SUSTAINABLE ENGINEERING CONCEPTS AND LIFE CYCLE ANALYSIS

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INTENDED AUDIENCE: Any interested learners.
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. The application of life cycle assessment methodology using appropriate case studies will be presented.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management, Life Cycle Analysis and Environmental Risk Assessment among other courses for nearly a decade. He has taught at several universities in USA, Canada, New Zealand, China andIndia. He has also conducted training programs in the Integrated Waste Management areas including that for Electronics Waste. Dr. Dubey has authored/co- authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

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.).