

Course Code. :	<b>CH 225005</b>
Course Title :	Chemistry of Engineering Materials
Credits:	L T P C 3 1 0 4
Prerequisites (if any)	Nil
Course Objective	<p>The course “Chemistry of Engineering materials” is designed to</p> <ul style="list-style-type: none"> <li>➤ To develop the fundamental understanding about Engineering materials</li> <li>➤ To provide the knowledge about structural features, synthesis, properties of various categories of materials.</li> <li>➤ To develop the skills for phase, microstructural and elemental characterisation of materials.</li> <li>➤ To provide the knowledge about the role of chemistry in modern engineering applications and understand the working principle and study the applicability of the most important methods used in materials characterization.</li> </ul>
Course Contents	<p><b>Unit I</b>  <b>FUELS, COMBUSTION AND REFRACTORIES</b>  <b>1.1 Fuels Fuel and fossil fuel</b>  Definition – Calorific value – Classification of fuels – Solid fuels – Wood – Coal – Varieties of Coal – Composition – Specific uses – Liquid fuels – Petroleum – Fractional distillation – Fractions and uses – Cracking (Concept only) – Liquid Hydrogen as fuel – Gaseous fuels – Preparation, composition and specific uses of Producer gas and Water gas – Composition and uses of CNG and LPG – Relative advantages of solid, liquid and gaseous fuels.  <b>1.2 Combustion Definition</b>  Combustion calculation by mass (for solid and liquid fuels) – Combustion calculation by volume (for gaseous fuels) – Stoichiometric calculations – Volume of air required – Excess air – Definition of Flue gas – Flue gas Analysis – Orsat Apparatus – Simple numerical problems.  <b>1.3 Refractories Definition</b>  Requirements of a good Refractory – Classification – Acidic, Basic and Neutral Refractories – Examples and uses – Uses of Fireclay bricks, Alumina bricks and Silica bricks.</p> <p style="text-align: right;">12 h</p> <p><b>Unit II</b>  <b>CEMENT, CERAMICS, LUBRICANTS AND ADHESIVES</b></p>

	<p><b>2.1 Cement</b>  Definition – Manufacture of Portland Cement – Wet Process – Setting of Cement.</p> <p><b>2.2 Ceramics</b>  White pottery – Definition – Manufacture of White pottery – Uses – Definition of glazing – Purpose – Method – Salt glazing.</p> <p><b>2.3 Lubricants</b>  Definition – Characteristics of Lubricant – Types of Lubricants – Solid – Semi-solid –Liquid Lubricants .</p> <p><b>2.4 Adhesives</b>  Definition – Requirements of good adhesives – Natural adhesive – Uses of Shellac, Starch, Asphalt – Synthetic adhesive – Uses of Cellulose Nitrate, PVC, Phenol-formaldehyde and Urea-formaldehyde.</p> <p style="text-align: right;">12h</p> <p><b>Unit III</b>  <b>POLYMERS</b></p> <p><b>3.1 Plastics</b>  Definition - Polymerization – Definition – Types of polymerization – Addition polymerization – Formation of Polythene – Condensation polymerization – Formation of Bakelite – Types of plastics – Thermoplastics and Thermoset plastics – Differences – Mechanical properties of plastics – Advantages of plastics over traditional materials (Wood and Metal) – Reinforced or filled plastics – Definition – Advantages – Applications – Polymers in Surgery – Biomaterials – Definition – Biomedical uses of Polyurethane, PVC, Polypropylene and Polyethylene.</p> <p><b>3.2 Rubber</b>  Definition, Preparation from Latex – Defects of natural rubber– Compounding of rubber – Ingredients and their functions – Vulcanization – Definition and Purpose – Reclaimed rubber – Definition – Process – Properties and uses.</p> <p><b>3.3 Composite materials</b>  Definition – Examples – Advantages over metals and polymers – General applications.</p> <p style="text-align: right;">12h</p> <p><b>Unit IV</b>  <b>Nano materials:</b>  Introduction to Nanoscale materials - Quantum Confinement - Influence of nano over micro/macro-size effects-surface to volume ratio-surface effects on the properties - Size Dependent Chemical and Physical Properties - Classification of nanomaterials and nanocomposites - Design and synthesis of nanomaterials</p> <p style="text-align: right;">6h</p>

Text books/  
References

TEXT/REFERENCE BOOKS

1. An Introduction to Materials Science & Engineering, W.D. Callister, John Wiley & Sons (2007).
2. Fundamental of Ceramics, MW Barsoum, IOP publishing (2003).
3. Text book of Nanoscience and Nanotechnology, T. Pradeep, Mc. Graw Hill Education (2003).
4. Textbook of Nanoscience and Nanotechnology, Murty, Shankar, B Raj, Rath, Murday, Springer (2013).
5. Materials Science and Engineering, V. Raghavan, Prentice-Hall of India Private Limited (2003).
6. The Chemistry and Technology of Petroleum, J.G. Speight, 2014 CRC Press.
7. Hydrocarbon Chemistry, George A. Olah & Arpad Molnar, Wiley-Interscience, 2nd Edition May 2008.
8. Handbook of Petroleum Product Analysis, J.G. Speight, , 2nd Edition 2015.
9. The Properties of Petroleum Fluids, William D. McCain Penn Well Publication, 3rd Edition 2017.
10. James G. Speight, The Chemistry and Technology of Petroleum, CRC Press, New York
11. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publication
12. Textbook of Engineering Chemistry, 4th Edition, R Gopalan, D Venkappayya, S Nagarajan, Vikas Publishing House
13. Engineering Materials: Polymers, Ceramics and Composites, 2<sup>nd</sup> Edition, A.K Bhargava, Prentice Hall India
14. Advanced Composites manufacturing, T.G. Gutowski, John Wiley and Sons, New York, 1997.
15. Mechanical Properties of Polymers and Composites, 2nd Edn., Lawrence E. Nielsen and Robert F. Landel Marcel Dekker, New York 1994.
16. Nanochemistry: A Chemical Approach to Nanomaterials, Geoffrey A. Ozin, Andre C. Arsenault, Royal Society of Chemistry, Cambridge, UK, 2005.
17. Chemistry of nanomaterials : Synthesis, properties and applications C. N. R. Rao, Achim Muller, A. K Cheetham, Wiley-VCH, 2004.