Kerala Technological university KTU First year B.tech Syllabus for **BE103 INTRODUCTION TO SUSTAINABLE ENGINEERING**

Course No. : BE103

Course Name: INTRODUCTION TO SUSTAINABLE ENGINEERING
L-T-P-Credits: 2-1-0-3

Year of Introduction: 2015

Course Objectives:

The purpose of this course is:-

1. To have an increased awareness among students on issues in areas of sustainability
2. To have an insight into global environmental issues
3. To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

Syllabus:

Sustainability- need and concept, understanding sustainability and threats, environment acts and legislations for protection of resources; Different types of tools for assessing sustainability in engineering, Environmental Impact Assessment studies; Energy, Conventional and renewable sources, Green buildings, green materials; Natural resources and their pollution, preservation of resources, treatment of pollutants, Different types of waste, waste to energy concept, Global effects of pollution

Expected outcome:

The student will be

- Able to appreciate and explain the different types of environmental pollution problems and their sustainable solutions
- Able to apply the concepts of sustainability in their respective area of specialization

References:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London,
2. Introduction to Environmental Engineering: special indian edition,Mackenzie Davis, David Cornwell, Amazon.com
3. Anil Markandya, Climate Change and Sustainable Development: Prospect s for Developing Countries, Routledge
4. EIA Guidelines, Notification of Govt of India, Environment Impact Assessment, 2006
5. Text book for Environmental studies, Erach Bharucha, UGC, NewDelhi, ebook, collegesat.du.ac.in/UG/Environmental%20Studies_ebook.pdf
6. Garg HP, J Prakash, Solar Energy: Fundamentals and Applications, Tata McGraw Hill
7. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
8. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI PUBLICATIONS – GRIHA Rating System, LEEDS Publications
9. Systems Analysis for Sustainable Engineering: Theory and Applications, Ni bin Chang, Amazon.com
10. John W Twidell and Anthony D Weir, Renewable Energy Resources, English Language Book Society (ELBS) 1996.
11. D P Kothari, K C Singal, Rakesh Ranjan, Renewable Energy Sources a nd Emerging Technologies, Prentice Hall of India
12. S.S Purohit , Green Technology-An approach for sustainable environment,

Agrobios publication
13. Mihelcic, J. R. and Zimmerman, J. B., Environmental Engineering, Wiley Publishers.
14. Brennen, D. Sustainable Process Engineering, Pan Stanford Publishers.

Module 1 Contents

Sustainability- Introduction, Need for sustainability, Concept of sustainability, social, environmental and economic sustainability concepts.Sustainable development, Engineering for sustainable development, Threats for sustainability, Low Impact development techniques. Environmental ethics, Environmental education, multilateral environmental agreements and Protocols –Environmental legislations in India- Water act, Air act

Examples for project work:
1. Identifying/assessment of sustainability in your neighbourhood in education, housing, water resources, energy resources, food supplies, land use, environmental protection etc.
2. Identify the threats for sustainability in any selected area and explore solutions for the same
3. Suggest some LID activities that can be adopted

Module 2 Contents

Tools for sustainability, Life cycle assessment, procedure for LCA, casestudies:ISO 14000, bio mimicking, responsibility of industries, industrial ecology,industrial symbiosis, cleaner production, clean development mechanism. Environment Impact Assessment, Procedures of EIA in India, Environmental auditing, Case studies in environmental sustainability Examples for

project work:
1. Conducting LCA of products (eg. Aluminium cans, PVC bottles, cars etc. or activities (Comparison of land filling and open burning)
2. Conducting an EIA study of a small project (eg. Construction of a building)

Module 3 Contents

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification.Methods for increasing energy efficiency of buildings, Sustainable cities,
Sustainable transportation, Case studies in sustainable engineering.
Examples for project work:
1. Consider the design of a sustainable building for your campus
2. Explore the different methods that can be adopted for maintaining a sustainable transport system in your city

Module 4 Contents

Air pollution- sources of air pollution, vehicular and industrial, types of air pollutants, Effects of air pollutants.
Global environmental issues, Resource degradation, Desertification, wetland reclamation, Climate change, Ozone layer depletion, Carbon credits and carbon trading, carbon foot print.
Examples for project work:
1. Collect details for instances of climate change in your locality.
2. Find out the carbon credits you can gain by using a sustainable transport system (travelling in a cycle or car pooling from college to home)

Module 5 Contents

Energy sources: Basic concepts-Conventional and non-conventional, solar energy, solar thermal systems, solar photo voltaic systems, Fuel cell. Wind energy, Small hydro plants, Biomass: types of biogas plants, bio fuels,
Energy derived from oceans, tides and waves, Geothermal energy. Energy conservation, Integration of alternate energy sources
Examples for project work:
Design a photovoltaic system for a house.Find out the energy savings that can be achieved by the installation of a solar water heater
Conduct a feasibility study for the installation of wind mills in Kerala

Module 6 Contents

Water pollutants- sources, persistent pollutants, Rain water harvesting, water quality standards, sustainable wastewater treatment methods, Energy from wastewater. Solid waste - sources, effects of solid waste pollutants, leachate, Hazardous
wastes, e wastes, plastic wastes, Radioactive wastes, Zero waste concept, 3R concept, waste to energy concept.
Examples for project work:
Design of biogas digesters for a small community
Advantages of installing rain water harvesting systems in campus
Assessing the pollution status of a small area
Programmes for enhancing public environmental awareness
Observe a pond nearby and think about the different measures that can be adopted for its conservation