



ENGINEERING MATERIALS (MM700OE)

Open Elective - II

COURSE PLANNER

COURSE OVERVIEW:

Engineering Materials After defining or explaining what Materials Science and Engineering is, we classify engineering materials according to their nature and the various categories of applications. Then we discuss the different levels of the internal structure of materials. Finally, we emphasize the importance of the structure–property relationships in materials, outlining the general approach of the ensuing chapter

COURSE PURPOSE:

As materials is a field that transcends all disciplines of science and engineering, it is beneficial for every scientist and engineer to know something about different materials. The discipline itself focuses on the STRUCTURE and PROPERTIES of materials, but in the larger sense this is just the initial portion of the well-known engineering sequence: In this course you will have the opportunity to learn something about the fundamentals of the structure/properties relationships of all types of materials (ceramics, metals and their alloys, polymers and composites thereof).

SCOPE OF COURSE:

At the end of the course student will understand different metals and alloys, their characteristics, properties and applications.

PRE REQUISITES:

The knowledge of following subjects is essential to understand the subject:

1. Basic knowledge of Physics
2. Material Science and Metallurgy

COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I.	To gain <i>knowledge</i> in applications properties strengthening mechanisms in structural steels and super alloys and stainless steels
II.	To develop a fundamental <i>understanding</i> of various electrical and electronic materials
III.	To be able to <i>understand</i> and importance of bio materials.

I. COURSE OUTCOME:

CLO Code	CLO's	At the end of the course, the student will have the ability to:	Bloom's Taxonomy Levels	POs / PSOs mapped
MM700OE.01	CLO1	To select and design components based on their properties and requirements.	L1: Knowledge L3: Apply	PO1, PO2, PO3, PO8, PO12, PSO1, PSO2, PSO3.
MM700OE.	CLO2	Awareness about the electrical and	L2: Understanding,	PO1, PO2, PO3, PO8,

02		electronic materials	L3: Apply	PO12, PSO1, PSO2, PSO3.
MM700OE.03	CLO3	Knowledge about bio materials like, titanium and stainless steel based.	L1: Knowledge L2: Understanding	PO1, PO2, PO3, PO8, PO12, PSO1, PSO2, PSO3.

II. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (PO)		Level	Proficiency assessed by
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Assignments, Practicals, Midterm and University examination
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments, Practicals, Midterm and University examination
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Assignments, Practicals, Midterm and University examination
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	-	--
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	-	--
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	-	--
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	--
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	2	Practicals, Projects
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	--
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	-	---
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	---
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	2	Practicals, Midterm and University examination, Projects, Technical activities.

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

- : None

III. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSO)	Level	Proficiency assessed by
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Program Specific Outcomes (PSO)		Level	Proficiency assessed by
PSO1	The student will be able to apply the knowledge of Mathematics, Sciences and engineering fundamentals to formulate, analyze and provide solutions for the problems related to Mechanical engineering and communicate them effectively to the concerned.	2	Lectures, Assignments
PSO2	Design mechanical systems in various fields such as machine elements, thermal, manufacturing, industrial and inter-disciplinary fields by using various engineering/technological tools to meet the mercurial needs of the industry and society at large.	2	Assignments / Mini Projects / Open ended experiments
PSO3	The ability to grasp the latest development, methodologies of mechanical engineering and posses competent knowledge of design process, practical proficiencies, skills and knowledge of program and developing ideas towards research.	1	Open ended experiments / Projects

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

- : None

IV. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	--	--	--	--	2	--	--	1	2	2	1	1
CO2	2	3	2	--	--	--	--	2	--	--	--	2	2	1	1
CO3	3	3	3	--	--	--	--	2	--	--	--	2	2	1	1
AVG	2.67	3	2.33	-	-	-	-	2.00	-	-	1	2.00	2	2	1

V. SYLLABUS (JNTUH)

UNIT - I

Structural Steels: Introduction, Classification: HSLA steels, Dual phase steels, TRIP steels, Maraging steels, HSS steels.

