ENVIRONMENTAL SCIENCE
VI SEMESTER

COURSE CODE: EVSC1622M **COURSE TYPE: MAJOR/MINOR**

COURSE TITLE: Environmental Pollution Control and Management

CREDITS: (Theory-4, Practical -2)

Course learning outcome: *The students in this course will be able to achieve the competence in the area of prevention and control measures of various types of pollution like air, water, soil, noise and electromagnetic. Students are expected to achieve the technical competence in monitoring the various types of pollutants.*

THEORY (4 credits: 64 hours)

Unit I: Air pollution control and management

1.1.Control of particulate and gaseous air pollution: Control technologies
1.2. Bio-filters for control of air pollution
1.3. Indoor air pollution control and technologies
1.4. Noise control technologies and abatement measures
1.5. Natural attenuation of air and noise pollution: Overview of physical, chemical and biological processes

Unit II: Water pollution control and management

2.1. Sanitation and sewage treatment (Municipal and Industrial)

2.2. Control of eutrophication: Restoration of lakes and wetlands

2.3. Control of stream and river pollution

2.4. Groundwater pollution control and management

2.5. Control of marine pollution

Unit III: Soil pollution control and management

3.1. Control of soil pollution and remediation of contaminated soils

3.2. Soil conservation techniques in arid, semi-arid and hilly areas.

3.3. Waste lands and their reclamation

3.4. Reclamation of soils (acidic. alkaline, sodic)

3.5. Sustainable agricultural practices for soil health.

Unit IV: Waste and radiation management

4.1. Plastic, microplastic and E-waste management

4.2. Radioactive waste management

4.4. Mitigation of radiation pollution

4.4. Solutions for reducing light pollution

4.5. Measures to control thermal pollution

PRACTICALS: (2 credits) **32 hours**

1. Determination of gaseous pollutants in ambient air
2. Case studies on air quality index of various cities
3. Measurement of soil erosion
4. Survey of a local area for identification of common soil pollutant sources such as pesticides, organic pollutants and fertilizers
5. Preparation of report about solid waste management practices adopted in the campus of the institute.
6. Visit to any landfill site /SWM facility

Suggested Reading:

1. Air Pollution Control Engineering. Noel de Nevers. McGraw Hill, 2023
2. Air Pollution: Its origin and Control. Kenneth Wark, Cecil F. Warner and Wayne T. Davis. Addison-Wesley. 1998
3. Environmental Pollution Control. C.S. Rao. New Age International Pvt. Ltd. 4th edition.
4. Water Pollution: Causes, Effects and Control. P.K. Goel. New age International Pvt. Ltd. 2006
5. Water Pollution Control. Suresh T. Nesaratnam. John Wiley and Sons. 2014.
6. Introduction to Environmental Engineering and Science. Gilbert M. Masters. 3rd edition. Prentice Hall.
7. Soil Pollution: Origin, Monitoring and Remediation. Ibrahim A. Mirsal. 2nd Edition. Springer.
8. Introduction to Waste Management: A Textbook. Syed E. Hasan. Google Books. 2022
9. Radioactive Waste Management. Yu. S. tang and James H. Saling. Google Books. 2018

ENVIRONMENTAL SCIENCE
VI SEMESTER

COURSE CODE: EVSC2622M **COURSE TYPE: MAJOR**

COURSE TITLE: Environmental Engineering and Biotechnology

CREDITS: (Theory-4, Practical -2)

Course learning outcome: *The syllabus for an environmental engineering course typically covers a range of topics related to the application of engineering principles to address environmental issues. This course introduces students to the principles and practices of environmental engineering, focusing on the identification, assessment, and design of solutions for environmental challenges. This course shall help students to find solutions for quality issues in air, water and land, which may pose a threat to life. Further the practical's will strengthen the theoretical concepts and help students to develop practical skills for environmental engineering*.

THEORY (4 credits: 64 hours)

Unit 1. Fundamentals of environmental engineering

1.1. Environmental Engineering: Introduction and Scope

1.2.. Sewerage and storm water drainage

1.3. Ecological sanitation

1.4.Green engineering and sustainable practices

1.5. Bioremediation: Concept and Overview

Unit II. Water supply and Waste water engineering

2.1. Overview of public water supply and distribution systems

2.2. Water purification methods for public supply: Screening; Coagulation; Flocculation; Sedimentation; Filtration; Disinfection methods; Advanced treatment processes

