



Dr. Vishwanath Karad

**MIT WORLD PEACE
UNIVERSITY** | PUNE

TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

Syllabus

DR VISHWANATH KARAD
MIT - WORLD PEACE UNIVERSITY

Faculty of Sciences & Health Sciences

School of Sciences & Environmental Studies

Department of Environmental Studies

Ph.D. in Environmental Science

Program Pattern

BATCH – 2024

Dr. Vishwanath Karad

MIT-WPUI
Approved by
Academic Council
24 MAY 2023
Date...../...../.....

PROGRAMME STRUCTURE

Introduction:

The field of environmental studies has gained significant prominence in recent years, given the pressing global challenges related to climate change, sustainability, and biodiversity conservation. Recognizing the importance of addressing these critical issues, MIT World Peace University in Pune, India, offers a distinguished PhD program in Environmental Studies.

Program Overview:

The PhD program in Environmental Studies at MIT World Peace University is designed to provide comprehensive knowledge and research skills to individuals passionate about studying and solving complex environmental problems. The program is rooted in a multidisciplinary approach, integrating concepts from environmental science, policy, economics, and technology.

Priority Areas:

- 1. Climate Change Mitigation and Adaptation:** The program focuses on understanding the impacts of climate change, exploring strategies for mitigating greenhouse gas emissions, and developing adaptive measures to minimize the effects on ecosystems and human societies.
- 2. Biodiversity Conservation:** With the alarming decline of global biodiversity, the program emphasizes the preservation and restoration of ecosystems, endangered species management, and the development of sustainable practices that promote biodiversity conservation.
- 3. Sustainable Resource Management:** Recognizing the finite nature of natural resources, the program investigates sustainable management practices for water, energy, land, and other vital resources. It explores innovative solutions to ensure resource efficiency and promote circular economy principles.
- 4. Environmental Policy and Governance:** The program delves into the formulation and implementation of environmental policies at local, national, and international levels. It equips students with the knowledge to address environmental challenges through effective governance, stakeholder engagement, and policy analysis.
- 5. Environmental Education and Awareness:** Recognizing the importance of education in fostering sustainable practices, the program focuses on designing environmental education initiatives, promoting awareness campaigns, and fostering behavioural changes to address environmental issues.

The PhD program in Environmental Studies at MIT World Peace University in Pune offers an exceptional opportunity for aspiring environmental scholars to delve into critical issues, conduct ground-breaking research, and contribute to the global quest for sustainability. With its multidisciplinary approach, focus on priority areas, and wide range of future prospects, the program equips students with the knowledge and skills necessary to make a significant impact in academia, policy-making, business, and environmental activism. By nurturing the next generation

of environmental leaders, MIT World Peace University plays a vital role in shaping a sustainable and prosperous future for our planet.

List of domains in which students can pursue Ph.D. in Environmental Studies:

Urban Ecology	Odonatology
Biogeography	Evolutionary Ecology
Biodiversity & Distribution Studies	Natural History
Socioecology	Climate Change & Natural Resource Management
Environmental Economics	Biodiversity Informatics
Sustainable Development	Environmental Remote Sensing & GIS
Environmental Impact Assessment	Marine and Coastal Ecosystems
Life Cycle Analysis	One Health
Ornithology	Ecological Modeling
Environmental Monitoring and Assessment	

Vision Statement:

The vision of the PhD program in Environmental Studies at MIT World Peace University (MIT-WPU) Pune is to be *a global leader in producing highly skilled and innovative researchers and scholars who are dedicated to addressing the pressing environmental challenges of our time. We strive to foster a multidisciplinary learning environment that promotes excellence in research, collaboration, and sustainable solutions, with the ultimate aim of creating a harmonious and resilient planet for future generations.*

Mission Statement:

The mission of the PhD program in Environmental Studies at MIT-WPU Pune is to provide a transformative educational experience that empowers students to become influential agents of change in the field of environmental studies. Our mission is driven by the following core principles:

