

**School of Earth Sciences,  
Department of Environmental Science,  
Solapur University, Solapur.  
Ph. D Course Work Syllabus – 2014**

**Pattern of Syllabus:** For the Ph. D course work there shall be four papers 100 marks each subject as below. Paper IV will be elective type. It includes 3 papers and student should select any one paper as Paper IV.

**Paper No I: Research Methodology & Information Communication Technology (ICT).**

**Paper No II: Recent Trends in Environmental Science:**

1. Instrumental Techniques in Environmental Chemical Analysis, Concept, principle, important parts, method of sample preparation and applications – Colorimeter, Nephelometer, Turbidometer and Potentiometer.
2. Spectroscopy - AAS, ICPEES, Flame photometer, UV spectrophotometer, Mass Spectrophotometer, NMR, X-ray fluorescence, FTIR, NDIS.
3. Chromatography – HPLC, Gas and Ion chromatography.
4. Remote Sensing technique in Environmental Science (RS): Concept, history, development, of Remote sensing in World and India, stages of remote sensing, Aerial photography- Types, Geometry, Scale, Height and Process of Aerial Photography, satellite imaginaries, Sensor: Types and uses of sensor and cameras, processes of sensor & its characteristics.
5. Geographical Information System (GIS): concept, need, scope, main components, and objectives. Overview of GIS application areas in the environmental field. Global Positioning System (GPS): Main segments, nature and sources of errors in GPS signals, differential GPS, applications of GPS.
6. Applications of GIS & RS in Forest Management, Marine Resources management, urban management, Disaster management, Geological mapping, water resources, Ecology, Agriculture & Soil.

**References:**

1. Environmental Chemistry : B. K. Sharma and H. Kaur.
2. Elements of Environmental Chemistry : H. V. Jadhav
3. Environmental Chemistry : S. K. Banerji
4. Environmental Chemistry : J. W. Moore and E. A. Moore.
5. Destruction of hazardous Chemicals in the Laboratory : G. Lunn and E. B. Sansone.
6. A text book of Environmental Chemistry and Pollution Control : S. S. Dara
7. Instrumental Methods of Analysis : G. W. Ewing
8. Instrumental Methods of Analysis : Chatwal and Anand
9. Geoinformatics for Environmental Management, B.S. Publication, by M. Anji Reddy.
10. Remote Sensing of the Environment Earth Resource Perspectives, 2<sup>nd</sup> Edition, by John R. Jensen.
11. Geoinformatics for Environmental Management, B.S. Publication, by M. Anji Reddy.
12. Remote Sensing: Principles and application by Panda.
13. Satellite Remote Sensing in Climatology, Studies in Climatology series CBS publication by Andrew Carleton.
14. Remote Sensing & Image Interpretation, Wiley publication by Thomas M.Lillesand, Ralph W.Kiefer and Jonathan W. Chipman.
15. Fundamental of Remote sensing , Jorge Josef
16. Subtle Issues in Coastal Management by Sudarshana R, Mishra, Roy P.S., Rao D.P., IIRS 2000.
17. Natural Disaster and their Mitigation by P.S.Roy, publishers by IIRS, 2000.

18. RS and GIS Application in Urban and Regional studies by Subudhi A.P., Sokhi B.S., Roy P.S, IIRS, 2001.

### **Paper No III: Modern Topics in Environmental Science:**

**1. Environmental Microbiology and Biotechnology:** Concept and scope in water, soil and air microbiology, industrial microbiology. Techniques in genetic engineering: nucleic acid hybridization and polymerase chain reaction as sensitive detection methods. Clone genes into new hosts using plasmid and phage vector systems. Use of micro-organisms like thermophiles, alkalophiles; acidophiles, halophiles and psychrophiles in waste treatment and methane production, production of enzymes like cellulase, proteases amylases; alcohol and acetic acid production. Microbial leaching of low grade mineral ores, molecular probes for organisms in mines and mine tailings, Petroleum pollutant biodegradation. Other uses are biodegradation of hazardous wastes, agro-industry, microbial degradation of chemical pesticides, use of bio-pesticides. Use of biotechnology in innovative practices such as organic farming, bio-fertilizers, aquaculture, apiculture, sericulture, agro forestry etc. Conservation biology, molecular biological techniques in species conservation.

**2. Green Chemistry:** - Concepts, scope, principles, Biotech/chemical Processes - Green processes, rules/recommendations using chemicals, Raw materials, Waste / Waste handling, Catalysis / Biocatalysis, Choice of solvents, Industrial "white" biotechnology, Biorefining processes / The Greenchem-program, Biobased production of energy carriers, Chemistry and sustainable development.

**3. Green Building:** Concept of green building, Intro to building science, Building Science Fundamentals, Green Design, Green Construction Methods, certification and categorization, Energy Auditing, Green Products and Miscellaneous Topics.

