

**Department of Environmental Science**  
**University School of Vocational Studies and Applied Sciences**  
**Gautam Buddha University**

**Programme - Ph.D. in Environmental Science**  
**Syllabus (Department specific courses)**

**ES - 601 METHODS IN ENVIRONMENTAL SCIENCE – I**  
**CREDIT : (L-T-P) : 3 (3-0-0)**

**OBJECTIVE**

To provide opportunity to learners on the basics of analysis of different components of environment and pollution (air, water, soil, and noise) and biodiversity

**OUTCOME**

The learners would be able to build the knowledge of the environmental analysis as needed essentially for environmental monitoring and assessment

**CONTENTS**

**Water quality monitoring:** Objective of water quality monitoring, water sampling and preservation; Description of monitoring area, sampling; Water quality monitoring in field, preservation of water samples; Microbiological analysis of water, techniques of isolation, purification and culture of microbes, biological monitoring of waters, toxicity assessment of water pollutants and effluents; River Continuum Concept (RCC); Study of waste treatment systems (ETP/STP), riparian management; Radioactivity measurement, structuring of Monitoring Report.

**Air and Noise quality Monitoring** – Micro-meteorological aspects of air pollution; Air quality monitoring and air quality standards; Monitoring of particulate air pollutants, monitoring of gaseous pollutants; Automobile exhaust monitoring; Stack monitoring; Monitoring of aeroallergens (pollen grains); Noise pollution monitoring; Fuel characterization and analysis; Weather monitoring

**Soil quality Monitoring-** Objectives and types, sampling techniques for soil studies; Analysis of physical parameters of soil; Analysis of chemical parameters of soil; Analysis of microbiological properties of soil

**Assessment of Biodiversity** - Classification and mapping of land cover or vegetation types; Biodiversity indices types and applications; Field sampling, measurement and data processing for biodiversity; Identification of species; Estimating sample size; Biodiversity database development; Geospatial framework for upscaling and interpolating diversity indices; Mapping biodiversity indices; Biodiversity measurement, Energy plantation; Methods of Environmental Economic valuation.

### **SUGGESTED READINGS:**

- Aery, N. C. 2010. *Manual of Environmental Analysis*. Ane books Pvt. Ltd., New Delhi, India.
- Aneja, K.R. 2018. *Experiments in Microbiology, Plant Pathology, Tissue Culture and Microbial Biotechnology*, 5th Edition, New Age International (P.) Ltd. Publishers, New Delhi
- APHA.1997. *Standard Methods for Examination of Water and Wastewater*, 21<sup>st</sup> Edition, American Public Health Association, American Water Works Association and Water Pollution Control Foundation, Washington, D.C.
- Biswas, T. and Mukherjee, S. 2017. *Textbook of Soil Science*. 2<sup>nd</sup> Edition. McGraw Hill Education, New Delhi.
- Central Pollution Control Board (CPCB). 2011. Guidelines for the measurement of ambient air pollutants <http://indiaenvironmentportal.org.in/files/NAAQSMannualVolumeI-1.pdf>.
- Jackson, M.L. 1998. *Soil Chemical Analysis*, Revised Edition, Prentice Hall, London.
- Kapur, P. and Govil, S.R. 2004. *Experimental Plant Ecology*, CBS Publishers and Distributors, New Delhi, 154 p.
- Maiti, S. K. *Handbook of methods in Environmental Studies, Volume I, water and wastewater analysis*. ABD Publishers, Natraj Nagar, Imliwala Phatak, Jaipur, Rajasthan, India.
- Piper, C.S. 1995. *Soil and Plant Analysis*, Revised Edition, University of Adelaide, Australia.
- Trivedi, R.K. Goel, R.K. and Trisal, C.L. 1998. *Practical Methods in Ecology and Environmental Science*, Revised Edition, Environmental Publications, Karad.

### **ES - 602 METHODS IN ENVIRONMENTAL SCIENCE – II**

**CREDIT : (L-T-P) : 3 (3-0-0)**

#### **OBJECTIVE**

To explain theoretical knowledge of advanced analytical techniques useful for monitoring the quality of environment

#### **OUTCOME**

The learners will acquire background knowledge of advanced analytical techniques for environmental monitoring.

#### **CONTENTS**

**Separation techniques** - Chromatography- Principles, types and environmental applications; High Performance Liquid Chromatography (HPLC); Gas Chromatography and Mass Spectrometry (GC-MS); Electrophoresis - Principles, types and environmental applications; Extraction - Principles, types and environmental applications; Flootation- Principles, types and environmental applications; Centrifugation – Principle, types and applications.