1. **Academic Excellence:** We are committed to providing rigorous academic training and research opportunities to develop scholars who possess deep knowledge and expertise in environmental studies. We strive for excellence in teaching, research, and publication, and we encourage students to pursue innovative and impactful research projects.
2. **Interdisciplinary Approach:** Our program encourages collaboration across various disciplines, fostering integration of knowledge from environmental science, policy, economics, technology, and social sciences. We aim to equip students with the skills to bridge disciplinary boundaries and develop innovative solutions.
3. **Sustainability and Ethical Responsibility:** We emphasize the principles of sustainability, promoting environmentally responsible practices, and ethics in research and decision-making. Our program instills a sense of environmental stewardship, encouraging students to consider the long-term impacts of their work on ecosystems, communities, and future generations.

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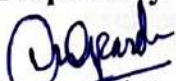
4. **Global Perspective and Social Justice:** Our program fosters a commitment to social justice and equity, addressing the disproportionate impacts of environmental degradation on marginalized communities.
5. **Collaboration and Engagement:** Our program encourages active participation in national and international research networks, partnerships with organizations, and community engagement initiatives to foster real-world impact.

By adhering to our vision and mission, the PhD program in Environmental Studies at MIT-WPU Pune seeks to produce exceptional scholars and researchers who contribute meaningfully to the advancement of environmental knowledge, policy, and practice, ultimately striving towards a sustainable and peaceful world.


Future Prospects:

1. **Academic and Research Careers:** Graduates of the PhD program in Environmental Studies from MIT World Peace University are well-equipped to pursue academic careers as professors, researchers, and scholars. They can contribute to cutting-edge research in various subfields, publish impactful studies, and mentor the next generation of environmental scientists.
2. **Policy and Consulting Roles:** The program prepares students for careers in environmental policy-making and consulting. Graduates can work with government agencies, non-profit organizations, and consulting firms to develop and implement sustainable environmental policies and strategies.
3. **Corporate Sustainability:** With increasing corporate interest in sustainability, PhD graduates can pursue careers in industries committed to environmental stewardship. They can serve as sustainability officers, consultants, or researchers, helping organizations integrate environmentally responsible practices into their operations.
4. **International Organizations and NGOs:** The program equips students with the knowledge and skills to work with international organizations and NGOs dedicated to environmental protection. Graduates can engage in advocacy, project management, and capacity building to address global environmental challenges.
5. **Entrepreneurship and Innovation:** The program encourages students to explore entrepreneurial opportunities by developing innovative solutions to environmental problems. Graduates can establish start-ups focused on renewable energy, waste management, eco-friendly technologies, and sustainable agriculture.

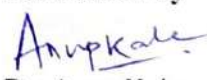
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Associate Dean
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Ph.D. Environmental Science Program Structure

Sr. No	Course Code	Name of Course	Contact hrs	Examination Scheme		Total Marks	Credit
				Continuous assessment	End Semester exam		
PART A							
I	SOS9PF01A	Research Methodology	4	50	50	100	4
II	WPU9UC01A	Research Publication and Ethics	2	50	50	100	2
III	EDU9UC01A	Foundation of Effective Teaching Pedagogy	2	50	-	50	2
IV	EVS9PMXX	Research Seminar	2	100	-	100	2
PART B							
V	EVS9PMXX	Advances and linkages in Environmental Science	4	100	-	100	4
Total			14	350	100	450	14

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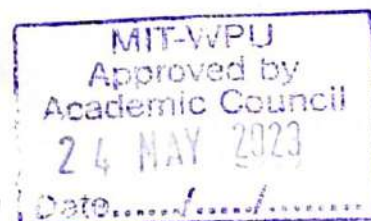
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COURSE STRUCTURE

Course Code	SOS9PF01A			
Course Category	Program Disciplinary Foundation			
Course Title	Research Methodology			
Teaching Scheme and Credits Weekly Load Hrs. (Total Lectures: 60)	Lectures	Tutorials	Laboratory	Credits
	2	2	-	2 + 2 + 0 = 4
Assessment Scheme Code	TT1			

Pre-requisites: Master's degree in Science and Environmental Studies

Course Objectives:

1. To follow ethical methods in scientific research.
2. To introduce the concept of design of experiment.
3. To familiarize data collection, analysis, interpretation and report making.
4. To know the insights of publication, peer review process and project proposal preparation.

