Sustainable Engineering Concepts and Life Cycle Analysis

Prof. Brajesh Kumar Dubey
Civil Engineering
IITKGP

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (26 Jul’21 - 17 Sep’21)
EXAM DATE : 26 Sep 2021

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO :- list of companies/industry that will recognize/value this online course Larsen and Turbo, Tata Group of Industries

COURSE OUTLINE :
This course will introduce students to the fundamental concepts related to interaction of industrial and environmental/ecological systems, sustainability challenges facing the current generation, and systems-based approaches required to create sustainable solutions for society. Students will understand the concepts and the scientific method as it applies to a systems-based, trans-disciplinary approach to sustainability, and will be prepared to identify problems in sustainability and formulate appropriate solutions based on scientific research, applied science, social and economic issues. The basic concepts of life cycle assessment (LCA) will be discussed, along with life cycle inventory (LCI) and life cycle impact assessment (LCIA) including the social and economic dimensions.

ABOUT INSTRUCTOR :
Brajesh Kr. Dubey is Associate Professor in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than a decade of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, Life Cycle Assessment (LCA) and Sustainable Engineering. He has collaborated with UN agencies, World Bank, National Science foundation, Ontario Ministry of Environment and Auckland Regional Council on various projects including that in the area of LCA.

COURSE PLAN :

Week 1: An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus)

Week 2: Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

Week 3: Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools)

Week 4: Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Week 5: Life Cycle Inventory and Impact Assessments (Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment, LCIA in Practice with Examples, Interpretation of LCIA Results)

Week 6: Factors for Good LCA Study (ISO Terminologies, LCA Steps Recap, Chemical Release and Fate and Transport, and Green Sustainable Materials)

Week 7: Design for Sustainability (Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis)

Week 8: Case Studies (e.g., Odour Removal for Organics Treatment Plant, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs. Solar Lamp, Bioplastic etc.).