

## Department of Mechanical Engineering Lesson Plan

**Name of the Subject** :Materials science and Metallurgy (14BT30302)

**Class& Semester** :B.Tech. IIYear (Mechanical Engineering)

**Name of the faculty Member** :B. Chaithanyakrushna

S. No.	Topic	No. of periods	Book(s) followed	Topics for self-study
<b>UNIT – I: STRUCTURE OF METALS</b>				
1	Introduction to engineering materials, classification of engineering materials	1	T2	Prepare a table for metals, non metals and also give some applications for metals and non metals.
2	Primary and Secondary bonding in materials	1	T1	
3	Space Lattice, Unit cell	1	T1	
4	Mechanical properties of materials	1	T1	
5	structure of materials- SC, BCC, FCC, HCP	1	T1,T2& R1	
6	crystal defects- Point, Line, Planar, and volume	2	T1 & T2	
7	grain and grain boundaries, effect of grain boundaries on properties of metal/alloys	1	T2	
8	Determination of grain size-Comparison method, Henry's intercept method	1	T2	
<b>Total periods required:</b>		<b>09</b>		
<b>UNIT – II: PHASE DIAGRAMS</b>				
9	Cooling curve of pure metal and alloy	1	T1,T2 & R3	Students are advised to go through the URL <a href="http://nptel.ac.in/courses/113105024/23">http://nptel.ac.in/courses/113105024/23</a> for better understanding of this topic
10	Phase, Phase Diagram, Gibbs's Phase rule	1	T1	
11	HumeRothery rules	2	T2	
12	Binary Isomorphous system	1	T1 & R2	
13	Invariant Reactions- Eutectic, Eutectoid, Peritectic, Peritectoid	1	T1& R3	
14	Iron-Iron carbide phase diagram	2	T1 & T2	
15	Effect of alloying elements on Iron-Iron carbon system	1	T2	
<b>Total periods required:</b>		<b>09</b>		
<b>UNIT-III: HEAT TREATMENT</b>				
18	Introduction	1	T1& T2	Students are advised to study about Hardenability by doing Jominy end
19	Annealing, Normalizing	1	T1 & T2	

20	Hardening, Tempering	1	T1 & T2	quench experiment in materials science lab.
21	TTT diagrams	1	T1 & T2	
22	Surface Heat treatment processes- Carburizing, Nitriding, Cyaniding, Flame and Induction hardening	4	T1 & T2	
23	Cryogenic treatment of alloys	1	T2	
<b>Total periods required:</b>		<b>09</b>		
<b>UNIT – IV: FERROUS, NONFERROUS, AND THEIR ALLOYS</b>				
25	Structure and properties of Cast Iron - white cast iron, Malleable cast iron, Grey cast iron and Spheroidal cast iron.	2	T1 & T2	Students are advised to visit the following website <a href="http://www.nickelinstitute.org/en/NickelUseInSociety/MaterialsSelectionAndUse/Ni-ContainingMaterialsProperties/HighNickelAlloysAndSuperalloy.s.aspx">http://www.nickelinstitute.org/en/NickelUseInSociety/MaterialsSelectionAndUse/Ni-ContainingMaterialsProperties/HighNickelAlloysAndSuperalloy.s.aspx</a> for better understanding about super alloys.
26	Classification of steels	1	T1 & T2	
27	Structure and properties of steels- Plain carbon steel, Low alloy steels, Hadfield manganese steels and stainless steel.	2	T1 & T2	
28	Properties and applications of copper and its alloys	1	T2 & R4	
29	Properties and applications of Aluminium and its alloys	1	T2 & R4	
30	Properties and applications of Titanium and its alloys, and super alloys	2	T2 & R4	
<b>Total periods required:</b>		<b>09</b>		
<b>UNIT – V: POWDER METALLURGY AND COMPOSITE MATERIALS</b>				
31	Introduction to powder metallurgy	1	T1, R1& R2	Students are advised to study Carbon-Carbon composites for better understanding the composite materials topic.
32	Methods of production of metal powders- Atomization, Reduction of oxides, Electrolytic deposition.	1	T1, R1& R2	
33	Mixing, Blending	1	T1, R1& R2	
34	Compacting, Sintering	1	T1, R1& R2	
35	Applications and limitations of powder metallurgy	1	T1 & T2	
36	Introduction to composite materials	1	R2	
37	Types of Matrices and Reinforcement	1	R2	
38	Polymer Matrix Composites- GFRP, CFRP	1	R2	
39	Metal Matrix Composites	1	R2	
<b>Total periods required:</b>		<b>09</b>		

**TEXT BOOKS:**

1. Sidney H. Avner, *Introduction to Physical Metallurgy*, Tata Mc Graw Hill, 2<sup>nd</sup> edition, 1997.
2. Kodigre V D, *Material Science and Metallurgy*, Everest Publishing House, 31<sup>st</sup> edition, 2011.

**REFERENCE BOOKS:**

1. V. Raghavan, *Physical Metallurgy: Principles and Practices*, PHI, 2<sup>nd</sup> edition, 2006.
2. William. D. Callister, *Materials Science & Engineering-An Introduction*, John Wiley and sons, 2<sup>nd</sup> edition, 2014.
3. Donald R. Askeland, Pradeep P. Fulay, D.K. Bhattacharya, *Materials Science and Engineering*, Cengage Learning, 1<sup>st</sup> edition, 2010.
4. R.K. Rajput, *Engineering Materials and Metallurgy*, S. Chand, 1<sup>st</sup> edition, 2006.