Course Outcomes:

On the completion of this course the student will be able to:

1. Identify an independent research problem and its execution.
2. Adopt principles of experimental design for reproducibility of data.
3. Understanding and following research ethics in analysis and reporting of data.
4. Preparing and submitting project proposal for funding agencies.

Contents:

1. **Introduction to Research Methodology:** Importance of research, objectives of research, motivation in research, understanding research and its goal, types of research, research approaches, research methods versus methodology, research and scientific method, research process, criteria of good research; Review of Literature and use of AI tools for the same.
2. **Research Ethics:** Ethical and moral issues in research, treatment of human subjects and animals in research, copy right laws, authorship issues in publications, conflict management, intellectual property rights, patent rights, accountability and reproducibility in research.
Research Design: Need for research design, features of good design, concepts related to research design, basic principle of experimental design and theoretical estimation, design tools. Problem-based critical thinking
3. **Data Collection:** Primary data and secondary data, methods of data collection, important data available for scientists in World Wide Web, reliability of public domain data bases and its implication in research. Advanced data visualization software tools that can be used for better data visualization, analysis and interpretation.

Data Analysis: Introduction to hypothesis testing & errors in testing, Z-test, t-test, Chi-square test, F-test, ANOVA (one way and two way), design of experiments: Block designs (CRD, RBD), Latin square design, introduction to statistical packages for data analysis. Set theory, Game theory, Conditional statistics, Regression analysis, Multivariate statistics, Principal component analysis

4. **Interpretation and Report writing:** Importance of interpretation, techniques of interpretation: precautions in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation, writing a good research report; Scientific report editing, peer review and feedback
5. **Publication and Project proposal preparation:** Role of scientific journal in research, different ways of citing a research article in manuscripts, Impact factor of journals, importance of citations, h-index, i10-index, cite score, plagiarism - software to detect plagiarism, reviewer comments. Funding agencies in India for Science, Engineering and Technology, preparation of a project proposal for funding. Identifying IP value of Research, IP generation & innovation management

Learning Resources:

Reference Books:

1. Research Methodology Methods and Techniques, by C.R. Kothari, (2014) 3rd Edition, New Age International Publishers.
2. Research Methodology A step-by-step guide for beginner, by Ranjit Kumar, (2011), SAGE Publication, New Delhi, India.
3. Research design and methods a process approach, by Kenneth. S. Bordens and Bruce B. Abbott, (2002), Tata McGraw-Hill companies Inc. USA.
4. Research Methodology, by Bill Taylor, Gautham Sinha & Taposh Ghoshal, (2006) PHI Learning Private Ltd., New Delhi, India.

Supplementary Books:

1. Fundamental of Research Methodology and Statistics, by Y.K. Singh, (2006) New Age International (P) Limited, Publishers 4835/24, Ansari Road, Daryaganj, New Delhi, India.
2. Introduction to Biostatistics and Research Methods, by P.S.S. Sundar Rao and J. Richard, (2012) 5th Edition, PHI Learning Private Ltd., New Delhi, India.
3. Biostatistics, Basic concepts and Methodology for the Health Sciences, by W.W. Daniel and C.L. Cross, (2020) 1st Edition, Wiley India.

