

Regulation GRBT-20	Godavari Institute of Engineering & Technology (Autonomous)	I B.Tech. II Sem (2 nd semester)			
Course Code	Material Science and Metallurgy (Common to ME, Mining, Petroleum Engineering)				
Teaching	Total contact hours-55	L	T	P	C
Prerequisite(s): Engineering Physics and Engineering Chemistry		3	0	0	3

Course Objective:

To understand the basic fundamentals of Material science and Physical metallurgy. The basic concepts to be taught will help for the improvement, proper selection and effective utilization of materials which is essential to satisfy the ever increasing demands of the society.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1:	Demonstrate the knowledge of science and fundamentals of materials.
CO2:	Describe the regions of stability of phases that occur in the alloy systems.
CO3:	Classify steels and cast Irons with applications.
CO4:	Select heat treatment methods and non-ferrous materials.
CO5:	Explain the concept of ceramics and composites.

Syllabus:

UNIT – I

STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS: Bonds in Solids–Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT –II

EQUILIBRIUM DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe₃C.

UNIT –III

CAST IRON AND STEELS: Classification of Cast Iron-Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels- structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

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UNIT – IV

HEAT TREATMENT OF ALLOYS: Effect of alloying elements on Fe-Fe₃C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys. Magnesium and its alloys

UNIT – V

CERAMICS: Crystalline ceramics, glasses, cermets, abrasive materials nano-materials.

COMPOSITES: Definition, properties and applications of the above. Classification of composites- particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites various methods of manufacturing of composites.






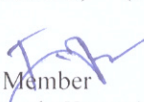
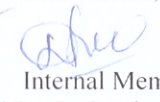







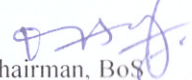
Text Books:

1. Introduction to Physical Metallurgy - Sidney H. Avener–McGrawHill
2. Material science and Engineering - V. Rahghavan

References:

1. Material Science and Metallurgy – Dr.V.D.kodgire.
2. Materials Science and engineering - Callister&Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers
4. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press
5. Material Science and Metallurgy – A V K Suryanarayana – B S Publications
6. Material Science and Metallurgy – U. C. Jindal – Pearson Publication
7. Material Science and Metallurgy for Engineers-Kodgire-Everest Publishing House

Useful Web-links : <http://nptel.ac.in/courses.php>
<http://mit.espe.edu.ec/courses/mechanical-engineering/>

 University Nominee (Dr. B. Balakrishna)	 Subject Expert (Dr. D. Ravi Kumar)	 Industrial Expert (Mr. Rajiv Aramadaka)	 Internal Member (Dr. P.M.M.S. Sarma)	 Special Invitee Member (Dr. M.V. Sekhar Babu)
 Internal Member (Dr. T. Jayananda Kumar)	 Internal Member (Dr. D. Santha Rao)	 Internal Member (Mr. Kedarath M)	 Internal Member (Mr. B. Joga Rao)	 Internal Member (Mrs. E. Nirmala Devi)
 Internal Member (Mr. M. Balakrishna)	 Internal Member (Mr. P. Veera Raju)	 Internal Member (Mr. D. Suman)	 Internal Member (Mr. G. Ramakrishna)	 Chairman, BoS (Dr. M. Sreenivasa Rao)