**ENVIRONMENTAL ENGINEERING**

Credit hours: 3 (2+1)

Prerequisites: None

**Specific Objectives**

To impart engineering skills and techniques in environmental infrastructure design and management

**Learning Objectives**

**????**

**Content List**

* Basic concepts and terminologies related to environmental engineering,
* Air Pollution: Sources of air pollution, air pollution measurement, air pollution control technologies and modeling.
* Water Resources and Water Pollution Control: Water supply, components, viz. collection from sources, transmission, treatment and distribution, water consumption. Planning guide for water consumption; water demand, water quality and standards, fire hydrants.
* Measures of Water Quality (Dissolved oxygen, oxygen demand, solids, nitrogen, Bacteriological measurement)
* Design of water supply lines and systems. Drinking Water Treatment Plant Design
* Sanitation and Sewerage Systems: collection, treatment, re-cycling and disposal
* Design criteria, quantity of sewage, average daily sanitary flow and BOD load
* Investigation and system design, elementary hydraulics of sewers, treatment plants, location and site requirements,
* Sewer construction, storm drainage, maximum and standard level interceptors and collectors, maximum drainage zones.
* Estimation of runoff of streets and urban areas.
* Introduction to watershed areas and flood control.
* Basic infrastructure in relation to rural settlements
* Solid and Hazardous Waste, solid waste generation, reuse, recycling, Incinerating and Land Filling Solid Wastes
* Hazardous Waste Management, Toxic Metals, Achieving Low-Waste Society

**Practical**

* Lab work for measuring water quality
* Field visits to know about technologies in use for controlling air pollution, waste water treatment plants, landfill sites and incineration plants.
* Design of services such as water supply, sewerage, drainage and for solid waste disposal in a development scheme.

**Proposed Teaching Methodology**

* Lecturing
* Field Visits
* Guest Speaker
* Assignment relating to designing of services

**Proposed Assessment**

**Quizzes (10%)**

* At least 3 quizzes will be given to the students in the semester

 **Mid-Term (40%)**

* Written (Long Questions, Short Questions, MCQs) 50%
* Presentation 10%
* Assignments 20%
* Final Project 20%

**Final Term (50%)**

* Written (Long Questions, Short Questions, MCQs) 50%
* Presentation 10%
* Assignments 20%
* Final Project 20%

**Recommended Books**

1. David, M. L., and Masten, S. J. (2014), Principles of Environmental Engineering and Science, McGraw-Hill. ISBN 978-0-07-339790-0.
2. Masters, G. M., and Ela, W. P. (2008), Introduction to Environmental Engineering and Science, Prentice Hall, ISBN 9780131481930.
3. PEPA, (1997), *Environmental Guidelines by PEPA*, Ministry of Education, Govt. of Pakistan.
4. Salvata, (1992), *Environmental Engineering & Sanitation*, Wiley Inter-Services.
5. Kumar, Santosh, *Water Supply Engineering,* Khanna Publishing, (Latest Edition).
6. Kumar, Santosh, Waste *Water Engineering,* Khanna Publishing, (Latest Edition).
7. Marsh, W. M. & Gross, A. J. (2005), Environmental Geography: Science, Landuse & Earth System, John Wiley & Sons, Hoboken.
8. Brimicombe, A. (2003), GIS, Environmental Modeling & Engineering, Taylor & Francis, London.
9. Critical Reviews in Environmental Sciences and Technology, Taylor & Francis.
10. Environmental Engineering Sciences, Mary Ann Liebert.