**4. Water & Waste Water Engineering:**

Concept of water, wastewater treatment technology and its requirements. Need of water quality standards for domestic & industrial purpose. Packaged drinking water. Water Treatment – Preliminary, Primary, Secondary- Principal, Application & Designing of various Unit Operation in water treatment. Advanced wastewater treatment methods Specification and methods of treated wastewater for disposal into surface water, on land & for treatment, current developments in the subject.

**5. Environmental Modeling:** - Concept, types, definitions and their applications in Environmental field. The need for modeling, Modeling Methodology: Setting up of the model, parameter estimation, verification, validation, sensitivity analysis. Approaches to development of models, linear, simple and multiple regression models, validation and forecasting models, population growth and interaction model, Lotka volterra model, Leslie's matrix model, point sources stream pollution model, box model, Gaussian plume model.

**6. Environmental Management:** Concept and scope, Environmental management plan (EMP), Environmental Impact Assessment (EIA), Environmental Management System (EMS), ISO 14000 series and safety standards, Corporate Social Responsibility (CSR) Environmental planning, micro and macro planning - rural and urban planning, global environmental initiatives, Integrated approach to pollution control management, fair environmental practices in trade, commerce and industry, eco-development and growth, sustainable development, International Environmental policies, National Environmental

Policies, National Environmental Legislation related water, air, mining, forest, wildlife, Coastal Regulation Zone and public litigation interest, environmental audit.

### References:

1. Environmental Sciences - Jackson and Jackson
2. Environmental Sciences - Tuckeer (1990)
3. Introduction to Environmental Chemistry – A.K.De
4. The Chemistry and Microbiology of pollution – I.S. Higgins and R.G. Burns, Academic press, London 1975.
5. Statistical Methods for Environment and Agricultural Sciences – Bidgelli Hossien
6. Pollution control in process industries – S.P.Mahajan. Tata McGraw Hill pub. New Delhi.
7. Environmental Toxicology - David wright and Pamela Wellbourn, Cambridge.
8. Ecotoxicology – F.Moriarty, Academic press -1998.
9. Environment and Health – Anthony I. Rowland & Paul Cooper, 3<sup>rd</sup> edition -1989.
10. Applied Eco-toxicology – Jorg Rombke & Johann F. Moltmann edition -1996.
11. Pollution control in process industries – S.P.Mahajan. Tata McGraw Hill pub. New Delhi.
12. Water and Waste water technology – M.J.Hammer, John Wiley A & sons, New York 1986.
13. Environment resources Management – Shastri
14. Wastewater Treatment for Pollution Control – Arcival S.J. Tata McGraw Hill Pub. New Delhi 1986.
15. Introduction to wastewater treatment process – R.S.Ramalho.
16. Current practices in Environmental Engineering. (Vol. I & II) Alam Singh and U.S. Sharma. International Book Traders, Delhi-1997.
17. Declaration of : The Stockholm Conference, Rio, Rio+5 and Rio+10.
18. Anti – Pollution Acts (3) and Commentaries published theorem.
19. Constitution of India [Referred articles from Part-III, Part-IV and Part-IV-A].
20. Pares Distn. Environmental Laws in India (Deep. Deep, Lated edn.)
21. P. Leelakrishnan, Environmental and the last (Bullorthworths, Latold, edn.).
22. Basic environmental technology : Jerry ;A. Nathanson.
23. Handbook of environmental management and technology : Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
24. The ISO 14000 Handbook : Joseph Cascio.
25. ISO 14004 – Environmental management systems : General guidelines on principles, systems and supporting techniques (ISO 14004 : 1996 (E)).
26. ISO 14001 : Environmental management systems : Specification with guidance for use (ISO 14001 : 1996b (E)). (International organization for standardization – Switzerland).

## Paper No IV (Elective papers)

### Elective papers:

#### A) Advanced Development in Natural Resource Management (NRM)

1. Concept and types of natural resources. Exsitu, insitu conservation and biological conservation. Biodiversity concept, scope and its value for conservation at global and national concern.
2. Wild life concept, management and their types of conservation.
3. Water resources conservation, Concept of wetlands, types of wetland, wetland conservation and applications.
4. Concept of Soil conservation, types of soil, Land use, land cover and soil conservation. Use of biological and chemical methods for soil pollution and soil erosion.
5. Forest resources, uses, forest products, and conservation.

6. Fossil fuel resource – oil & natural gas, minerals etc. uses, conservation and accounting, impact of population on resources use,

