Subject: **Materials Science (OE – 1)**								
Program: **B. Tech in Metallurgical Engineering**				Subject Code:			Semester: **I**	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	16/40	0	24/60	0	100

Course Objectives

1. To evaluate different materials for engineering applications.
2. To categorize material according to their properties and requirement.
3. To classify materials and understand the importance of each material in order to find applications in other fields of engineering.

CONTENTS

UNIT-I

[10 hours]

Materials

Introduction, Engineering requirement of different materials, Classification of Engineering materials, Properties of engineering materials, Criteria for selection of materials for engineering application.

Crystal Physics

Structure of crystalline solids; Lattices, unit cells; atom size, co-ordination number, atomic packing factor. coIndexing of directions and planes, notations, Interplanar spacing and angles, Crystal structure analysis - Bragg's law for X-ray diffraction.

UNIT-II

[10 hours]

Ferrous metals & Alloys

Pig iron, cast iron, carbon steel, alloy steels- Classification, properties, composition and applications.

Non-Ferrous Metals & Alloys

Important non-ferrous metals (Al, Cu, Pb, Zn, Sn, Mg, Ti, Ni,), Non-ferrous alloys (Cu alloys, Al alloys, Mg-alloys, Ni-alloys) – Composition, properties, classification and applications.

UNIT-III

[10 hours]

Ceramics

Introduction, Simple crystal structure, Classification- Traditional (clay-products, refractories, abrasives, cement) and Engineering Ceramics- Glass Ceramics, Properties of ceramics, Application of Ceramics, Glasses, Glass structure, Properties and application of Glass, Types of glass.

Polymers

Introduction, Classification and forms of Polymers, Thermosetting & thermoplastic polymer, types of polymerizations, Molecular weight, Plastics, Natural rubber and synthetic rubber, Applications of polymeric materials.

UNIT-IV

[10 hours]

Composites

Introduction, Classification & Applications, Dispersion-strengthened, Composites, Particulate Composites, Fiber-reinforced Composites: Influence of Fiber Length, Influence of Fiber Orientation and Concentration, The Fiber Phase, The Matrix Phase, Polymer-Matrix.
Composites, Metal-Matrix Composites, Ceramic - Matrix Composites, Carbon–Carbon Composites, Processing of Fiber-Reinforced Composites.

Advanced Materials

Smart materials (Shape memory material, Piezo electric material) Photoconductors, Bio-materials, Nano materials, Dielectric materials, magnetic materials, metamaterials, Cryogenics, Optical Fiber.

Course Outcomes

1. To apply the fundamentals of mass, matter and materials from daily life.
2. To acquaint the student with applications and properties of materials used from engineering aspects.
3. To apply student's knowledge about advanced materials to be used in futuristic applications.

Text Books

1. O. P. Khanna, "Material Science and Metallurgy", Dalpat Rai Publications, 2nd Edition, 2014, ISBN: 9789383182459.
2. R. K Rajput, "Engineering Materials", S. Chand Publications, 4th Edition, 2000, ISBN: 9788121919609.
3. W.D. Callister, "Material Science & Engineering – An Introduction", John Wiley Publishers, 7th Edition, 2007, ISBN: 9780471736967.

Reference Books

1. J. Shackelford, "Introduction to Materials Science for Engineers", Pearson-Prentice Hall Publications, 8th Edition, 2006, ISBN: 8131700909.
2. L.H. Vanvlack, "Elements of Materials Science and Engineering", Pearson Education India, 6th Edition, 2002, ISBN: 8131706001.
3. D. Swarup, "Elements of Metallurgy", Rastogi Publications, 2005, ISBN: 8171338135.
4. V. Raghavan, "Materials Science and Engineering – A First Course", Prentice Hall India Learning Private Limited, 6th Edition, 2015, ISBN: 8120350928.

Web Resources

1. MOOC Course on "Materials Science and Engineering" (https://www.edx.org/course/materials-science-engineering-misisx-mse1x)