Programme	B.Sc. (Engg.) Energy Engineering	Course Code	EE 121	Credit Hours	3 + 0 = 3
Course Title	**Energy Engineering Principles and Calculations -I**				

Course Introduction

This course covers engineering foundation and is designed to provide students with a comprehensive understanding of the fundamental concepts and practical applications of energy in engineering. Throughout the course, students will understand essential terminologies and analyze material balance problems. Energy plays a crucial role in engineering, influencing everything from design decisions to sustainability practices. By mastering the principles of energy and its calculations, students will be equipped to address complex engineering problems and contribute to innovative solutions in various fields.

Mapped SDGs	SDG-7: Affordable and Clean Energy

Learning Outcomes

1. **Define** the concepts related to process and process variables. (C1)
2. **Describe** the basis of mass and mole balance. (C2)
3. **Solve** material balance problems. (C3)

Course Content		Assignments/Readings
Week 1	**Unit-I Introduction to energy engineering principles** 1.1 Energy, its various forms and its relationship with power. 1.2 Thermal/ Chemical / Nuclear/ Solar energy basics 1.2.1 Dimensions, Units. 1.2.2 Conversion factors 1.2.3 System of Units.	The teacher may assign home assignments/problem-based learning/reading materials/learning activity etc.
Week 2	1.2.4 Conventions in methods of Analysis and Measurement. 1.2.5 Basis and the mole Unit.	
Week 3	**Unit- II Process and Process Variables.** 2.1 Mass, Volume and Density. 2.2 Temperature	
Week 4	2.3 Pressure.	
Week 5	2.4 Flow rate. 2.5 Chemical Composition.	

Week 6	2.6 Balance Equations and Stoichiometry 2.6.1 Limiting Reactant. 2.6.2 Excess Reactant 2.6.3 Selectivity. 2.6.4 Degree of Completion 2.6.5 Yield	
Week 7	**Unit- III Fundamental of Material Balance with application** 3.1 System characteristics	
Week 8	3.2 Process classification 3.3 Steady state and non-Steady state considerations	
Week 9	**Unit- III Fundamental of Material Balance with application** 3.1 System characteristics 3.2 Process classification 3.3 Steady state and non-Steady state considerations 3.4 Degree of Freedom. 3.5 Tie Components. 3.6 Sub-systems and interconnections	
Week 10	3.7 Familiarization with flow sheets 3.8 Mass balance diagrams and tables 3.9 Mass balances for items of plant 3.10 Choice of basis/datum for balances 3.11 Overall and component balances	
Week 11	Unit-IV Balances for engineering and process systems 4.1 Terminologies used in Material Balances. 4.2 Species Mole Balances	
Week 12	4.3 Element Material Balances 4.4 Mass balances for non-reactive processes.	

Week 13	4.5 Mass balances for reactive processes 4.6 Mass balance for Multiple-Unit processes.	
Week 14	4.7 Combustion Material Balances 4.7.1 Material balance for the combustion of gaseous fuel. 4.7.2 Combustion of liquid fuels	
Week 15	4.7.3 Combustion of solid fuels 4.7.4 Use of flow balance for combustion calculations	
Week 16	4.8 Recycle, Bypass and Purge Calculations.	

Textbooks and Reading Material

1. Himmelblau, D. M., & Riggs, J. B. (2023). Basic principles and calculations in chemical engineering. FT press.
2. Felder, R. M., Rousseau, R. W., & Bullard, L. G. (2020). Elementary principles of chemical processes. John Wiley & Sons.
3. Hicks, T., & Chopey, N. (2012). Handbook of chemical engineering calculations. McGraw Hill Professional.
4. Green, D. W., & Perry, R. H. (2019). Perry's Chemical Engineers' Handbook/edición Don W. Green y Robert H. Perry (No. C 660.28 P47 2008.
5. Hipple, J. (2017). Chemical Engineering for Non-Chemical Engineers. John Wiley & Sons.
6. Morris, A.E., Geiger, G., & Fine, H.A. (2011). Handbook on Material and Energy Balance Calculations in Material Processing. John Wiley & Sons.

Teaching Learning Strategies

The learning and teaching strategies for the Energy Engineering Principles course will incorporate a variety of approaches to enhance understanding and engagement. Lectures will utilize multimedia and whiteboards, to present core concepts effectively. Group discussions will foster critical thinking. Home tasks will provide hands-on experience in applying material balance techniques, complemented by reading and writing assignments to deepen the concepts.

Assignments: Types and Number with Calendar

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Activity	-	-	Assignment 1	-	-	Quiz.	-	-

Week	9	10	11	12	13	14	15	16
Activity	-	-	Assignment 2	-	-	Quiz.	-	-

The abovementioned schedule of assignments/quizzes/presentations is tentative. The schedule will be provided to the students at the start of semester.

Assessment			
Sr. No.	**Elements**	**Weightage**	**Details**
1.	Midterm Assessment	35%	Written assessment at the mid-point of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work, report writing, and viva-voce examination, etc.
2.	Sessional Assessment	25%	This assessment may include classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written assessment at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work, report writing, and viva-voce examination, etc.