### References:

1. Fundamentals of Ecology:- E.P. Odum, Revised Edition 1995-96 Edition 2003.
2. The Biological diversity Act 2002 and Biological diversity rules 2004. - National Biodiversity Authority INDIA. 475, 9th South cross street, Kalpalocwar Nagar, Neelangarai Chennai – 600041.
3. Biodiversity and Environment:- S.K. Agarwal, S. Tiwari and P.S. Dubey, 1996.
4. Concept of Ecology :- E.J. Koromondy, 1996, Concept of modern Biology Series, Prentice Hall.
5. Biodiversity Measurement and Estimation :- D.L. Hawks worth Director international Mycological Institute Surrey, UK, Published:- Chapman & Hall, Condou New York, Tokyo, Madras.
6. Biodiversity Conservation:- Global agreements and nationat concems. RAMSAR sites CBD, Ouarantine, Regulation, National terety pdicy Biodiversity Act wild life Act.
7. Environmental Science :- Daniel Botkin and Edward Kelter, John Wiley and Sons, NewYork.
8. Environmental Science :- Eldon d. Enger and Bradley F. Smith, WCB Publishers; Boston.
9. Ecology 2000 :- Sir Edmand Hillary.
10. Manual for field ecology :- R. Mishra.
11. Modern Concepts of Ecology :- H.D. Kumar.
- 12 Fundamentals of Ecology:- Dash M.C. Tata McGraw Hill. Pub. Co-Ltd. New Delhi.
- 13) Ecology and Environment :- P.D. Sharma Rastogi Publications, Meerut.
- 14) Principals of Environmental Biology :- P.K.G. Nair, Himalaya Pub. House, Delhi.
- 15) Environmental Science :- Enger, Smith, Smith W.M.C, Brown. Company Publication

### B) Advanced Development in Environmental Pollution, Monitoring and Control

1. Concept of Environmental pollution and their types, origin of pollution, classification and nature of pollutants, sources - Air pollution, water pollution, noise pollution, soil pollution, marine pollution, radioactive pollution, thermal pollution, solid waste pollution, biomedical waste-
2. Effects of various environmental pollutants on – man, plants, animals, monuments, building structures and surrounding environment.
3. Control and abatement methods as well as techniques of environmental pollutants.
4. Impacts of local regional and global level, pollution monitoring, administrative, scientific and technical control measures.
5. Environmental pollution Standards and Current developments in environmental pollution.
6. Case studies at local, national and global level of Environmental Pollution.

### References:

1. Source book on atomic energy - S. Glasstone, D. Van Nastrand & Germany.
2. Environmental radioactivity – M. Eisendbud, Academic press.
3. Essentials of nuclear chemistry – II, T. Arnika, Wiley easter.
4. Nuclear chemistry through problems – II, T. Arnika & N. S. Rajurkar, New age Int. (P) Ltd.
5. Environmental Science – A study of Inter relationships, E. D. Enger, B. E. Smith, 5th ed., W C B publication.
6. Liquid Waste of Industry Theory, Practice and Treatment. Nelson L. Memerow. Adison Wasley Publishing Co.,
7. Treatment of Industrial Effluent A.B. Calleyl, D.A. Stafford.
8. Industrial Water Pollution Control. W.W. Wasley Mc Graw Hill Publication.
9. Industrial Pollution Control Issues and Technology.Nancy, J. Bell. Elsevier Scientific Publishing Co.,
10. Industrial Waste Water Management. Studies in Environmental Science – 5. Elsevier Scientific Publishing Co.,
11. Pollution Control Metal Finishing. Studies in Environmental Science – 5. Elsevier Scientific Publishing

Co.

12. Journal of Indian Environment Society, Indian Water Works, Journal of Environmental Health.

### **C) Advanced Development in Energy and Environment**

1. Solar energy- Basic concept, theories, and application. Fossil fuels – classification, composition physio-chemical characteristics and energy content of coal, petroleum and natural gas;
2. Hydro- Energy basic concept, principles of generation of hydroelectric power.
3. Concept wind energy, types and designing of wind mills, applications of wind energy.
4. Nuclear energy – Concept of fission and fusion, radioactive waste and radioactivity from nuclear reactions.
5. Biomass or bio-energy – Concept of biomass and biogas, anaerobic digestion; energy use pattern in different parts of the world. Environmental implication of energy use.
6. Alternative Energy resources: Concept and their applications in Magneto Hydrodynamic (MHD) power, Ocean Thermal Energy conversion, geothermal energy. tidal, Fuel cell, Hydrogen energy,

### **References:**

1. Politics, Policy and Natural Resources - Dennis L. Thompson. The free press, New York 1972.
2. The Global Ecology handbook – Walter H. Corson Beacon Press Boston -1990
3. Environmental Management – P.Khanna.
4. Environmental Policies – Sinha P.C.
5. Environmental Audit – Mhaskar A.K. Media Enviro Pune – 1998.
6. Energy Society and environment – David Elliott Routledge, London – 1997.
7. Energy and Environment in Developing countries – M.Chatterji, John Wiley and sons Chichester – 1981.
8. Introduction to energy E.S. Carredy and P.Z. Grossman, Cambridge University Press, Cambridge U.K. – 1998.
9. Non – conventional Energy sources – Rai G.D. Khanna pub. New Delhi – 2000.
10. Renewable Energy Environment and Development, Maheswar Dayal Konark Publishers Pvt.Ltd.
12. Renewable Energy Programmes in India : some recent developments , Sinha P.C., Natural Resource Forum, 18(3), 1994
13. Renewable Energy Resources: Basic Principles And Applications Tiwari, G.N., Narosa Publishing House .
14. Conventional and Non conventional Energy sources G. D Rai