Web Resources:

Weblinks:

<http://onlinestatbook.com/2/>

<https://www.khanacademy.org/math/statistics-probability>

Pedagogy:

- Power point presentations
- Scientific animations and videos
- Group activity
- Demonstrations
- Expert talks

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Lesson Plan

Module No.	Contents	Workload in Hrs		
		Theory	Tut.	Assess
1	Introduction to Research Methodology	8	4	-
2	Research Ethics & Research Design	6	6	-
3	Data Collection & Analysis	6	6	-
4	Interpretation and Report writing	6	6	-
5	Publication and Project proposal preparation	6	6	-



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COURSE STRUCTURE

Course Code	WPU9UC01A			
Course Category	University Core			
Course Title	Research and Publication Ethics (RPE)			
Teaching Scheme and Credits	Lectures	Tutorials	Laboratory	Credits
Weekly Load Hrs.	2	-	-	2 + 0 + 0 = 2
(Total Lectures: 30)				
Assessment Scheme Code	TTI			
<u>Pre-requisites:</u> Master's degree in Science and Environmental Studies				
<u>Course Objectives:</u>				
<ol style="list-style-type: none"> 1. Learn the basics of philosophy of science and ethics, research integrity, publication ethics. 2. Hands-on sessions to identify research misconduct and predatory publications. 3. Learn Indexing and citation databases, open access publications, research metrics. 4. To sensitize on plagiarism. 				
<u>Course Outcomes:</u>				
On the completion of this course the student will be able to:				
<ol style="list-style-type: none"> 1. Understand data analysis and statistics to evaluate results. 2. Able to design scientific experiment with proper methodology. 3. Interpret the results obtained from the scientific experiments. 4. Write a research paper, review article, write a research proposal. 				
<u>Contents:</u>				
<ol style="list-style-type: none"> 1. Philosophy and Ethics: Introduction to Philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral, philosophy, nature of moral judgements and reactions 2. Scientific conduct: Ethics with respect to science and research; Intellectual honesty and research integrity; Scientific misconducts: Falsification, Fabrication, Plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data. 3. Publication Ethics: Publication Ethics: definition, introduction, importance; Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.; Conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types; Violation of publication ethics, authorship and contributor ship. Identification of publication misconduct, complaints, and appeals. Predatory publishers and journals 4. Open Access Publishing: Open access publication and initiatives; SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies; Software tool to identify predatory publications developed by SPPU; Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc. 5. Publication Misconduct: A. GROUP DISCUSSIONS; Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from 				

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India and abroad; SOFTWARE TOOLS; Use of plagiarism software like Turnitin, Urkind and other open source software tools;

6. **Databases and Research Metrics:** A. DATABASES, Indexing databases; Citation databases: Web of Science, Scopus, etc.; RESEARCH METRICS; Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score; Metrics: h-index, g index, i10 index, altmetrix

Learning Resources:

Reference Books:

1. Research Methodology Methods and Techniques, by C.R. Kothari, (2014) 3rd Edition, New Age International Publishers.
2. Research Methodology A step-by-step guide for beginner, by Ranjit Kumar, (2011), SAGE Publication, New Delhi, India.
3. Research design and methods a process approach, by Kenneth. S. Bordens and Bruce B. Abbott, (2002), Tata McGraw-Hill companies Inc. USA.
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1. Fundamental of Research Methodology and Statistics, by Y.K. Singh, (2006) New Age International (P) Limited, Publishers 4835/24, Ansari Road, Daryaganj, New Delhi, India.
2. Introduction to Biostatistics and Research Methods, by P.S.S. Sundar Rao and J. Richard, (2012) 5th Edition, PHI Learning Private Ltd., New Delhi, India.
3. Biostatistics, Basic concepts and Methodology for the Health Sciences, by W.W. Daniel and C.L. Cross, (2020) 1st Edition, Wiley India.

Web Resources:

Weblinks:

Pedagogy:

- Power point presentations
- Classroom teaching, Guest lectures, group discussions, and practical sessions
- Scientific animations and videos
- Group activity
- Demonstrations
- Expert talks

Lesson Plan


Module No.	Contents	Workload in Hrs		
		Theory	Tut.	Assess
1	Philosophy and ethics; Scientific conducts	4	4	-
2	Publication ethics	4	3	-
3	Open access publishing	4	-	-
4	Publication misconduct	2	2	-
5	Databases and research metrics	4	3	-