UNIT - II

Superalloys: Introduction, Classification, Applications and properties of Ni, Fe, Co based superalloys and their thermo-mechanical treatments.

UNIT - III

Electrical and Electronic Materials: Introduction, Classification, Applications and properties of Pyro, Piezo, Ferro-electrics, Extrinsic and Intrinsic semiconductors; super conducting materials.

UNIT - IV

Stainless steels: Ferritic, Martensitic, Austenitic stainless steels.

UNIT - V

Bio materials: Introduction, Property requirements for biomaterials, concept of biocompatibility, important bio metallic alloys.

SUGGESTED BOOKS:

TEXT BOOK:

1. Superalloys-II edited by C.T. SIMS, N.S. Stoloff and W.C. Hagel A Wiley-Inter science publication John Wiley and sons, New York, 1972.

REFERENCE BOOKS:

1. An Introduction to Materials Science and Engineering, W. D. Callister, John Wiley & Sons (2007).
2. Materials Science and Engineering, V. Raghavan, PHI, 2004.

Syllabus Blow up:

Unit-1

Lecture No.	Topics to be covered	Content to be covered under each topic	Course Learning Outcomes(CLO's)	References
1	Structural Steels	Introduction Structural Steels	CLO1	T1
2	Classification: HSLA steels	Classification, Concept HSLA	CLO1	T1
3	Dual phase steels	Concept dual phase steels	CLO1	T1
4	TRIP steels,	Concept of TRIP steel	CLO1	T1
5	Maraging steels,	Concept of Maraging Steel	CLO1	T1
6	HSS steels.	Concept of HSS Steel	CLO1	T1

Unit-2

Lecture No.	Topics to be covered	Content to be covered under each topic	Course Learning Outcomes(CLO's)	References
1	Superalloys: Introduction	Introduction of superalloys Concept of alloys, Methodizes of superalloys	CLO1	T1
2	Classification, Applications and properties of Ni	Classification of Ni Application of Ni Properties of Ni Concept of Ni	CLO1	T1
3	Classification, Applications and properties of Fe	Classification of Fe Application of Fe Properties of Fe Concept of Fe	CLO1	T1

4	Classification, Applications and properties of Co	Classification of Co Application of Co Properties of Co Concept of Co	CLO1	T1
5	Superalloys	Concepts of Superalloys	CLO1	T1
6	their thermo-mechanical treatments.	Types of Mechanical treatment Concept of thermo-mechanical treatments.	CLO2	T1

Unit-3

Lecture No.	Topics to be covered	Content to be covered under each topic	Course Learning Outcomes(CLO's)	References
1	Electrical and Electronic Materials	Introduction of Electrical and Electronic Materials. Classifications of E & EM Concept of E & EM	CLO1	T1
2	Classification, Applications and properties of Pyro	Classification of Pyro. Concept of Pyro Application of Pyro. Properties of Pyro.	CLO2	T1
3	Classification, Applications and properties of Piezo	Classification of Piezo. Concept of Piezo Application of Piezo. Properties of Piezo.	CLO2	T1
4	Classification, Applications and properties of Ferro-electrics	Classification of Ferro-electrics. Concept of Ferro-electrics Application of Ferro-electrics. Properties of Ferro-electrics.	CLO2	T1
5	Extrinsic and Intrinsic semiconductors	Concept of Extrinsic and Intrinsic semiconductors	CLO3	T1
6	Super conducting materials.	Introduction of Super conducting materials. Concept of super conducting materials	CLO3	T1

Unit-4

Lecture No.	Topics to be covered	Content to be covered under each topic	Course Learning Outcomes(CLO's)	References
1	Stainless steels	Introduction of Stainless steels. Concept of Stainless steels Application of Stainless steels. Properties of Stainless steels.	CLO3	T1
2	Ferritic,	Introduction of Ferritic Concept of Ferritic Application of Ferritic	CLO3	T1

		Properties of Ferritic		
3	Martensitic	Introduction of Martensitic Concept of Martensitic Application of Martensitic Properties of Martensitic	CLO3	T1
4	Austenitic stainless steels	Concept of Austenitic stainless steels	CLO3	T1

