FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Automobile Engineering)**

Semester: **V**

Course Code: **202020521**

Course Title: **Sustainability Engineering**

Course Group: **Open Elective-I**

Course Objectives: This course provides an overview of sustainability in a chemical engineering context. The aim is to establish the conceptual framework and foundation for quantitative methods to the analysis of (bio) chemical processes with respect to their impact on sustainability.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	0	3	50/18	50/17	NA	NA	100/35

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Sustainability Introduction: Definitions, principles and indicators of sustainability, Need and concept of sustainability, Social- environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Roles of engineers in developing sustainable society, Quantification of sustainability	08
2	Air Pollution, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste - sources, impacts of solid waste, Zero waste concepts, 3 R concept. Global environmental issues- Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.	08
3	Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) – Scope, Goal and case studies , Bio-mimicking, Environment Impact Assessment (EIA) - Procedures of EIA in India and case studies.	08
4	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 transport	07

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5	Green Engineering, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.	**07**
6	Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energyderived from oceans, Geothermal energy.	**06**

Reference Books:

1	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies,Prentice Hall.
2	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
3	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, Imndon. 1998.
4	ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy EfficiencyPublications-Rating System, TERI Publications - GRIHA Rating System.
5	Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-HillProfessional.
6	Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society(ELBS).
7	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.

Supplementary learning Material:

1	Video lectures available on the websites NPTEL
2	CDs available with some reference books for the solution of problems.
3	Use of subject relevant software for the problems solving and analyzing the thermodynamic processes.

Pedagogy: Following one or more points can be incorporated as relevant pedagogy methods.

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster Presentation
- Industrial/ Field visits
- Course Projects

Internal Evaluation :

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

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Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying;**N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25%	20%	25%	15%	10%	5%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the complex environmental, economic, and social issues related to sustainable engineering.	**20**
CO-2	Become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities.	**20**
CO-3	Critically evaluate existing and new methods related to sustainable engineering.	**25**
CO-4	Develop sustainable engineering solutions by applying methods and tools to research a specific system design.	**20**
C0-5	Clearly communicate results related to their research on sustainable engineering.	**15**

Curriculum Revision:

Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

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