ADVANCED ENVIRONMENTAL ENGINEERING

Lectures / Tutorials : 4 Periods/Week — Sessional marks: 40
Semester End Exam. : 3 Hours — Semester End Exam. marks: 60
Credits : 4

Course Objectives:

- To explain the importance of self-purification of streams and to derive Streeter- Phelps equation and to discuss the effects of various pollutants on receiving streams.
- To introduce new concepts in biological treatment like nitrogen and phosphorous removal, anaerobic filters, RBC and U-tube aeration systems, their working principles and suitability.
- To understand the characteristics and the treatment and disposal methods of liquid wastes produced in Dairy industry, Sugar industry and Pulp & paper industry.
- To introduce various functional elements of urban solid waste management and to introduce various methods of solid waste treatment methods with special emphasis on recovery and reuse of solid waste.
- To introduce sources, global effects and the effects on human health, plants and materials of air pollution.
- To discuss about the effects of various meteorological parameters on air pollution and to explain various equipment for controlling particulate pollution and their suitability.
- To introduce sources, effects and controlling measures of noise pollution and to discuss noise rating systems and acceptable noise levels for various places.

Course Outcomes:

At the end of the course the student will be able to:

- Understand the importance of self-purification and the effects of various pollutants on receiving streams.
- Determine the critical D.O. deficit and the degree of treatment required for wastewater at the treatment plant to maintain a minimum D.O. at any point in the stream.
- Update his knowledge in biological treatment with new and more advanced treatment methods.
- Understand the characteristics and suggest suitable methods of treatment and disposal of industrial wastewater.
- Suggest suitable methods for collection, transport, recovery, reuse and treatment of urban solid waste.
- Understand global implications of air pollution and suggest suitable methods of control of particulate pollution depending on concentration and size of the particulate matter.
- Acquire knowledge on noise pollution and suggest suitable noise control techniques according to the situation.

UNIT – I

Stream Sanitation

Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's Dissolved Oxygen Model; Zones of Self-purification;

Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.

New Concepts in Biological Waste Treatment (theory only)

Introduction; Nitrogen removal by biological nitrification and de-nitrification; Phosphate removal from the activated sludge process; Rotating Disc Biological Contactor; Anaerobic filters; U-Tube aeration systems.

UNIT – II

Industrial Wastewater Treatment

Introduction to Industrial Wastewater treatment;

Sugar Plant: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

Dairy Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

Pulp and Paper Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

UNIT – III

Urban Solid Waste Management

Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods such as compositing, incineration, sanitary landfill and pyrolysis.

Sources and Classification of Air Pollution

Stationary and mobile sources; Primary and secondary pollutants; Natural contaminants; Particulate matter; Aerosols; Gaseous pollutants.

Meteorology and Air Pollution

Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behaviour; Gaussian Dispersion Model; Plume rise; Wind rose.

UNIT – IV

Effects of Air Pollution

Global Effects: Global warming; Ozone depletion; Acid rains; Effects of air pollutants on human health; Effects on plants; Economical effects.

Control of Air Pollution

Objectives; Types of collection equipment: Settling chamber; Inertial separators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers.

Noise Pollution

Introduction; Levels of noise; Noise rating systems; Measurement of noise; Sources of noise and their noise levels; Acceptable noise levels; Effects of noise; Control of noise.

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOKS

1. Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd., 2008.
2. Environmental Pollution Control Engineering by C.S. Rao, New Age International, 2006.

3. Air Pollution by M.N. Rao and H.V.N. Rao, Tata Mc Graw-Hill,1989.

REFERENCES

1. Wastewater Engineering : Treatment, Disposal and Reuse by Metcalf & Eddy , 3rd Edition, Mc Graw- Hill, 1991.
2. Water Supply and Wastewater Disposal by G.M. Fair et. al., John Wiley & Sons, 1971.
3. Sewage Disposal and Air Pollution Engineering by S.K. Garg; Khanna Publications, 2010.
4. Sewage and Sewage Treatment by S.K. Kshirasagar; Roorkee Publishing House, Roorkee.