



## Course Book

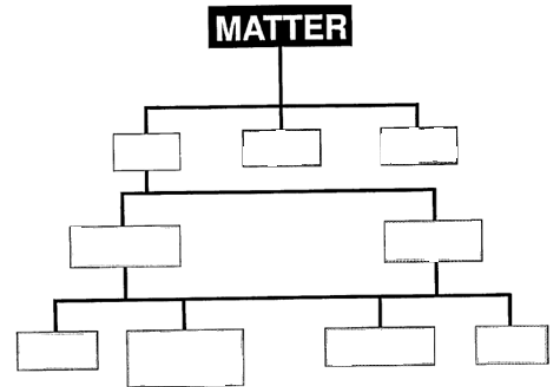
<b>Course Description</b>	<p>This course focuses on the fundamental aspects of materials science which every material scientist is supposed to be familiar with. The course discusses the basic structure of solids, classification of materials based on the structure and the correlation between the structure and properties. The evolution of properties based on the structure and its alteration is also dealt with.</p>
<b>Course objectives</b>	<p>The course is prepared for first class students. To provide the students with basic knowledge of materials science, so that they would be able to understand and distinguish between varieties of materials based on their structure and properties.</p> <ol style="list-style-type: none"> <li>1. To understand various mechanical properties of materials.</li> <li>2. To understand how and why the properties of materials are controlled by its structure at the microscopic and macroscopic levels.</li> <li>3. To understand how and why the structure and composition of a material may be controlled by processing.</li> <li>4. To create different types of composite materials and its applications.</li> <li>5. To remember polymer material classifications and applications.</li> </ol>
<b>Student's obligation</b>	<p><b>Respect</b> A student has an obligation to exhibit honesty and to respect the ethical standards of the profession in carrying out his/her academic assignments. Without limiting the application of this principle.</p> <p><b>Attendance</b> Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse of the absence. However, the absent student should take the responsibility for making up the missed lecture.</p> <p><b>The lectures format</b></p> <p>The lectures are divided on two weekly hours theoretically. Mainly, the two theoretical hours will be dedicated for the topic backgrounds and the main principles. Notes and handouts are given to the students containing the detail of the theoretical topics. Theoretical lectures will be assisted by presentations using white board and data show. Discussion time is provided for the students for questions.</p> <p><b>Questions:</b></p> <p>Asking questions about unclear material is an important part of the classroom experience. It is not uncommon for students to have similar difficulties, so speaking up will help everyone understand the discussed</p>

	<p>information. Teachers can also benefit from a student's questions. By finding out what subjects are hard to understand, instructors can adjust their lectures to clear up confusing topics.</p> <p><b>Assignment</b> A student must submit the assignment on <b>moodle</b> app. every week and also present a seminar about something subject related to his/her course.</p>
<b>Assessment scheme</b>	<p>24% Mid Term (Theory) 36% Assignment (report, quiz, homework, seminar) 40% Final (Theory)</p>
<b>Specific learning outcome:</b>	<p>After taking this course, students have ability to:</p> <ol style="list-style-type: none"> <li>1. Students will get to know the different classes of materials used in engineering applications and would be able to choose the right materials for specific applications.</li> <li>2. Students will learn the sample preparation methods and sample handling <ul style="list-style-type: none"> <li>• Students will acquire the ability to analyse the data obtained from the techniques</li> <li>• The student will be able to identify the ideal method of analysis to draw the required information.</li> </ul> </li> <li>3. On completion of the course, the students will be aware of the significance of nanomaterial, how to synthesize/make them and the fundamentals/theories that makes them different from their bulk counterparts. This knowledge will enable the students to choose and identify new materials for various applications and manipulate matter to create new nanomaterial for the niche applications which may not be possible with the bulk materials.</li> </ol>
<b>Course References:</b>	<ol style="list-style-type: none"> <li>1. Material Science by Dr. Kodgire, Everest publications, Pune.</li> <li>2. V.Raghavan, Material Science and Engineering, Prentice –Hall of India Pvt. Ltd., 2007</li> <li>3. Sidney H. Avner, Introduction to physical metallurgy, Tata Mc-Graw-Hill, Inc. 1997.</li> <li>4. D.R. Askeland, P.P. Phule, W.J. Wright, The Science and Engineering of Materials, 6th ed., Cengage Learning, 2010.</li> <li>5. W.D. Callister, D.G. Rethwisch, Materials science and Engineering: An Introduction, 8th ed., Wiley, 2010.</li> <li>6. B.S. Mitchell, An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, 1st ed., Wiley- Interscience, 2003.</li> <li>7. C. Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2005.</li> </ol>

