University of Kalyani
Department of Environmental Science
Proposed Course Structure and Syllabus For
M.Phil. Program in Environmental Science, 2022
(Two Years/ Four Semester)

	Paper Code	Group	Name of the Paper	Total Marks and Credit Distribution
Semester I	Total 8 credits (200 marks)			
	Paper- 1	A	Research Methodology and Statistics	60 (Term End) + 20 (Internal Assessment) + 20 (Viva – voce) = 100 (4 credits)
		B	Research Ethics and Research Communication	
		C	Syllabus for computer application	
		D	Training and Field Work	
	Paper - 2	Unit - I	Research Methodology	30 (Report) + 10 (presentation)+ 10 Viva-voce) = 50 (2 credit)
		Unit II	Term Paper and Seminar Presentation	30 (Report) + 10 (presentation) +10 (viva-voce) = 50 (2 credit)
Semester II	Total 8 credits (200 marks)			
	Paper - 3	Unit I	Ecology and Environment	Total 4 Credits (100 Marks)
		Unit II	Environmental Management System	

		Unit III	Analytical Technique and Instrumentation	
	Paper - 4	Unit I	Waste Management	Total 4 Credits (100 Marks)
		Unit II	Environmental Quality Monitoring and Management	
		Unit III	Spatial Technologies	
Semester III & IV	Dissertation: background, aims & objectives, review work, work plan, methodology adopted and progress of research work Dissertation: seminar presentation and viva voce			Total 8 Credits (150+50 =200 Marks)
Total Credit = 24 **Total Marks = 600**				

Semester I Full marks: 200 Credit: 8

Paper -1 Full marks: 100 Credit: 4

Group – A (Syllabus for Research Methodology and Statistics)

General Track (For all students)

Unit 1: Introduction to Research Methodology: Research – Definition, Importance, Characteristics – Types of Research - Research question – Importance of Survey of Literature – formulation of research question and objectives – Formulation of hypothesis – types of hypothesis - Research process – research design – developing a research plan - Types of research methods

Unit 2: Types of data - Sources of data - Methods of collecting data – Sampling methods

Special Track 1 (For students with basic knowledge):

Unit 3: Qualitative Research Methods - Various qualitative research methods – Ethnography, Historical, Narrative, Phenomenological, Case studies, Grounded theory, Content analysis, Framing analysis, Rhetorical analysis, Discourse analysis

Unit 4: Quantitative research methods: Frequency distribution – Presentation of data – Descriptive statistics – Correlation analysis

Special Track 2 (For students with advanced knowledge):

Unit 3: Qualitative Research Methods – Case Studies

Unit 4: Quantitative research methods: Non-parametric methods - Basic Regression analysis – Inference and hypothesis testing.

GROUP - B (Research Ethics and Research Communication for all students)

Unit 1: Ethical Aspects of Undertaking Research

Concept of Philosophy, Basic Philosophical Assumption to Social Science Research, Major Philosophies in Social Science Research, Research Philosophy, Approaches to Theory Development in Research, Ethical Judgments in Research.

Unit 2: Managing Scientific Conduct

Concept of Academic Integrity: Integrity Concepts, Academic integrity; Scientific Misconduct and Research Fraud (Falsification, Fabrication and Plagiarism: FFP): Scientific misconduct, Research Fraud, Intellectual Honesty in Research; Redundant publications: Duplicate and Overlapping publications, Salami Slicing; Selective Reporting and Misrepresentation of Data: Selective Reporting, Misrepresentation of Data.

Unit 3: Publication Ethics

Concept of Publication Ethics, Research Ethics: Concept and Objectives, Ethics Committee, Managing Publication Ethics through Best Practices Standards: COPE, WAME; Publication & Research Misconduct: Concept of Research Misconduct, Concept of Plagiarism, Nature of Plagiarism, UGC Guidelines on Levels of Plagiarism, Plagiarism : AI vs AI; Plagiarism Detection Software-Selection of Appropriate Software, Violation of Publication Ethics, Authorship and Contributor ship - Conflict of Interest: Note on Violation of Publication Ethics, Authorship and Contributor ship, Conflict of Interest; Identification of Publication Misconduct and Appeal; Concept of Publication Misconduct, Responding to allegations of possible misconduct; Predatory Journals and Publishers: Backdrop, Meaning of Predatory Journal, Characteristics of a Predatory Journal; Way to Find Predatory Journals and Publishers, Role of Academic Community to Fight Against Predatory Publication.

Unit 4: Scientific Writing

Structure and components of Scientific Reports, Preparation of Project Proposal, Preparation of manuscript for Seminar Presentation and Publication of Research paper, Components of Doctoral Thesis, Footnotes and Referencing Styles.

Group – C (Syllabus for Computer Applications)

General Track (For all students)

Technology and Tools for Research: Brief description of Computer Hardware & Software; Preliminary knowledge of Computer Technology, Peripheral devices and their uses; Preliminary knowledge of Operating Systems; Basics of Word processing, spreadsheet and slides preparation (offline and cloud-based software).

Literature search: Search techniques, search strategies, search tools; Open Access (OA) resources - Open Access Vs Toll Access, OA types, OA services; Open Access path finder services.