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COURSE STRUCTURE

Course Code	EDU9UC01A			
Course Category	University Core			
Course Title	Foundations of Effective Teaching Pedagogy			
Teaching Scheme	Lectures	Tutorials	Laboratory / Practical	Total
Weekly load hours	2	-	-	2
Credits	2	-	-	2
Assessment Scheme Code	TT2			

Prerequisites:

Student should be knowing the basics of teaching pedagogy

Course Objectives:

1. To understand Pedagogical Principles
2. To critically analyse and compare learning theories to use pedagogy of teaching.
3. To develop classroom management strategies that promote a positive learning environment
4. To implement a variety of pedagogical strategies

Course Outcomes:

After completion of this course students will be able to:

1. Differentiate between Pedagogy, Andragogy and Heutagogy.
2. Identify and analyze key pedagogical theories and their proponents.
3. Evaluate and adapt pedagogical strategies to diverse learning environments.
4. Apply pedagogical principles to create effective lesson plans.
5. Reflect on their teaching practices and make informed pedagogical decisions.

Course Contents:

Unit 1: Basics of Pedagogy

- Concept of Pedagogy, principles of Pedagogy, Andragogy and Heutagogy
- Pedagogical Theories: Behaviourism, cognitivism, constructivism, and connectivism
- Outcome based Education – Blooms taxonomy, CO PO mapping, Assessment
- Parameters of effective lesson plan

Unit 2: Pedagogical Strategies:

- **Active Learning** – Brainstorming, Think pair share, Quizzes, minute paper, Summarizing, designing questions, problem solving, critical thinking exercise, use of games, ice breakers

- **Collaborative Learning** - Experiential Learning, cooperative Learning, Project based learning
- **Digital pedagogy** - Flipped Classroom, Blended Learning
- **Inclusive Pedagogy** - Learning Styles, Multiple Intelligences, Differentiated Instructions
- **Metacognitive Instruction**- Teacher as a Reflective Practitioner-Dialogic Reflection, Critical Reflection, Descriptive Reflection

Internal Evaluation: The course will have Formative Assessment and no Term End Exam. The evaluation details are as follows:

Assignment based on domain specific Research Review	15 marks
Seminar Presentation	20 marks
Developing a lesson plan using any one pedagogical strategy for domain specific subjects, Implementation and Reflection	15 marks
Total	50 marks

Learning Resources:

Text Books/ Reference Books:

- Foundation of Educational Psychology, J.S. Walia, Ahim Paul publishers, 2010
- Educational Psychology, S.K. Mangal, Tandon Publications,
- Psychological Foundation of Education, R.A.Sharma, R.Lall Book Depot (Vinay Rakheja)
- Educational Psychology, D. Bhatia, D.K. Walia, J.C. Mangal and T.C. Datt., Doaba House, Delhi.
- Joyce, Bruce, Well, Marsha and Calhoun, Emily (2011). Models of Teaching 8th Ed. New Delhi: PHI Learning Pvt. Ltd.
- M. C. Gore (2004). Successful Inclusion strategies for secondary and middle school teachers, Crown Press, Sage Pub.
- Mangal, S.K., Education of Exceptional Children, PHI, New Delhi

Weblinks:

- <https://thesecondprinciple.com/optimal-learning/types-of-learning/>
- <https://scottbuchholtzblog.wordpress.com/2017/11/29/constructivist-learning-theory-teaching-and-learning/>
- <https://link.springer.com/article/10.1007/s11412-009-9069-5>
- <https://poorvucenter.yale.edu/ConstructingStudentKnowledge>
- <http://theimportanceofemotionalintelligence.weebly.com/the-5-components.html>
- <http://www.free-management-ebooks.com/faqpp/understanding-02.htm>
- https://www.mindtools.com/pages/article/newCDV_59.htm
- <https://www.cu.edu/sites/default/files/ExecWorkingEI.pdf>
- <https://www.youtube.com/watch?v=iVUT4ydXYJg&list5>
- <https://www.managementstudyguide.com/emotional-intelligence-components.htm>

