Programme	B.Sc. (Engg.) Energy Engineering	Course Code	EE 212	Credit Hours	2+0=2
Course Title	**Engineering Materials**				

Course Introduction

Engineering Materials falls within the knowledge area of foundation courses providing basics of knowledge and understanding. This course gives the introduction about the building blocks of modern technology and infrastructure, playing a critical role in the design and construction of everything from bridges and airplanes to electronics and medical devices. These materials are selected and engineered based on their unique properties, such as strength, durability, flexibility, and thermal or electrical conductivity, to meet the specific requirements of various applications. This course tells about the materials that can be broadly categorized into metals, polymers, ceramics, and composites, each with distinct characteristics and advantages. Metals, known for their strength and ductility, are essential in structural applications; polymers offer versatility and lightweight properties for a wide range of products; ceramics provide high hardness and heat resistance for demanding environments; and composites combine the best features of multiple materials to achieve superior performance. The study and innovation in engineering materials are crucial for advancing technology, enhancing performance, and driving sustainability across numerous industries. As research progresses and new materials are developed, they continue to expand the possibilities of what can be achieved in engineering and design.

Mapped SDGs	SDG-9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Learning Outcomes

1. **Distinguish** between the various properties of materials. (C4)
2. **Review** the potential of materials in engineering applications. (C4)

Course Content		Assignments/Readings
Week 1	**Unit-I Introduction and properties of engineering materials** 1.1 Introduction to Engineering Materials	The teacher may assign home assignments/problem-based learning/reading materials/learning activity etc.
Week 2	1.2 Significance of materials in engineering equipment design and fabrication	
Week 3	1.3. Mechanical and thermal properties and their applications	
Week 4	1.4. Fundamental concepts of stress and strain, their estimation and applications in Engineering Design	
Week 5	**Unit-II Engineering materials** 2.1 Iron	

	2.2 Polymeric materials	
Week 6	2.3 Glass	
	2.4 Composite materials	
Week 7	2.5 Ceramics and stoneware	
	2.6 Acid-resistant bricks and tiles	
Week 8	2.7 Selection of materials of construction	
	2.8 Introduction to corrosion and its types	
Week 9	**Unit III Biomaterials** 3.1 The Need for Biomaterials and Biomedical Devices	
	3.2 Historical Development of Biomaterials	
Week 10	3.3 Properties of Biomaterials	
	3.4 Biomaterial Sources	
Week 11	3.5 Biocompatibility	
	3.6 Bio composites	
Week 12	**Unit-IV Nanomaterials** 4.1 Introduction to Nanomaterials	
	4.2 Motivation and Scope of Nanomaterials	
Week 13	4.3 Manufacturing processes for Nanomaterials	
Week 14	4.4 Characterization of Nanomaterials	
Week 15	4.5 Applications of Nanomaterials	
Week 16	4.6 Bio Nanotechnology	

Textbooks and Reading Material

1. Yadav, S. S., Dhiman, R., & Anklekar, R. M. (2024). Materials Science and Engineering. Cambridge Scholars Publishing.
2. Gupta, K. M. (2020). Engineering Materials: Research, Applications and Advances. United Kingdom: CRC PRESS,Taylor & Francis Group.
3. Fujiwara, A., Tan, K. H., Tanaka, M., Zaki, R. M., Ikram, T. (2020). Key Engineering Materials and Technologies. Switzerland: Trans Tech Publications Limited.
4. Tantra, R. (2016). Nanomaterial characterization: An introduction. John Wiley & Sons.

5. Francis, L. F. (2015). Materials processing: a unified approach to processing of metals, ceramics and polymers. Academic Press.
6. Sinnott, R., Richardson, J. F., & Coulson, J. M. (2013). Chemical engineering: An introduction to chemical engineering design. Elsevier.
7. De Graef, M., & McHenry, M. E. (2012). Structure of materials: an introduction to crystallography, diffraction and symmetry. Cambridge University Press.
8. Schimmel, T. (2012). Nanotechnology. An Introduction. By Jeremy J. Ramsden. AngewandteChemie International Edition, 51(39), 9733-9733.

Teaching Learning Strategies

The learning and teaching strategies will be comprised of lectures via multimedia, white/blackboard, group discussions to enhance critical thinking, individual and group assignments, project based learning, reading and writing assignments, and presentations.

Assignments: Types and Number with Calendar

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

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

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.