PVP 23

Code: 23ME3302

II B.Tech - I Semester – Regular / Supplementary Examinations
NOVEMBER 2025

MATERIAL SCIENCE AND METALLURGY
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Define space lattice in a crystal structure of engineering materials.	L1	CO1
1.b)	What is Gibbs phase rule ? and Write its importance.	L2	CO1
1.c)	Write the function of P,S and C in cast irons.	L3	CO2
1.d)	State the difference between wrought and cast aluminium alloy.	L3	CO2
1.e)	Define Martensite and Bainite phases in steels.	L1	CO3
1.f)	What is Austempering process?	L2	CO3
1.g)	Explain the terms compaction and sintering.	L2	CO4
1.h)	Why particle size distribution is important in the packing of powders?	L3	CO4
1.i)	Differentiate between ceramic and non-ceramic materials.	L2	CO5

1.j)	List the applications of gold nanoparticles in engineering fields.	L2	CO5

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	What is meant by packing factor. Derive the packing factor of BCC structure.	L3	CO1	5 M
	b)	Explain the Eutectoid and Eutectic binary systems with help of phase diagrams.	L3	CO1	5 M
OR					
3	a)	Write a short note on point defects, line defects and surface defects with suitable diagrams.	L2	CO1	6 M
	b)	What are the condition's to form a solid solution based on Hume Rothery's rules.	L2	CO1	4 M
UNIT-II					
4	a)	Write the classification of tool steels. And explain in detail about Hot working and cold working tool steels as per AISI in view of industrial applications.	L3	CO2	5 M
	b)	What are the different types of brass and bronze alloys? Also mention its properties and application with help of microstructures.	L3	CO2	5 M
OR					

5	a)	With help of microstructures explain the chemical composition, properties and applications of cast iron.	L3	CO2	5 M
	b)	Draw the microstructures of aluminium alloys and label the different phases.	L3	CO2	5 M
		UNIT-III			
6	a)	How alloying elements shows effect on Iron-Carbon diagram explain with cooling curves.	L3	CO3	4 M
	b)	In what way TTT diagram is differ from Fe-Fe_3C phase diagram, and draw the TTT for 0.8% steel.	L4	CO3	6 M
		OR			
7	a)	Why tempering process is significant in heat treatment of steels? And mention the classification of tempering with respect to temperature range.	L3	CO3	4 M
	b)	Write a short note on surface hardening techniques with suitable diagrams.	L3	CO3	6 M
		UNIT-IV			
8	a)	How are self-lubricating bearings produced?	L3	CO4	4 M
	b)	Explain the following processes (i) Infiltration (ii) Impregnation	L3	CO4	6 M

OR					
9	a)	Describe the production of the Cemented carbide using powder metallurgy in detail with neat flow chat process.	L3	CO4	6 M
	b)	Draw and explain Mechanical pulverization and Atomization.	L3	CO4	4 M
UNIT-V					
10	a)	Explain the different stages involved in manufacturing of ceramics using uniaxial pressing and slip Casting process with neat diagrams.	L3	CO5	6 M
	b)	With help of flow chart discuss sol-gel process to produce SiO_2 nanoparticles.	L3	CO5	4 M
OR					
11	a)	What is meant by composite materials and explain any one manufacturing method with neat sketch.	L2	CO5	6 M
	b)	Define nanomaterials and list out the applications.	L3	CO5	4 M