Tools for literature review: Use of citation/reference networks in literature review; Tools and Techniques for literature review; AI based literature review.

Special Track 1 (For students with basic computer knowledge)

Office Tools & Technology : Office document Management, Typesetting, Use of office Tools, Use of layout software, Preparation of Power Point Presentation, Table Management and basic calculations using Excel/other spreadsheet programs; Use of Internet; Digital Access Brokers.

Special Track 2 (For students with advanced computer knowledge)

Data Science & Statistical Tools: Statistical packages (R, SPSS etc.), Statistical Computing, Internet Technology and its Internal Architecture; Advanced Spreadsheet operations; Document and slides preparation in LaTeX; Digital Access Brokers; Data Wrangling Tools & Techniques.

Group – D: Training and Field Work

Paper – 2 Full marks: 100 Credit: 4

Unit 1: Research Methodology Full marks: 50 Credit: 2

Review of Published Research, Documentation/ Submission of Reports on Review Work and Presentation.

Unit 2: Term Paper and Seminar Presentation Full marks: 50 Credit: 2

Semester II Full marks: 200 Credit: 8

Paper – 3 Full marks: 100 Credit: 4

Unit I: Ecology and Environment

Ecology and Environment; Air, Water and Soil Quality Monitoring, Pollution Studies, Toxicology, Waste Management and Waste Valorization, Remediation Techniques,

Thermodynamic and Kinetic. Landfill Waste Pollution and Control: Principles of landfill practice, biological, physical and chemical processes within landfill, landfill gas, landfill leachate other landfill hazards.

Unit II: Environmental Management System

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. Disaster- causes, impacts. Risk assessment and vulnerability analysis. Disaster Management: Geodynamic aspect of natural hazard IDNDR viewpoint; Natural hazard management scenario in India, industrial disaster management, case studies.

Unit III: Analytical Technique and Instrumentation

Analytical Techniques: Accuracy, Precision, Calibration, Method optimization; Interpretation of analytical data / results; Sampling Techniques - collection, treatment, preservation; Microbial Techniques, Microscopy; Titrimetry, Gravimetry, Nephelometry, Turbidimetry, Chromatographic Techniques, Gas Chromatography, Ion Chromatography, HPLC, Spectroscopy, Gel Electrophoresis, Mass Spectrometry, LCMS, GCMS etc.

Instrument: Principles, Procedure and Applications: Petrological Microscope, Spectrophotometer, Flame Photometer, Atomic Absorption Spectrophotometer, Gas Chromatograph, Ion Chromatograph, High Volume Sampler, Spectrofluorimeter, Fluorescent Microscope, Inductively Coupled Plasma Mass Spectrometer, XRD, XRF etc.

Paper 4 Full marks: 100 Credit: 4

Unit I: Waste Management

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.

Unit II: Environmental Quality Monitoring and Management

(i) Adsorption and Degradation studies of emerging contaminants, Green Synthesis and Bioprospecting, Development of Chemo-sensor and Application, Nano Technology and Applications, Statistical Analysis.

(ii) Geo-Environmental control on pollutants spreading, creating human health hazards.

Unit III: Spatial Technologies

Principles of Remote Sensing and GIS, Satellite Imagery, Toposheet Interpretation, Thematic Map Creation and GIS Analysis, Digital Image Processing (DIP) including Band Rationing, Filtering using Filter Kernels and Image Classification, use of GIS Software.

An overview of Sediment Water Interface, Concept of Scale and Creation of Thematic Maps, land Use study and Environment, water resource management, Remote Sensing (RS) and Geographical Information System (GIS) applications in environment.

Semester III & IV Full Marks: 150+50 Credit: 8

Dissertation: background, aims & objectives, review work, work plan, methodology adopted and progress of research work,

Dissertation: seminar presentation and viva voce.

Reference Books:

1. Fundamentals of Ecology – E. Odum
2. Fundamentals of Ecology & Environmental Biology – S.C.Santra Animal physiology, Adaptation and Environment
3. Environmental Chemistry (3 rd Ed.) A.K. De, Wiley Edation.
4. Environmental chemistry' – S.E. Manahan, - Villard Grant Press, USA.
5. Environmental Geography – S. Singh, 1991. Pragag Pustak Bhawan, Allahabad
6. Climatology – D.S.Lal
7. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice Hall of India Pvt. Ltd.

8. S. C. Bhatia, Solid & Hazardous Waste Management, Atlantic Publishers.
9. Metcalf & Eddy, Inc., Wastewater Engineering – Treatment, Disposal and Reuse – Third Edition, McGraw Hill
10. 'Water Pollution – Causes, Effects, and Control' – P.K. Goel, New age International
11. Statistics for Environmental biology and Toxicology W.E. Piegrosch and J.A.Bailer (Chapman and Hall London, UK)
12. Introductory Digital Image Processing – J.R.Jensen
13. Remote Sensing – Lillesand and Keife
14. Remote Sensing And GIS (2nd Edition) – Basudeb Bhatta
15. Introductory Digital Image Processing – J.R.Jensen
16. Remote Sensing – Lillesand and Keife
17. V.K. Ahluwalia and M. Kidwai. (2004). New Trends in Green Chemistry - Anamaya Publishers, New Delhi
18. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill, New York, USA.