**Thermal and surface analysis techniques** - Thermal analytical techniques -TGA, DTA; DSC- Principles, instrumentation and applications; Electron microscopy- Principles,

instrumentation, types and applications, Transmission electron microscopy (TEM), Scanning transmission electron microscopy (SEM); Brunauer Emmett Teller (BET) method, Calorimetry – Principle and application.

**Chemical sensing and structural analysis methods:** Principles, types and application of sensors (chemical, humidity and biosensors). Diffraction from crystalline materials; X-ray and neutron sources; powder diffraction methods.

**Spectroscopy and Electro-analytical Techniques** - Principles, instrumentations and environmental applications of Ultraviolet and Visible spectrophotometry (UV-VIS); Infrared Spectroscopy (IR); Fourier-transform infrared spectroscopy (FTIR); Energy Dispersive X-ray (EDX)

Nuclear Magnetic Resonance (NMR); Atomic Absorption Spectroscopy (AAS), Flame Photometry.

**Electro-analytical Techniques** – Conductometry, Potentiometry, Ion selective electrodes; Electrogravimetry.

**Biological Techniques** – Study of bio-indicators of Environmental health, bio-monitoring of ecosystems – vegetation analysis; Measurement of primary productivity – Terrestrial and aquatic ecosystem; Bioassay.

#### **SUGGESTED READINGS:**

- Christian, G. D. 1994. *Analytical Chemistry*, 5<sup>th</sup> Edition, John Wiley and Sons, New York.
- Kennedy, J. H. 1990. *Principles of Analytical Chemistry*, 2<sup>nd</sup> Edition, Saunders Holt, London.
- Pecsok, R. L., Shields, L. D., Cairns, T. and Mc William, L. C. 1976. *Modern Methods of Chemical Analysis*, 2<sup>nd</sup> Edition, John Wiley, New York.
- Skoog, D. A., West, D. M., Holler, F. J. and Crouch, S. R. 2004. *Fundamentals of Analytical Chemistry*, 8<sup>th</sup> Edition, Thomson Brooks/Cole Pub., Singapore.
- Willard, H. H., Merritt, L. L., Dean, J. A. and Settle, F. A. 2004. *Instrumental Methods of Analysis*, 7<sup>th</sup> Edition, CBS Pub., New Delhi.

#### **ES - 603 SEMINAR**

**CREDIT : (L-T-P) : 2 (2-0-0)**

#### **OBJECTIVE**

To develop broad understanding of an environmental topic and hands on practice of the art of reporting of the study/work

#### **OUTCOME**

The scholar would be able to acquire the understanding of field forces concerning an environmental topic and their analysis and presenting the study/work

#### **PROCESS**

The course will be coordinated by a faculty of the department of Environmental Science. The Coordinator will assign suitable topics to the doctoral scholars considering the scholar's

academic interest and physical access to the study area. Depending upon the professional requirement, the other faculty members of the department of Environmental Science will also be involved in the study. After completion of the study, the scholar has to submit report (one hard copy) following the guidelines of writing a scientific report to the Coordinator before oral presentation. The scholar has to present the work orally using powerpoint by the end of the semester in presence of the faculty members, research scholars and M.Sc. students of the Department of Environmental Science. After the oral presentation, the scholar has to submit well illustrated final report (hard copy 02 numbers).

## **ES - 604 FIELD STUDY**

**CREDIT : (L-T-P) : 2 (0-0-2)**

### **OBJECTIVE**

To develop belongingness to field reality concerning environment, environment-human interactions and conservation oriented activities/initiatives among learners and promote their observation and action-oriented real-life skills.

### **OUTCOME**

The learners would be able to correlate field/real-life-based issues and practices concerning environment, environment-human interactions and conservation initiatives with the knowledge and technology inputs.

### **CONTENTS**

Scholars are required to visit any local industry, river, wetland, grassland, desert, slum, high rise settlement, zoo, botanical/botanic garden, forest, agricultural landscape, city park, garden, public space (controlled nature), and community nature, urban forest, biodiversity park, Indian Meteorological Department (to learn about measurement of weather conditions and weather precision) etc. To understand the site/situation-specific environmental issues and possible measures to control/minimize the environmental problems of the site concerned. Each scholar has to prepare a well illustrated explanatory study report thereof in a professional manner. The field study will be evaluated on the basis of written report and oral. Scholars are required to expose themselves to the real-life situations related to environmental science and environmental studies. After oral presentation in the presence of the faculty, research scholars and M.Sc. students of the Department of Environmental Science. The scholar has to submit 02 hard copies of the well illustrated field study report to the Coordinator faculty member for the office record and guidance for the future learners.

*No literature review-based study will be permitted under this course.*