Unit-5

Lecture No.	Topics to be covered	Content to be covered under each topic	Course Learning Outcomes (CLO's)	References
1	Bio materials	Introduction of Bio Materials, Concepts of Bio materials	CLO3	T1
2	Property requirements for biomaterials	Property of biomaterials Requirements for biomaterials	CLO3	T1
3	concept of biocompatibility	Concept of biocompatibility	CLO3	T1
4	Important bio metallic alloys.	important bio metallic alloys. Advantages of Bio metallic Comparison of alloys	CLO3	T1

GATE SYLLABUS: NA

IES SYLLABUS: NA

VI. COURSE PLAN:

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
1	I	Introduction	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing	CO1	Knowledge	ICT	T1 & R2
2	I	Introduction	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
3	I	Introduction	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
4	I	Structural Steels	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
5	I	Classification: HSLA steels	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
6	I	Dual phase steels	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
7	I	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	T1 & R2
8	I	TRIP steels,	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
9	I	Maraging steels,	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
10	I	HSS steels.	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
11	I	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing				

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
12	I	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
13	I							
14	II	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing	CO1, CO2		ICT	T1 & R2
15	II	Superalloys: Introduction	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
16	II	Classification, Applications of Ni	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
17	II	properties of Ni	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
18	II	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
19	II	Classification, Applications of Fe	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
20	II	properties of Fe	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
21	II	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
22	II	Classification, Applications of Co	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
23	II	properties of Co	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
24	II	Superalloys	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
25	II	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
26	II	their thermo/mechanical treatments.	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
27	II	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
28	II	Electrical and Electronic Materials	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
29	II	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
30	III	Classification, Applications of Pyro	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing	CO2	Understand	ICT	T1 & R2
31	III	properties of Pyro	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
32	III	Classification, Applications of Piezo	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
33	III	properties of Piezo	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
34	III	Classification, Applications of Ferro/electrics	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
35	III	properties of Ferro/electrics	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
36	III	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
37	III	Extrinsic and Intrinsic semiconductors	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEq_hQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
38	III	super conducting materials.	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing	CO3	Explain	ICT	T1 & R2
39	III	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
40	III	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
41	III	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
42	IV	Stainless steels	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
43	IV	Ferritic,	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
44	IV	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
45	IV	Martensitic	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
46	IV	Austenitic stainless steels	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
47	IV	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
48	IV	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	
49	IV	Revision	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
50	IV							
51	IV	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing				
52	V	Bio materials	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
53	V	Property of biomaterials	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Knowledge	ICT	T1 & R2
54	V	requirements for biomaterials	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
55	V	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing				

Lecture No.	Unit No.	Topics to be covered	Link for PPT	Link for PDF	Course learning outcomes	Bloom's Taxonomy	Teaching Methodology	Reference
56	V	concept of biocompatibility	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Understand	ICT	T1 & R2
57	V	important bio metallic alloys.	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing		Explain	ICT	T1 & R2
58	V	Student PPT	https://drive.google.com/drive/folders/161IdTTyZmoe34w1FjEEqhQyESbEz7hEU?usp=sharing	https://drive.google.com/drive/folders/1JYIQtsVv-SI-MR6AiVICoqhFgcRBjQTL?usp=sharing			ICT	

VII. QUESTION BANK: (JNTUH) DESCRIPTIVE QUESTIONS:

UNIT-I

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain Structural Steel	L1	C01
2	Explain about HSLA Steels	L1	C01
3	Explain Dual Phase steel	L1	C01
4	Explain HSS Steels	L1	C01
5	Write TRIP steels	L1	C01

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Write the HSLA Steels Categories and explain each	L1,	C01
2	Write the strengthening mechanisms in HSLA	L1	C01
3	Write the processing methods of Trip Steels	L1	C01
4	Write the application of Maraging steels	L1	C01
5	Write the Properties, application of HSS	L1,	C01

