Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech IV Semester End Examinations, May– 2020

Regulations: IARE-R18

MATERIALS AND MECHANICS OF SOLIDS

(MECHANICAL ENGINEERING**)**

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Module
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1.	a)	What is a metallic bond? How the type of bonding does influence the properties of crystals? Distinguish between a family of planes and family of directions.	**[7M]**
	b)	What is Atomic packing factor (APF)? Find APF of a Body Centered Cube and a Face Centered Cube?	**[7M]**
2.	a)	Explain the effects of crystal structure and atomic radii on formation of solid solution between two metallic elements.	**[7M]**
	b)	What are intermediate phases? Explain most common types of intermediate phases with examples.	**[7M]**

MODULE – II

3.	a)	What is cooling curve? With the help of appropriate diagram explain the cooling curve for (i) Pure metal (ii) Binary solid solution (iii) Binary eutectic system.	**[7M]**
	b)	Elements A and B melt at 600˚C and 900˚C respectively. They form an eutectic at 40 % B and at temperature 400˚C. Draw a typical phase diagram between A and B. Find (i) Amount of free A and eutectic in 20 % B alloy (ii)Amount of free B and eutectic in 60 % B alloy	**[7M]**
4.	a)	Draw and explain the various areas of an isomorphous system (phase diagram) in which two metals are completely soluble in solid as well as liquid.	**[7M]**
	b)	How is the cored structure formed and how can it be eliminated?	**[7M]**

MODULE – III

5.	a)	A concrete column is reinforced with steel bars comprising 6 percent of the gross area of column section. What is the fraction of the compressive load sustained by steel bars, if the ratio of Young's modulii of steel and concrete is 12.5?	**[7M]**
	b)	A prismatic member of length l and unit weight w is suspended freely from its end. Determine the elongation of the member under gravity.	**[7M]**
6.	a)	A circular alloy bar 2 m long uniformly tapers from 30 mm diameter to 20 mm diameter. Calculate the elongation of the rod under an axial force of 50 KN. Take E for the alloy as 140 GPa.	**[7M]**
	b)	A mild steel rod 1 m long and 20 mm diameter is subjected to an axial pull of 62.5 KN. What is the elongation of the rod, when the load is applied (i) gradually,	**[7M]**

and (ii) suddenly? Take E = 200 GPa.

MODULE – IV

7. a) A cantilever beam 4 m long carries a gradually varying load, zero at the free end to 3 KN/m at the fixed end. Draw bending moment and shear force diagrams for the Beam. [**7M]**

   b) A Beam of length 6.0m is simply supported at the ends and carries a u.d.l of intensity 1.5KN/m run and three concentrated loads of 1KN, 2KN and 3KN acting at a distance of 1.5m, 3.0m and 4.5m respectively from left end. Draw the S.F.D and B.M.D and also determine the maximum bending moment. **[7M]**

8. a) A cantilever beam AB, 1.8 m long carries a point load of 2.5 KN at its free end and a uniformly distributed load of 1KN/m from A to B. Draw shear force and bending moment diagrams for the beam. **[7M]**

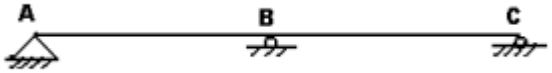
   b) A simply supported beam of 3 m span carries two loads of 5 KN each at 1 m and 2 m from the left hand support. Draw shear force and bending moment diagrams for the beam. **[7M]**

MODULE – V

9. a) Compute the rotation at middle support of a two equal span continuous beam fixed at the ends and carrying UDL of 10 kN/m over the entire beam span 5 m. Take EI = 60000 kNm^2. **[7M]**

   b) Explain the use of slope deflection method. **[7M]**

10. a) The beam shown in figure is to be analyzed by slope deflection method. What are the unknowns and to determine them, what are the conditions used? **[7M]**



   b) A rigid frame is having totally 10 joints including support joints. Out of slope deflection and moment distribution methods, which method would you prefer for analysis? Why? **[7M]**

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COURSE OBJECTIVES:

I	Understand the basic structure and crystal arrangement of materials.
II	Knowledge of phase diagrams and equilibrium diagrams.
III	Understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
IV	Calculate the slope and deflection of different types of beams.