<b>Course topics (Theory)</b>	<b>Week</b>	<b>Learning Outcome</b>
Explain the catalogue course	1	
(Materials Technology) Definition and key characteristics.	2	
Fundamentals of Materials Science, Ferrous and Non Ferrous Alloys, Heat Treatment Methods.	3	
Ceramic Materials, Introduction to Ceramics, Advanced Ceramic Materials - Crystal Structures –Silicate ceramics, glass and its manufacturing process, Functional properties and applications of ceramic materials.	4	
Composites Materials: Introduction, Classification of composites - Fibres reinforced materials –	5	
Polymer Materials:Polymers,Classification of polymer – Mechanisms of polymerization - Thermoplastics - Elastomers – Thermosets –Liquid crystal polymers - Conductive polymers – High Performance fibers - Biomedical applications – Photonic polymers.	6	
Selection of Engineering Materials Semiconductors, Biomaterials, Smart Materials, and Nano engineered Materials.	7	
The Materials Selection Process, Introduction to Roles & Responsibilities of Materials Engineer,	8	
Factors affecting the selection of materials: Component shape, Dimensional tolerance, Mechanical properties, Fabrication (Manufacturing) requirements, Service requirements, Cost.	9	
Cost of the material, Cost of processing, Availability of the material, Procedure for materials selection.	10	
Nanomaterials classification according to the size criteria, Nano scale in three dimensions, Nanomaterials in two dimensions, Nanomaterials classification according to phase composition criterion,	11	
Processing Parameters, Selection for electrical properties, Electrical properties for different types of materials, Selection for magnetic properties.	12	

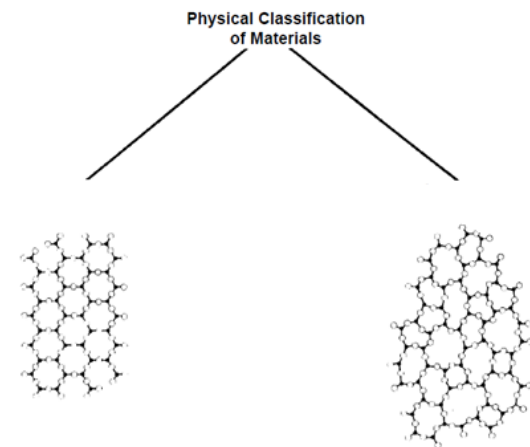


**Q1/** Classify the matter by state:



25 Mark

**Q2/** Classify the materials by atomic structure, then show the interrelationships between classes of materials.



25 Mark

**Q3/** Show by block diagram the procedure that every engineered item goes through:

Design----                      ----                      ---                      --- and  
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15 Mark

**Q4/** Fill in the blanks:

- 1- Nano materials with a least one dimensions in the range of -----  
-.
- 2- Semiconductors have electrical properties that are ----- between  
conductors and insulators.
- 3- A polymer is long chain molecule made up many repeating units called---  
-----.
- 4- Wood is an----- materials.
- 5- Concrete is an example of -----materials.
- 6- Some properties of metals and alloys are-----, -----and-----.
- 7- Biomaterials must not produce----- substances.

35 Marks

**GOOD LUCK**

Lecturer

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