2.3. Nature and types and characteristics of wastewater

2.4. Wastewater treatment methods: primary, secondary, tertiary and advanced

2.5. Design of treatment facilities for sludge management

Unit III: Air, soil and solid Waste engineering

3.1. Ventilation and air conditioning

3.3. Building acoustics

3.3. Soil remediation techniques: Bioremediation, Phytoremediation, Soil washing

3.4. Design and operation of sanitary landfills

3.5. Waste to energy technologies and Smart waste management systems (IoT, AI-based solutions)

Unit IV: Biotechnology applications

4.1 Pollution Control: Biotechnological approaches

4.2. Environmental genomics: concept and applications

4.3. Genetic engineering: concept and applications

4.4. GMOs and Metagenomics: Concept, environmental applications and risks

4.5. Application of microbes in the control of oil pollution, pesticides and metals

Tutorial: (2 credits): Eco-Modelling and Python 32 hours

1. Ecological modelling project based on python programming

Suggested Reading:

1. The Environmental Engineers' handbook. David H.F. Liu and Bela G. Liptak. Taylor and Fracis Group/Lewis Publishers. 1997
2. Environmental Engineering. M.P. Poonia, S.C. Sharma and Santosh Kumar. Khanna Book Publishing. 2023
3. Textbook of Environmental Engineering. P.V. Rao. Prentice Hall India. 2002.
4. Handbook of Environmental Analysis. Chemical Pollutants In Air, Water, Soil and Solid Wastes. Pradyot Patnaik. CRC Press. 2017.
5. Solid Waste Engineering: A Global perspective. William A.Worrell, A. Aarne Vesilind and Christain Ludwig. Cengage Learning. 2016.
6. Environmental Biotechnology. B. Bhattacharyya and Rintu Banerjee. Oxford University Press. 2008.
7. Textbook of Environmental Biotechnology. Pramod Kumar and Vipin Kumar. WPI Publishing. 2019.
8. Environmental Biotechnology: Handbook of Environmental Engineering Series. Lawrence K. Wang, Volodymyr Ivanov, Joo-Hwa Tay. Humana Press (Springer) 2020.

ENVIRONMENTAL SCIENCE
VI SEMESTER

COURSE CODE: EVSC3622M **COURSE TYPE: MAJOR**
COURSE TITLE: Environmental Planning, Remote Sensing and GIS
CREDITS: (Theory-4, Practical -2)

Course learning outcome: *This course focuses on the principles and practices of environmental planning. Students will learn how to assess, design, and implement sustainable solutions to environmental challenges, considering ecological, social, and economic factors. The students will also explore the use of remote sensing and GIS in environmental planning and management. Students will learn how to collect, analyse, and visualize spatial data to make informed decisions for sustainable environmental practices.*

THEORY (4 credits: 64 hours)

Unit I: Introduction to environmental planning

1.1.Environmental planning – importance and objectives

1.2. Land use planning and zoning

1.3. Planning for Urban and rural development

1.4. Smart city and carbon neutral: Concept

1.5. Green belt: Concept and design

Unit II: Introduction to remote sensing

2.1. Remote sensing: Concept and history

2.2. Electromagnetic spectrum: EMR sources-active & passive, radiation laws

2.3. Resolution: spatial, spectral, radiometric and temporal

2.4. Remote Sensing satellites: LANDSAT & IRS satellite series

2.5. Aerial photographs and Image processing, interpretation and classification

Unit III: Introduction to geographic information system (GIS)

3.1. GIS: history and development

3.2. Functional requirements: Hardware configuration, software modules

3.3. Geographic data: Spatial and non-spatial data types

3.4. Geospatial data models: raster and vector

3.5. Global positioning system (GPS)

Unit IV: Applications of remote sensing and GIS

4.1. GIS smart tools: Google Earth

4.2. Land-use planning

4.3. Watershed management

4.4. Forest management and Biodiversity conservation

4.5. Disaster monitoring and management

PRACTICALS: (2 credits) **(32 hours)**

1. Data collection techniques (GPS, field surveys, etc.)
2. Demonstration of basic image interpretation skills using satellite imagery or aerial photography
3. Delineation of point, line and polygon
4. Delineation of drainage of a given area from satellite data
5. Generation of land use/ land cover map
6. Calculate vegetation indices like NDVI (Normalized Difference Vegetation Index) using satellite imagery.
7. Identify changes in land cover using change detection techniques
8. GPS-based survey and mapping

Suggested Reading:

1. Environmental Land Use Planning and Management. John Randolph. Island press. 2011.
2. Environmental Planning and Management. Hamid Reza Jafari, Saeed Karimi and Fatima Sadat Alavipoor. Cambridge Scholars Publishing. 2019.
3. Remote Sensing and Image Interpretation. Thomas M. Lilesand, Ralph W. Kiefer and Jonathan Chipman. Wiley. 2015.
4. Introduction to Remote Sensing. James B. Campbell, Randolph H. Wynne and Valerie A. Thomas. The Guilford Press. 2022.
5. Fundamentals of Remote Sensing. George Joseph. Universities Press (India) Pvt. Ltd. 2023.
6. Remote Sensing Applications in Environmental and Earth System Sciences. Nicolas R. Dalezios. CRC Press (Taylor and Francis Group). 2021.