



**Ahmedabad
University**

Course	ENR108 Materials and the Engineering World	Semester	Monsoon Semester 2024													
Faculty Name(s)	Mona Jani	Contact	mona.jani@ahduni.edu.in													
School	SEAS	Credits	3													
GER Category:	Not Applicable	Teaching Pedagogy Enable:NO	P/NP Course: Can not be taken as P/NP													
Schedule	<table> <tr> <td rowspan="4">Section 1</td><td>01:00 pm to 02:00 pm</td><td>Thu</td><td>01-08-24 to 26-11-24</td></tr> <tr> <td>02:00 pm to 03:00 pm</td><td>Thu</td><td>01-08-24 to 26-11-24</td></tr> <tr> <td>03:00 pm to 04:00 pm</td><td>Fri</td><td>01-08-24 to 26-11-24</td></tr> <tr> <td>03:00 pm to 04:00 pm</td><td>Mon</td><td>01-08-24 to 26-11-24</td></tr> </table>			Section 1	01:00 pm to 02:00 pm	Thu	01-08-24 to 26-11-24	02:00 pm to 03:00 pm	Thu	01-08-24 to 26-11-24	03:00 pm to 04:00 pm	Fri	01-08-24 to 26-11-24	03:00 pm to 04:00 pm	Mon	01-08-24 to 26-11-24
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Prerequisite	Not Applicable															
Antirequisite	Not Applicable															
Corequisite	Not Applicable															

Course Description	Starting with history, the course will look at the evolution of materials, their applications, and processing using the compendium Cambridge Engineering Selector as a guide. Physical, chemical and biological properties will be discussed. These properties will be connected with the science of material structure, such as, crystals and grains, at different length scales. Standards of materials designation will be introduced, as also how these materials are available in the market. Hands-on laboratory work will give experience of measuring material properties, and structure of materials. Engineering uses and environmental aspects of the products will be integrated into the course.
Course Objectives	<p>The objectives of the course are to</p> <p>CE01 Become aware about the history, development and uses of materials;</p> <p>CE02 Interpret the Periodic Table to understand elements and their compounds and their properties;</p> <p>CE03 Gain exposure to production processes and how they influence materials structure, properties and applications;</p> <p>CE04 Learn, in theory and via hands-on work, about the micro- and macro-scopic structure of materials;</p> <p>CE05 Learn to operate instruments to measure material properties;</p> <p>CE06 Learn about enhancing material performance via coatings and treatments; and</p> <p>CE07 Become aware about the environmental impact of materials used in a variety of engineering applications.</p>
Learning Outcomes	<p>After completing this course, a student should be able to,</p> <ul style="list-style-type: none"> • CO1 Student will be able to identify the general category and sub-category of a material as per standards; • CO2 Be able to describe the properties of a material; • CO3 Be able to perform experiments for material characterization and interpret the data; • CO4 Identify candidate materials for given duty requirements; • CO5 Be able to indicate compatibility of pairs of materials in applications; • CO6 State the desired material properties for specific applications; and • CO7 Indicate the environmental impact of a material during use and at end-of-life.
Pedagogy	Lecture will be blackboard and projection-based that will be used for explain pictures, videos and animations. These will be supplemented with assignments some of which will require hands-on work. In the laboratory, students will use various instruments for characterizing microstructures, and measuring physical properties, and understand materials aspects of some engineered products.

Expectation From Students	None
Assessment/Evaluation	<ul style="list-style-type: none"> • Mid-Semester Examination: <ul style="list-style-type: none"> ◦ Written - 25% • End Semester Examination: <ul style="list-style-type: none"> ◦ Written - 30% • Other Components: <ul style="list-style-type: none"> ◦ Assignment - 10% ◦ Quiz - 10% ◦ Practical - 25%
Attendance Policy	As per Ahmedabad University Policy.
Project / Assignment Details	
Course Material	<p>Text Book(s)</p> <ul style="list-style-type: none"> • Introduction to Materials Science and Engineering: A Design-led approach, Butterworth-Heinemann, 2023, MF Ashby, H Shercliff, and D Cebon,, Butterworth-Heinemann, Year: 2023, • Materials Science and Engineering, V Raghavan, Prentice Hall, Year: 2013, <p>Reference Book</p> <ul style="list-style-type: none"> • Francois Cardarelli . Materials handbook, Springer, 2008., • Materials: Engineering, Science, Processing and Design,, M F Ashby, H Shercliff, D Cebon ,, Elsevier, Year: 2018, • https://www.iso.org/benefits-of-standards-the-iso-materials.html, • chrome-extension://efaidnbmninnibpcajpcglclefindmkaj/rnhttps://law.resource.org/pub/in/bis/S03/is.sp.21.2005.pdf, • Introduction to Materials Science for Engineers,, J Shackelford, 8th ed. Pearson, Year: 2018,
Additional Information	

Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Introduction to the course, history of materials, and periodic table and its use in understanding materials. Examples from recent applications.	Introduction. Exploration experiment.		About 20-25 % assignment problems will be design type	
2	Description, classification, and standard designation: Natural materials (wood, leather, fibrous materials, etc.), metals and their alloys, polymers, rubbers, ceramics, and composites	By rotation, teams of students will perform a set of experiments (one per week), as listed below, on different aspects of materials. Sl. No. 2 to 13 below.	Chapter-1		
3	Electrical and electronic materials: Semiconductors, magnetic materials; electrical materials, insulators, super conductivity.	Bioplastics	Chapter-2		

4	Crystal geometry, structure and its implications on material properties and performance. Crystal imperfections and defects. Single crystals and their applications.	Materials and processes of making and characterization	Chapter-10	N.A.	
5	Atomic structure and chemical bonding basics. Implications on material properties.	Crystal structure/making	Chapter-3/ guided learning-1	N.A.	
6	Structure of solids: Phase diagram and phase transformations of binary metal mixtures (metal alloys). Grain structure. Grain and grain boundary chemical aspects. Effects of heat and magnetic treatment. Failure and cracks.	Crystal models. Growing crystals and their characterization	Chapter-3	N.A.	
7	Physical and mechanical properties: Strength, stiffness, hardness, toughness, ductility, etc. Examples of applications.	Making and characterization of PDMS polymer	Chapter-6 /guided learning-4	N.A.	

8	Electrical, thermal, and optical properties. Super conductivity. Insulators.	Polydimethylsiloxane polymer classification, uses and making. Characterization of properties.	Chapter-4 and 5	N.A.	
9	Polymers and plastics: Types, classification. Structure and properties. Additives for enhancing properties.	Studying metal alloy microstructure	Chapter-7 and 10	N.A.	
10	Ceramics and glass: Types, structure and properties. Applications. Coatings on metals substrates.	Microstructure of binary compositions (Iron-Carbon, etc.). Influences of heat treatment. Effect on macro properties.	Chapter-2 and 11	N.A.	
11	Mid-term examination	Experiments on corrosion	Chapter-2 and 11	N.A.	
12	Quiet Reading Period	Controlled experiments on corrosion of steels.	N.A.	N.A.	
13	End-semester examination	Phase change materials	N.A.	N.A.	
14	N.A.	PCM salts and their thermal properties; SMA Nitinol.	N.A.	N.A.	
15		Semiconductor materials	N.A.	N.A.	
16	N.A.	Electrical behaviour of semiconductors. Microstructure.	N.A.	N.A.	
17	N.A.	Powder/granular materials:	N.A.	N.A.	

18	N.A.	Characterization of shape and size. Measurement techniques.	N.A.	N.A.	
19	N.A.	Composite material	N.A.	N.A.	
20	N.A.	Structure, materials and processes of making, Mechanical and electrical properties measurement.	N.A.	N.A.	
21	N.A.	Mechanical properties	N.A.	N.A.	
22	N.A.		N.A.	N.A.	
23	N.A.	Phase diagram experiment	N.A.	N.A.	
24	N.A.	Tin-bismuth, or iron-carbon, phase diagram experiment and measurements.	N.A.	N.A.	
25	N.A.	Heat treatment	N.A.	N.A.	
26	N.A.	Experiments on quenching, annealing, etc.	N.A.	N.A.	
27	N.A.	Review and revision	N.A.	N.A.	

