14000, ISO14001, other standards in ISO14001 series [20]
- III. Disaster Management: Geodynamic aspect of natural hazard IDNDR viewpoint; Natural hazard management scenario in India, industrial disaster management, case studies [10]

Paper – VII: MPHIL 203

Term Papers (two) and Related Presentations

Credit: 4

Semester – III & IV
MPHIL 301 & MPHIL 401

Dissertation and *Viva-voce*

(Credit 12+4)