Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Environmental Science

Name of the Course: Ph.D. Course work Paper No.3

(Syllabus to be implemented from June 2021)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

School of Earth Sciences

Ph. D. Course Work in Environmental Science

About Course:

The research scholars of Environmental Science subject have to undergo a Ph.D. course of 20 credits to be gain in a semester. This course comprises two components (i) common / compulsory course (14 credits) and (ii) Advanced knowledge in the core domain of the concerned subject (6 credits).

Course Structure:

Paper	Title	Marks	Credit	Hrs
I	Research Methodology (Compulsory)	80 UA + 20 CA = 100	4	48
II A	Information and Computer Technology (Compulsory)	40UA + 10 CA = 50	2	24
II B	Research and Public Ethics (Compulsory)	40 UA + 10 CA= 50	2	24
III	Elective: Applied Research in Environmental Science	100 UA + 50 CA = 150	6	60
IV	Foundation and Philosophy of Research (Compulsory)	100 UA + 50 CA = 150	6	60
	Total =	**500**	**20**	

PAPER – III: Applied Research in Environmental Science

L. – 60 Credits: 0.6 Marks: 100UA + 50 CA = 150

Units	Topic Details	
I	Introduction: Importance, aims and objectives of environmental research, research hypothesis, steps in research, types of research-basic, applied and novel research, Ethics in research-plagiarism, searching and selection of research topics-literature, through internet, formulation. Tools and techniques of research in environmental Science: • Survey techniques-participatory and no participatory survey by using questionnaires and interviews, case studies. • Field visits for observations, sampling design, sample size selection, census and sample surveys, types of sampling, sampling distribution. • Data collection-collection of primary and secondary data, statically data, processing, validation of data.	**06 Hrs** **0.5 Credit** **10 Marks**
II	Field data collection and Experimentation. • Use of tools like camera and other sampling equipments to collect field data • Use of tools and instruments helpful for observation and data collection from aquatic, terrestrial and arboreal environment, along with meters logical data collection. • Manual environmental data collection systems-Biological systems • Automated environmental data collection system-meteorological data. • Data collections systems from ocean, atmosphere • Field experimentation-To study the impact of any specific parameters on biotic and non-biotic components. • Field experimentation for understanding basic environmental components and mechanism of action etc and checklist presentation. • Experimentation for primary data collection and use of data for modeling • Interpretation of primary and secondary data collected from experimentation and by census, inferencing and concluding from the data. • Field trials and case studies from the field of environmental science. • Methods of EIA, Environmental Audit, EMP, Economic Growth and the Environment (Climate impact studies – Carbon emission, sequestration, carbon credits, footprints)	**24 Hrs** **2.5 Credit** **40 Marks**
III	Use of the sampling equipments for environmental parameter's analysis. • Purposeful sampling ,Random sampling • Sampling equipments for –water sampling form lake, ponds, reservoirs, oceans, bottom sediments. • Sampling equipments for soil sampling • Sampling equipments for air sampling • Sampling equipments for microflora and micro founa sampling from air, water, soil from sediments. • Sampling equipments for macro flora and founa study from terrestrial, aquatic and arboreal life. • Sampling equipments for radioactively study and collection of samples • Advances in Environmental Microbiology, Biotechnology, Environmental Nanotechnology and toxicology – Bioremediation and Eco-remediation • Recent advances in water and wastewater management, pollution monitoring and control technologies. • Energy and Environment • Recent Advances of Remote Sensing, Geographical Information system, UAV (Drones) in environmental science	**24 Hrs** **2.5 Credit** **40 Marks**

IV	Applications of analytical instruments in Environment: Use of analytical instruments for physico-chemical parameters of water, soil, sediments and air samples. • Qualitative and Quantitative analytical instruments. • Radiation and radioactivity detection and measurement instruments. • Sound and noise measurement equipments. • Electric field and Magnetism detection and measurement equipments. • Study of microscopic organisms from environment through use equipment's for microbe detection, visualization and counting (microscopy). • Environmental monitoring systems- noise, air, water and soil quality monitoring. • Radiation intensity and energy input monitoring. • Meteorological parameters and climate change monitoring. • Human, domestic life and wildlife senses-Environmental disaster monitoring. • Environmental modeling for human population, population explosion studies, modeling for climate change, and simulations for environmental disasters and modeling for environmental impacts on economy. Population etc.	**06 Hrs** **0.5 Credit** **10 Marks**
Total Credit = 06, Total Marks = 100 UA + 50 CA, Total Hrs = 60		

Reference Books:

1. Research methodology and Project work by Prakash herekar, Phadake Prakashan
2. Research methodology : Tools and Techniques by Prabhat Pandy and M.M.Pandy,bridge conter,2015 Romania,Europian union.
3. Research Methodology by R.Rajasekar, P.Philominathan and V.Chimathambi,2013
4. Handbook of Research Methodology; by S.B.Mishra and A compendium for Scholars and Researchers Shashi alok. 2011 Education Publishing , New Delhi.
5. The Essence of Research methodlogy: A concise Guide for master and Ph.D Students in Management Science by Jan Jonker and Bartjan Pennink, 2010 Springer, New York.
6. Essentials of Research Design and methodology by G. Marcyk David Demattes and David festinger, Essential of behavioral Science,2005, John wiley and sons New jersey
7. Fundaments of Research methodology and data collection by chinelo Igwenagy, Enugu state Writessity of Science and technology, 2016 Research Gate Publications.
8. Geographic Information Systems; concepts methodologies tools and Applications, vol-I Editor in Chief Meh Khosrow-pour, Contemporary research in Information science and technology –Book series 2013, USA.
9. Research methodology : A Step by step guide for beginners by Ranjit Kumar 2011 Sage Publication, London UK.
10. Research Method handbook by Stuart Macdonald and Micola Hadlam, CLES 1986, Manchster UK.
11. Environmental Impact Assessment, Canter, L.W., 1977, McGraw Hills, New York.
12. A Handbook of EIA, V.S. Kulkarni, S.N. Kaul and R. K. Trivedi, Scientific Publication (India).
13. Hanley, Nick, Jason F. Shogren & Ben White: Environmental Economics in Theory and Practice, New Delhi: Macmillan –India, 1997.
14. Nash, R.F., The Rights of Nature: A History of Environmental Ethics, University of Wisconsin, 1989.
15. S. K. Agarwal. 2003. Nuclear Energy: Principles Practice and Prospects. APH Publishing Corporation.
16. P. Chaturvedi. 1995. Bio-Energy Resources. Concept Publications.
17. V S. Mahajan. 1991. National Energy: policy, crisis and growth. Ashish Publishing House.
18. M. Dayal. (6th Ed). 1997. Renewable Energy: Environment and Development. Konark Pub. Pvt. Ltd.
19. M. H. Fulekar. Environmental Biotechnology.
20. Alan Scragg, Environmental Biotechnology. Oxford University Press.
21. Indu Shekhar Thakur, I. K. Environmental Biotechnology: Basic Concepts and Applications. International Pvt. Ltd.