Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering & Technology					II Year B. Tech. (Mechanical Engineering) Full Time	
Course Code & Name	**Instructions Hours per Semester and Credits**					
3RMPC2 **MATERIALS SCIENCE**	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**		
	30	**10**	**20**	**60**	**120**	**4**

Course Learning Objectives:

The course is designed:

1. To develop an understanding of the relationship between the internal structure and properties of engineering materials.
2. To provide comprehensive knowledge of various engineering materials and their classifications.
3. To introduce fundamental concepts of material behavior relevant to mechanical design and manufacturing applications.
4. To familiarize students with various material testing methods and their significance in engineering practice.

Pre-requisites

Engineering Chemistry and Engineering Physics

COURSE CONTENTS

UNIT-I

Description of Crystal Structure and Imperfections in metal crystals: Review of crystal structure: Seven Crystal System. Bravais lattice. Symmetry and properties of simple crystal structure, Millers indices. Imperfections in metal crystals, Point Defects, Edge Dislocation, Screw dislocations slip planes.

UNIT-II

Ferrous and Non-Ferrous Metals and Alloys: Properties and application of various steels and cast iron. Effect of impurities, in ferrous metals. Effect of common alloying elements on the steels, High speed steels, Stainless steel, other steel. Corrosion and its prevention. Composition, microstructure, properties and applications of Aluminum and its principle alloys, Copper and its principle alloys, Nickel and its principle alloys.

UNIT-III

Concept of Phase Diagrams and Equilibrium Diagrams: Iron Allotropy, cooling curves, phase diagrams, Gibbs phase rule, Various types of phase diagrams, Interpretation of Phase diagrams, Iron carbon

equilibrium diagram, Classification of Equilibrium Diagrams: Eutectic, Eutectoid and Peritectic transformation, Iron carbon equilibrium diagram, TTT diagrams, Comparison of Iron carbon equilibrium diagram and TTT diagrams.

UNIT-IV

Heat Treatment of Metals and Alloys and Powder metallurgy: Classification of Heat treatment processes, Surface or case hardening of steel, Defects in heat treated parts. Manufacturing of metal powders. Sintering and secondary operations. Design considerations and applications.

UNIT-V

Metallography, Destructive and Non-Destructive Testing: Introduction to Metallography, Study of sample preparation and metallurgical Microscope. Study of Mechanical Properties and their significance in Engineering Applications, Classification of testing of materials, Tensile, Compression, Bend, Torsion, Fatigue, Impact, Hardness, Creep Tests, Ultrasonic, Magnetic, Radiography Tests etc.

BOOKS RECOMMENDED:

1. Calllister W.D.Jr., Mateials Science and Engineering an Introduction, Wiley Publications (P) Ltd, 2004.
2. Askeland D. R.,Fulay,P.P., Essentials of Materials Science and Engineering, Cengage Learning Publications,2010
3. Raghavan, V.,Materials Science and Engineering, Prentice-Hall of India (P) Ltd.,2001.
4. Khanna, O.,P., Material Science and Metallurgy, Dhanpat Rai Publications,2005

LIST OF PRACTICAL ASSIGNMENT

1. Performance of hardness test of ferrous materials using Rock Well hardness testing machine
2. Performance of magnetic particle crack detection to detect the cracks
3. Performance of impact test on a plastic test sample to detect impact strength of material.
4. Performance of crack detection using ultrasonic crack detector.
5. Study and perform steps involved in sample preparation for observing the microstructure under metallurgical microscope
6. Study and perform various heat treatment process using muffle furnace
7. Study of construction and function of metallurgical microscope.
8. Study of microstructures of ferrous metal alloys
9. Study of iron carbon diagram
10. Study of T.T.T. diagram

Course Outcomes (COs)

Course Out Come (CO)	After completion of the course, students will be able to:
CO1	Analyze crystal structures and lattice imperfections influencing material behavior.
CO2	Classify ferrous and non-ferrous alloys and correlate composition with mechanical properties and applications.
CO3	Interpret and apply phase and equilibrium diagrams to understand phase transformations in metals.
CO4	Evaluate the effect of heat treatment and powder metallurgy processes on material properties.
CO5	Examine microstructures and assess material performance using destructive and non-destructive testing methods.

CO-PO-PSO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO 1	PSO 2	PSO 3
CO 1	3	1	2	2	2	1	0	0	0	1	1	1	2	0
CO 2	3	3	2	3	2	0	2	0	0	0	1	2	1	0
CO 3	3	1	3	3	2	2	0	0	0	0	2	2	1	0
CO 4	3	3	2	2	0	0	0	0	0	1	0	1	0	0
CO 5	2	2	1	2	1	0	0	0	0	1	1	1	0	0

* CO (rows) mention nil/very small/insignificant contribution to the PO (column)

1→ relevant and small significance 2 → medium or moderate and 3 →strong