

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5105 – Environmental Toxicology and Risk Assessment

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: This course will provide detailed introduction of the concepts of environmental toxicology (such as principles of toxicology, dose-response relationships, and environmental hazards) and health risk assessment using different assessment methodologies. Expected Outcomes: At the end of the full course, students can be able to 1. Understand the necessity of toxicity testing and various protocols of toxicity analysis 2. Design toxicity experiments and quantify the potential toxicity associated.

Course Content: Historical context and importance of environmental toxicology, Environmental contaminants, classification and types, Fate of contaminants in environmental media, bioaccumulation, and bioavailability in multiphase systems; Dose-response relationship and Toxicity Testing, Hazard and risk; Routes of exposure, oral route, dermal route, inhalation route, distribution, elimination, absorption, and bioavailability; Mechanism of action, endocrine disruption, cytotoxic, enzyme inhibition, reproductive toxicology, teratology, biotransformation, and secondary effect. Toxicokinetics, Toxicodynamics, Sub-lethal effects to individuals and organisms, Mutation, Acute and chronic lethal effects to individuals, Effects on population, Effects of communities and ecosystems, Landscape to global effects, Antibiotic resistance genes and mitigation measures. Pollution and biomonitoring, chemical and biological pollution monitoring, Quantitative analysis of fate, Quantitative analysis of effects, Environmental benchmarks, Data sources for exposure risk characterization; Algal assay approaches to pollution studies in aquatic systems, Toxicity testing of hazardous wastes, Instruments for toxicity testing, Terrestrial bioassays, Traditional approaches and limitations, Bio-indicators of environmental monitoring and pollution control. Integrated exposure assessment (case studies). Introduction to quantitative risk assessment, Application of statistical and Monte Carlo simulations and other techniques for probabilistic exposure assessment; Microbial risk assessment - Risk characterization, Uncertainty and Sensitivity Analysis; Communication, Decision making and Risk Management.

Textbooks

- A Textbook of Modern Toxicology. E. Hodgson (Ed.). John Wiley & Sons, Inc. 4th Edition. 2010.
- Hayes' Principles and Methods of Toxicology, Hayes, A. W., Kruger, C.L., CRC Press, Taylor and Francis, 6th edition, 2014.
- Fundamentals of aquatic toxicology: Effects, Environmental Fate and Risk Assessment, Gary M Rand. (Ed), CRC Press, 2nd Edition, 1995.
- Fundamentals of Ecotoxicology: The Science of Pollution, Michael C Newman and Michael A Unger, Lewis Publishers (CRC Press), 2nd Edition, 2003.
- Principles of Ecotoxicology, Walker, C.H., Sibly, R.M., Hopkin, S.p., Peakall, D.B., CRC Press, 2012.

- An Introduction to Environmental Toxicology, Michael H. Dong. Lash and Temple Publishing, 4th edition, 2018.
- Environmental Risk Assessment: A Toxicological Approach, Ted Simon, CRC Press, 2014

Reference Books:

- Risk Assessment: Theory, Methods and Applications, Marvin Rausand, Wiley, 2011.
- Pollution and Bio Monitoring, Rana B.C, Tata McGraw Hill Publishing Co., 1995
- Risk-Benefit Analysis, Wilson, R. and E.A.C. Crouch. Harvard University Press, 2nd edition, 2001.

Prerequisite: NIL