COURSE OUTCOMES:

S. No.	Description	Blooms Taxonomy Level
AMEB11.01	Understand the concepts crystallography, crystal structures, unit cells, crystallographic planes, directions and miller indices.	Remember
AMEB11.02	Discuss the crystal imperfections and Frank Reed source of dislocation.	Understand
AMEB11.03	Demonstrate the concept of Bauschinger"s effect, twinning, strain hardening and seasons cracking.	Remember
AMEB11.04	Knowledge of yield point phenomenon, cold/hot working, recovery, re-crystallization, grain growth and strengthening of metals.	Understand
AMEB11.05	Discuss the constitution of alloys and phase diagrams, constitution of alloys, solid solutions, substitutional and interstitial.	Remember
AMEB11.06	Demonstrate the phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions.	Understand
AMEB11.07	Construction of iron –Iron carbide equilibrium diagram.	Remember
AMEB11.08	Classification of steel and cast-Iron microstructure, properties and application.	Understand
AMEB11.09	Discuss Hooke's law, stresses and strains	Remember
AMEB11.10	Derive relationship between elastic constants.	Understand
AMEB11.11	Describe the concept of poisson's ratio, linear and lateral strains.	Remember
AMEB11.12	Construct the Mohr's circle to solve principal stresses and strains.	Understand
AMEB11.13	Understand the beams and types transverse loading on beams, shear force and bend moment diagrams.	Remember
AMEB11.14	Discuss types of beam supports, simply supported and over-hanging beams, cantilevers.	Understand
AMEB11.15	Understand theory of bending of beams, bending stress distribution and neutral axis.	Remember
AMEB11.16	Understand the shear stress distribution, point and distributed loads.	Remember
AMEB11.17	Understand moment of inertia about an axis and polar moment of inertia.	Understand

AMEB11.18	Derive the deflection of a beam using double integration Method.	Remember
AMEB11.19	Computation of slopes and deflection in beams.	Understand
AMEB11.20	Discuss Maxwell‟s reciprocal theorems.	Remember

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DEPARTMENT OF MECHANICAL ENGINEERING

MAPPING OF MODEL QUESTION PAPER QUESTIONS TO THE ACHIEVEMENT OF COURSE OUTCOMES

SEE Question No.		Course Outcomes		Blooms Taxonomy
1	a	AMEB11.01	Understand the concepts crystallography, crystal structures, unit cells, crystallographic planes, directions and miller indices.	Remember
	b	AMEB11.01	Discuss the crystal imperfections and Frank Reed source of dislocation.	Understand
2	a	AMEB11.02	Demonstrate the concept of Bauschinger‟s effect, twinning, strain hardening and seasons cracking.	Remember
	b	AMEB11.03	Knowledge of yield point phenomenon, cold/hot working, recovery, re-crystallization, grain growth and strengthening of metals.	Understand
3	a	AMEB11.04	Discuss the constitution of alloys and phase diagrams, constitution of alloys, solid solutions, substitutional and interstitial.	Remember
	b	AMEB11.04	Demonstrate the phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions.	Understand
4	a	AMEB11.04	Construction of iron –Iron carbide equilibrium diagram.	Remember
	b	AMEB11.04	Classification of steel and cast-Iron microstructure, properties and application.	Understand
5	a	AMEB11.05	Discuss Hooke’s law, stresses and strains	Remember
	b	AMEB11.05	Derive relationship between elastic constants.	Understand
6	a	AMEB11.06	Describe the concept of poisson’s ratio, linear and lateral strains.	Remember
	b	AMEB11.06	Construct the Mohr’s circle to solve principal stresses and strains.	Understand
7	a	AMEB11.07	Understand the beams and types transverse loading on beams, shear force and bend moment diagrams.	Remember
	b	AMEB11.07	Discuss types of beam supports, simply supported and over-hanging beams, cantilevers.	Understand
8	a	AMEB11.08	Understand theory of bending of beams, bending stress distribution and neutral axis.	Remember
	b	AMEB11.08	Understand the shear stress distribution, point and distributed loads.	Understand
9	a	AMEB11.09	Understand moment of inertia about an axis and polar moment of inertia.	Remember
	b	AMEB11.10	Derive the deflection of a beam using double integration Method.	Understand
10	a	AMEB11.11	Computation of slopes and deflection in beams.	Remember
	b	AMEB11.12	Discuss Maxwell‟s reciprocal theorems.	Understand

Signature of Course Coordinator

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HOD, M.E