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- <https://bold.expert/tag/metacognition>
- <http://www.psy.gla.ac.uk/~steve/courses/archive/CERE12-13-safari-archive/topic3/webarchive-index.html>
- index.html

Pedagogy:

- PowerPoint presentations
- Discussions
- Group activity
- Brainstorming
- Cooperative learning

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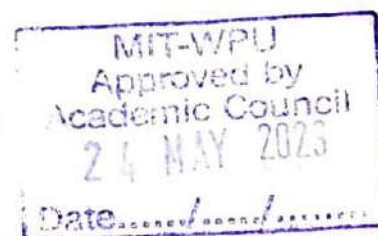
School of Science and
Environmental Studies.

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COURSE STRUCTURE

Course Code	EVS9PMXX			
Course Category	Program Major			
Course Title	Research Seminar			
Teaching Scheme and Credits Weekly Load Hrs. (Total Lectures: 30)	Lectures	Tutorials	Laboratory	Credits
	2	-	-	2 + 0 + 0 = 2
Assessment Scheme Code	TT2			
<u>Pre-requisites:</u> Master's degree in science and technology				
<u>Course Objectives:</u>				
<ol style="list-style-type: none"> 1. To provide students with an in-depth understanding of a specific topic, issue, or field of study. Seminars often focus on niche or advanced subjects that may not be covered in regular coursework. 2. To develop students' critical thinking skills by encouraging them to analyze, evaluate, and synthesize complex information and arguments. 3. To foster a deeper and more meaningful engagement with the subject matter, often through interactive and participatory learning methods. 4. To improve students' research skills, including the ability to locate, evaluate, and use scholarly sources effectively 5. To enhance students' oral and written communication skills through class discussions, presentations, and written assignments 6. In courses related to culture, history, or social issues, the objective may be to increase students' cultural awareness and sensitivity 7. To enable students to apply their knowledge and critical thinking skills to real-world problems or case studies related to the seminar topic. 				
<u>Course Outcomes:</u>				
After completion of this course, students will be able to;				
<ol style="list-style-type: none"> 1. Acquire knowledge of key concepts, theories, and historical developments related to the seminar topic. 2. Encourage students to question assumptions and engage in intellectual inquiry. 3. Develop effective research skills, including the ability to locate, evaluate, and synthesize information from various sources. 4. Enhance written communication skills by composing research papers, essays, or reports. 5. Develop effective presentation skills, including the ability to convey complex ideas clearly and persuasively. 				
<u>Course Contents:</u>				
Broad topic related to the proposed Ph.D. title, mutually agreed by scholar and supervisor.				
Following are the suggested reference points:				
<ol style="list-style-type: none"> 1. Seminar Title and Introduction: Explain the purpose and objectives of the seminar 				


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2. **Learning Objectives:** List the specific goals and learning outcomes participants will achieve by the end of the seminar.
 3. **Background and Context:** Offer an introduction to the topic, explain why the topic is important or timely.
 4. **Main Content Modules:** Divide the seminar into modules or sections, include hands-on exercises or discussions to reinforce learning.
 5. **Case Studies and Examples:** Use real-world examples or case studies to illustrate key points.
 6. **Interactive Activities:** Include group discussions, brainstorming sessions, allocate time for participants to ask questions. Address common concerns or misconceptions.
 7. **Additional Resources:** Provide a list of recommended books, articles, websites, or tools for further learning. Include references or citations for any research mentioned.
- Pedagogy:**
1. Powerpoint presentations
 2. Scientific animations and videos
 3. Group activity
 4. Demonstrations
 5. Expert talks

SYLLABUS:

Module No.	Contents	Workload in Hrs		
		Theory	Tut.	Assess
1	Seminar Title and Introduction	4	-	-
2	Learning Objectives	4	-	-
3	Background and Context	4	-	-
4	Main Content Modules	4	-	-
5	Case Studies and Examples	5	-	-
6	Interactive Activities	5	-	-
7	Additional Resources	4	-	-