UNIT-II

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain Superalloys	L1	C01



2	Write the Classification of Superalloys	L1	C01
3	Write the application of superalloys	L1	C01
4	Write the Properties of superalloys	L1	C01
5	Write the methods of thermo-mechanical treatments	L1	C01

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Write the strengthening mechanisms in superalloys	L1,	C01
2	Write the classification of superalloys and explain all	L1	C01
3	Briefly of explain of microstructure of superalloys	L1	C01
4	Write the chemical composition of superalloys	L1	C01
5	Write the application of superalloys	L1,	C01

UNIT-III

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Explain Electrical Materials	L1	C02
2	Explain Electronic Materials	L1	C02
3	Write the application of Electrical Materials	L1	C02
4	Write the Properties of Electronics materials	L1	C02
5	Explain the semiconductors	L1	C02

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Write components of Electronics materials	L1,	C02
2	Write the superconductor and their applications	L1	C02
3	Briefly of explain of Semiconductors	L2	C02
4	Write the copper and its properties	L1	C02
5	Write the Electrical conductivity	L1,	C02

UNIT-IV

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	What is Stainless steels	L1	C03
2	What is Ferritic steels	L1	C03
3	What is Martensitic steels	L1	C03
4	What is Austenitic stainless steels	L1	C03
5	Write the Importance of stainless steels	L1	C03

Long Answer Questions-

S.No	Question	Blooms	Course
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o		s	outcomes
1	Write manufacturing process of stainless steels	L1,	C03
2	Write the characteristics of stainless steels	L1	C03
3	Write the application of stainless steels	L2	C03
4	Write the Physical properties of stainless steels	L1	C03
5	Write the mechanical properties of stainless steels	L1,	C03

UNIT-V

Short Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Define Biomaterials	L1	C03
2	What the use of Biomaterials	L1	C03
3	What the characteristics of biomaterials	L2	C03
4	What is the main future of biomaterials	L2	C03
5	Write the application of biomaterials	L1	C03

Long Answer Questions-

S.No	Question	Blooms	Course outcomes
1	Write the selection parameters of bio materials	L2,	C03
2	Write the characteristics of stainless steels	L1	C03
3	Write the advances in biomaterials technology	L2	C03
4	What are some of the challenges of biomaterials	L1	C03
5	Write the application of Bio materials	L2,	C03

OBJECTIVE QUESTIONS:

JNTUH:

UNIT-I

1. What kind of steel requires definite amounts of other alloying elements. _____
2. Which of these is not a function of alloy steels _____
3. Steels containing up to 3% to 4% of one or more alloying elements are known as _____
4. Which of these is not an application of HSLA steels _____
5. Steels containing more than 5% of one or more alloying elements are known as _____
6. The most popular and standard type for all purpose tool steels 18:4:1 High Speed steel (HSS) which contains _____
7. The tool made of cemented carbide wears out faster at
 - a) Medium steel,
 - b) slow speed
 - c) fast speed
 - d) very fast speed
 Answer: b
8. Maximum percentage of carbon in austenite is
 - A) 0.025%
 - B) 0.26%
 - C) 0.8%
 - D) 1.7%

Answer: D

9. The composition of silver solder is
A) Silver, copper, zinc, B) Silver, tin, nickel. C) Silver, lead, zinc, D) Silver, copper, aluminium

Answer: A

10. The following element can't impart high strength at elevated temperature
A) Manganese B) Magnesium C) Nickel D) Silicon

Answer: B

UNIT-II

1. How much silica do silica refractories usually contain _____
2. What is the hardness of tungsten at room temperature _____
3. Which of the following is not a characteristic of tungsten _____
4. Which phase represents the matrix of the alloy _____ -
5. TCP phase of nickel-based superalloys are formed at a temperature of _____
6. Which of the following applications does a tungsten-carbide coating provide
a) Abrasion resistance, b) Corrosion resistance
c) Loss of coating mass, d) Heat resistance

Answer: C

7. What kind of steel requires definite amounts of other alloying elements
a) Carbon steel b) Alloying steel c) Stainless steel d) Tool steel

Answer: b

8. Which of these is not a function of alloy steels
a) Increases strength, b) Improves ductility c) Reduces cost d) Improves machinability

