

**Course ESE724C: Environmental Risk Assessment and Management**  
**Alternate to MOOC Course**  
**P.G. Department of Environmental Sciences**  
**Programme: M.Tech. in Environmental Sciences in Engineering**  
**To be floated in 4<sup>th</sup> Semester (Batch 2022-24 and 2023-25)**

**Course objectives**

Develop a basic understanding of environmental health and risk assessment and its role within the risk management process.

Develop a basic understanding of how to assess impact of pollution such as air pollution, water pollution on environment and human health.

To learn about different risk assessment formats and their use in environmental health studies

To learn about hazard identification and dose response calculations

To understand and use epidemiological data, case study analysis to understand various methods of risk assessment

**Learning outcomes**

After attending the course students shall have gained knowledge and understanding of the methods and processes employed in environmental health and risk assessment

The students shall also have gained a professional attitude in the interpretation of epidemiological and toxicological studies for use in environmental health and risk assessment.

To understand key principles of environmental health risk characterization

Should be able to assess risk due to carcinogens, analyse various methods of risk assessment

Should be able to understand exposure modelling, point estimate and probability modelling

**CH-3**

**Unit-I**

**Introduction to Environmental Health and Risk Assessment:** Risk assessment, epidemiology, toxicology; Environmental health and occupational health; Hazard waste and environmental remediation; Indian scenario; Current framework (MoEF, CPCB, SPCB); Standards; Relevant legislation: (NEPA, NGT etc)

**Unit-II**

**Hazard Identification:** Background information, past site knowledge; Record of contamination; Sampling plans; Toxicity Profiles; Classification as 'contaminant of concern'

**Unit-III**

**Dose Response Assessment:** Threshold Effect: NOAEL, LOAEL and UFs, RFD/Cs); Carcinogenic effects: Group A-E; Relative Absorption Factors; Groups of Chemicals (PAHs, Dioxins, PCBs); commended format

**Exposure Assessment:** Development of Exposure Profiles: In-continuation to sampling plan; Basic Approach/Assumptions: Conservative approach, 90<sup>th</sup> percentile; Quantitative Estimations of Exposure: ADD, LADD; Exposure factors; Exposure Equations

**Unit-IV**

**Risk Characterization:** Non-cancer Risk: HI; Cancer Risk: ELCR (SF, UF); Comparison to Applicable or Suitably Analogous Public Health Standards: EPA, WHO, ADB guidelines; Risk characterization conclusions

Risk assessment tools: risk matrix, decision tree, failure modes and effects analysis (FMEA), and bowtie model, what-if analysis, failure tree analysis, and hazard operability analysis.

**Suggested Books:**

Hopkin, P. (2017). *Fundamentals of Risk management*, IRM. Kogan Page Limited

Asante-Duah, D.K. (1998). *Risk Assessment in Environmental Management*. John Wiley & Sons, Chichester, England.

Asante-Duah, D.K. (2017). *Public Health Risk Assessment for Human Exposure to Chemicals*. Springer, Dordrecht, The Netherlands.

Theodore, L. and Dupont, R.R. (2012). *Environmental Health and Hazard Risk Assessment Principles and Calculations*. CRC Press, Taylor & Francis Group.

**Question Setting and Evaluation:**

Course Teachers will set the Questions and Evaluate the Answerscripts in Internal and Endterm examinations for this Course



# Course ENS529C: Water and Wastewater treatment

## Alternate to MOOC Course

P.G. Department of Environmental Sciences

Programme: M.Sc. in Environmental Science

To be floated in 4<sup>th</sup> Semester (Batch 2022-24 and 2023-25)

### Course objectives

Develop a basic understanding of Water and Wastewater treatment process; Develop a basic understanding of Water quality parameters; Learn about Treatment plant, Methods of Filtration, Methods of Disinfection, RO process and Desalination processes

### Outcome of the Course

After attending the course students shall Understand the characteristics of water, Learn the methods of disinfection, Understand about several types of filters, Learn about surface water treatment plant, Learn about sewage treatment plant process, Learn about effluent treatment plants, Understand desalination process, Learn about reverse osmosis plants

## CH-3

### UNIT-I

**Water Quality Characteristics:** Introduction to Water Treatment, Physical Properties of Water, Chemical Properties of Water, Biological Parameters of Water

**Waste Water Characteristics:** Introduction of Waste Water, Physical Characteristics of Waste Water, Chemical Characteristics of Waste Water, Chemical Characteristics of Waste Water, Biological Characteristics of Waste Water.

### UNIT-II

**Surface Water Treatment Plant:** Introduction to SWTP Process, Aeration, Coagulation and Flocculation, Sedimentation, Types of Sedimentation, Clariflocculator and Settlers, SWTP Process, Waste water Treatment Plant

**Methods of Disinfection:** Introduction to Disinfection, Minor Methods of Disinfection, Basics of Chlorination, Forms of Chlorination, Types of Chlorination, Chlorination Equipment, Methods of Disinfection

**Types of Filters:** Theory of Filtration, Filter Media. Slow Sand Filter: Gravity Filters, Rapid Sand Filter: Gravity Filters, Horizontal Pressure Filter, Vertical Pressure Filter, Pressure Sand Filter, Multi Grade Filter, Activated Carbon Filter, Dual Media Filter, Multi Media Filter, Cartridge Filter

### UNIT-III

**Sewage Treatment Plant:** Introduction of STP, Challenging Words of STP, Biological Treatment Process, Activated Sludge Processes, Sequence Batch Reactor SBR, Membrane Biological Reactor MBR, Aerated Lagoon, Trickling Filter, Rotating Biological Reactor RBC, Moving Bed Biofilm Reactor MBBR, Fixed Bed Bio Reactors FBRR.

**Biological Treatment Process:** Anaerobic Process, Types of Anaerobic Process, MBR Plant Process  
Effluent Treatment Process: Introduction of Effluent Treatment Plant, Effluent Treatment Plant Process,

### UNIT-IV

**Reverse Osmosis:** Introduction of Reverse Osmosis Plant, Membrane Filtration, Membrane Materials, RO Membrane Modules, RO Membrane Housing, RO Membrane Fouling and Scaling, Chemicals used in RO Plant, Chemicals used in RO Plant, Components and Specification of RO Plant, RO Plant Process, Cleaning of RO Membrane

**Desalination Process:** Introduction of Desalination Process

### Selected Books:

1. Davis, Mackenzie L., Water and Wastewater Engineering: Design Principles and Practice, 2nd Edition, McGraw-Hill, New York, 2010.
2. Metcalf and Eddy, Wastewater Engineering: Treatment and Resource Recovery, Fifth Edition, Metcalf & Eddy, Inc., McGraw-Hill Publishers, New York, 2013.
3. Tchobanoglous, G., et al., Wastewater Engineering: Treatment, Disposal, and Reuse, Fifth Edition, Metcalf & Eddy, Inc., McGraw-Hill Publishers, New York, 2013.
4. Crittenden, J.C., et al., Water Treatment Principles and Design, 2nd Ed., Montgomery, Inc., John Wiley and Sons, New York, 2005.
5. Reynolds, T.D., Richards, P.A., Unit Operations and Processes in Environmental Engineering, PWS Publishing Company, Boston, 1996.

### Question Setting and Evaluation:

Course Teachers will set the Questions and Evaluate the Answerscripts in Internal and Endterm examinations for this Course