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COURSE STRUCTURE

Course Code	EVS9PMXXX			
Course Category	Program Major			
Course Title	Advances and linkages in Environmental Science			
Teaching Scheme and Credits Weekly Load Hrs. (Total Lectures: 30)	Lectures	Tutorials	Laboratory	Credits
	4	-	-	4 + 0 + 0 = 4
Assessment Scheme Code	TT2			
Pre-requisites: Master's degree in science and technology				
Course Objectives:				
<ol style="list-style-type: none"> 1. To gain the knowledge of fundamentals of environmental science and technology 2. Familiarize with the advancement in environmental sciences & technology 3. Understanding linkages between people, planet and profit in environmental sector 				
Course Outcomes:				
After completion of this course students will be able to;				
<ol style="list-style-type: none"> 1. To understand the holistic nature of environmental science and choose from available opportunities 2. To analyze and apply the concepts of environmental science in various specific domains 				
Course Contents:				
Unit 1. Foundations of Environmental Studies				
<ul style="list-style-type: none"> • Scope in the environmental sector • Environmental studies as holistic science • Stakeholders in environmental studies • Challenges and opportunities in environmental science 				
Unit 2. People, Planet and Profit				
<ul style="list-style-type: none"> • Multi-dimensional nature of environmental science • Interconnectedness of ecology and economy • MDGs and Sustainable Development Goals 				
Unit 3. Environmental Pollution				
<ul style="list-style-type: none"> • Pollution: Water, Air, Soil, Light, Noise • Impact of pollution and effects of pollutants • Pollution Control Technology • Environmental Biotechnology in Pollution Control 				

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Unit 4. Biodiversity & Conservation

- Biodiversity: Structure and Functions
- Ecosystem Services and Biodiversity Crediting
- Principles of Conservation Biology
- Ethics in Conservation Science

Unit 5. Tools & Techniques Used in Environmental Studies

- Laboratory testing: Water, Air, Soil, Noise, Light
- Field surveys and wildlife research methods
- AI-based Pollution Control and Wildlife Management
- RS-GIS and Drone-based Mapping

Unit 6. Climate Action Leadership

- Community participation in environmental awareness and pollution control
- Environmental justice
- Green entrepreneurship and climate leadership
- Climate action governance

Learning Resources:

Reference Books:

- O'riordan, T., 2014. *Environmental science for environmental management*. Routledge.
- Miller, G.T. and Spoolman, S., 2010. *Environmental science*. Brooks/Cole, Cengage Learning.
- Kriebel, D., Tickner, J., Epstein, P., Lemons, J., Levins, R., Loechler, E.L., Quinn, M., Rudel, R., Schettler, T. and Stoto, M., 2001. The precautionary principle in environmental science. *Environmental health perspectives*, 109(9), pp.871-876.
- Zhu, J.J., Yang, M. and Ren, Z.J., 2023. Machine learning in environmental research: common pitfalls and best practices. *Environmental Science & Technology*, 57(46), pp.17671-17689.
- Mukhtar, M.U., Fayyaz, Z., Aftab, M.M., Nawaz, M.H., Javed, M.A., Hussain, B., Shahid, R. and Ullah, F., 2023. One health approach to zoonosis: integrating medicine, veterinary science, and environmental science. *Zoonosis*, Unique Scientific Publishers, Faisalabad, Pakistan, 1, pp.226-236.

Web Resources:

Weblinks:

https://onlinecourses.nptel.ac.in/noc23_hs155

https://onlinecourses.nptel.ac.in/noc24_hs70/

Pedagogy:

1. Power point presentations
2. Scientific animations and videos
3. Group activity
4. Demonstrations
5. Expert talks

Lesson Plan

Module No.	Contents	Workload in Hrs		
		Theory	Tut.	Assess
1	Foundations of Environmental Studies	8	-	-
2	People, Planet and Profit	10	-	-
3	Environmental Pollution	12	-	-
4	Biodiversity & Conservation	8	-	-
5	Tools & Techniques Used in Environmental Studies	12		
6	Climate Action Leadership	10		



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