Answer: C

UNIT-III

1. In conductors conduction of electricity takes place due to movement of _____
2. Total number of crystal systems is _____
3. Which of the following is an advantage of stranded conductor over equivalent single conductor

4. A good electric contact material should have all of the following properties except _____
5. A highly conductive material must have _____
6. On which of the following factors does the resistivity of a material depend?
A) Resistance of the conductor B) Area of the conductor section
C) Length of the conductor D) All of the above

Answer: D

7. Most of the common metals have _____ structure.
A) Linear B) Hexagonal C) Orthorhombic D) Cubic

Answer: D

8. Selenium is _____ semiconductor.
A) Extrinsic B) Intrinsic C) N-type D) P-type

Answer: B

UNIT-IV

1. Which is the primary element used for making stainless steel alloy _____ -
2. Addition of _____ gives stainless steels an austenitic structure.
3. Stainless steels with little carbon and no nickel are called _____
4. Which of the following are applications of Ferritic stainless steels _____



5. What do TRIP steels stand for _____
6. The low-carbon, high-alloyed steels which possess high strength and toughness are known as _____
a) Carbon steels b) Alloy steels, c) Maraging steels d) Stainless steels

Answer: c

7. What property does the AISI-SAE tool steel grade 'L' possess
a) Cold-working b) Hot-working c) Plastic mild d) Special Purpose

Answer: d

8. Which of the following is not a type of oil-hardening steel?

a) O1 b) O2 c) O6 d) O9

Answer: c

UNIT-V

1. Which of the following is a characterization technique used to measure Young's modulus of a biomaterial _____
2. Constant stress test helps in measurement of _____ for a biomaterial.
3. Which of the following gel/hydrogel is formed by a physical gelation mechanism _____
4. _____ is prepared by condensation which is a chemical gelation mechanism.
5. Type I collagen is the dominant component in the native _____ scaffold.
6. _____ is one of the most common methods of modifying hyaluronic acid.
a) Esterification b) Enzymatic modification c) Hydrolysis d) Trans-esterification

Answer: a

7. Alginate is obtained from _____
a) brown algae b) amoeba c) goldfish d) phytoplankton

Answer: a

8. Alginate is suitable for _____
a) drug delivery b) wound Healing c) storage d) consumption

Answer: a

VIII. NPTEL WEB VIDEOS:

1. <https://nptel.ac.in/courses/112/108/112108150/>
2. <https://nptel.ac.in/courses/113/102/113102080/>

IX. WEBSITES:

<https://mse.stanford.edu/>
www.iitk.ac.in/msp/
www.mse.seas.upenn.edu/about-mse/mse-defined.php
<http://www.msm.cam.ac.uk/>
<http://www.mse.berkeley.edu/>
<http://www.mse.utoronto.ca/Page4.aspx>

X. EXPERT DETAILS:

1. Dr. Pinaki Prasad Bhattcharjee, Department of Material Science and Metallurgical Engineering, IIT, Hyderabad
2. Dr. Prasada Rao, Department of Metallurgical Engineering, IIT, Madras
3. Dr. Mudrika Khandewal, Department of Material Science and Metallurgical Engineering, IIT, Hyderabad
4. Dr. K. Venkateswara rao, Department of Nano Science and Nanotechnology, JNTU, Hyderabad

XI. JOURNALS:

1. International Journal of Minerals, Metallurgy, and Materials
2. Journal of Institution of Engineers (India)-Metallurgical & Materials Science Engineering.
3. Materials Science and Engineering
4. Indian Journal of Materials Science
5. Indian Journal of Engineering & Material Sciences (CSIR)
6. International Journal of Metallurgical & Materials Science and Engineering(IJMMSE)

XII. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Bonding in stretchers of Steels
2. Stainless steels
3. Electrical Materials
4. Biomaterials

XIII. CASE STUDIES / SMALL PROJECTS

1. Study of different stretchers of Steels
2. Study of Biomaterials
3. Preparation of HSS Steels and Thermo-electrical treatment