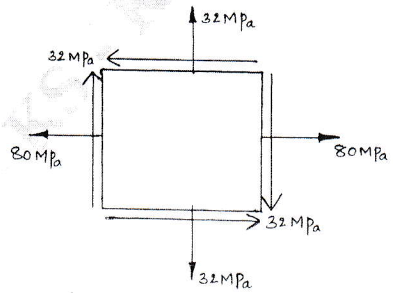
CBCS SCHEME

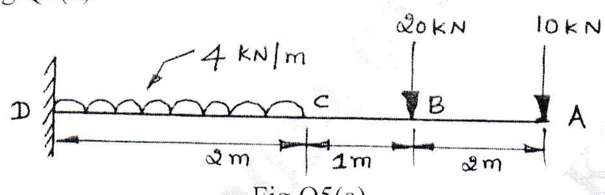
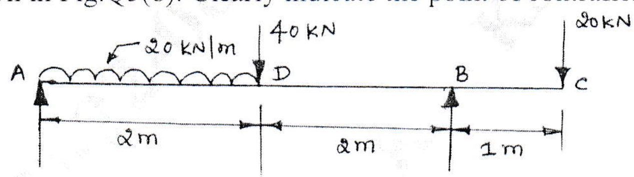
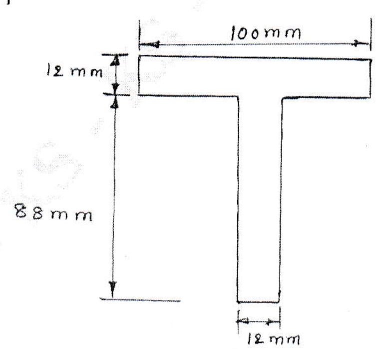
USN | | | | | | | | | | | BME301

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following with necessary equations: (i) Normal stress (ii) Shear stress (iii) Poisson's ratio (iv) Young's modulus (v) Thermal stress	10	L1	CO1
	b.	The tensile test was conducted on a mild steel bar. The following was obtained from the test: Diameter of steel bar = 16 mm ; Gauge length of the bar = 80 mm ; Load at proportionality limit = 72 kN ; Extension at a load of 60 kN = 0.115 mm ; Load at failure = 80 kN ; Final gauge length of bar = 104 mm ; Diameter of the bar at failure = 12 mm Determine: (i) Young's modulus (ii) Proportionality limit (iii) True breaking stress (iv) Percentage elongation (v) Percentage decrease in area	10	L3	CO1
		OR			
Q.2	a.	Write the relation between the following with usual notations and meaning: (i) Modulus of elasticity and bulk modulus (ii) Modulus of elasticity and modulus of rigidity (iii) Modulus of elasticity, modulus of rigidity and bulk modulus	06	L1	CO1
	b.	Define the following: (i) Gradual load (ii) Sudden load (iii) Impact load (iv) Shock load	04	L1	CO1
	c.	Rails laid such that there is no stress in them at 24°C. If the rails are 32 m long, determine: (i) The stress in the rails at 80°C, when there is no allowance for expansion. (ii) The stress in the rails at 80°C, when there is an expansion allowance of 8 mm per rail (iii) The expansion allowance for no stress in the rails at 80°C. Take $\alpha = 11 \times 10^{-6}/°C$, E = 205 GPa.	10	L3	CO1
		Module – 2			
Q.3	a.	Derive the expression for normal stress and shear stress on a plane inclined at 'θ' angle to the vertical axis in a biaxial stress system with shear stress.	10	L2	CO2
	b.	For the two-dimensional stressed element, shown in Fig.Q3(b), determine the value of: (i) Maximum and minimum principal stress (ii) Principal planes (iii) Maximum shear stress and its plane Verify the answer's by Mohr's circle method  Fig.Q3(b)	10	L3	CO2

		OR			
Q.4	a.	Derive an expression for circumferential stress and longitudinal stress for a thin cylinder subjected to an internal pressure 'P'.	**10**	**L2**	**CO2**
	b.	A thick cylinder of internal diameter 160 mm is subjected to an internal fluid pressure of 40 N/mm^2. If the allowable stress in the material is 120 N/mm^2, find the required wall thickness of the cylinder.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	a.	Draw the shear force and bending moment diagrams for the cantilever shown in Fig.Q5(a).  Fig.Q5(a)	**10**	**L4**	**CO3**
	b.	Draw the bending moment and shear force diagram for the overhanging beam shown in Fig.Q5(b). Clearly indicate the point of contraflexure.  Fig.Q5(b)	**10**	**L4**	**CO3**
		OR			
Q.6		A simply supported beam of 7m span with overhangs rests on supports which are 4m apart. The left end overhang is 2 m. The beam carries loads of 30 kN and 20 kN on the left and the right ends respectively apart from a uniformly distributed load of 25 kN/m between the supporting points. Draw the shear force and bending moment diagrams. Locate point of contraflexure if any.	**20**	**L4**	**CO3**
		Module – 4			
Q.7	a.	Derive the bending equation in the form of $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$.	**10**	**L2**	**CO4**
	b.	A square beam 20 mm × 20 mm in section and 2 m long is supported at the ends. The beam fails when a point load of 400 N is applied at the centre of the beam. What uniformly distributed load per metre length will break a cantilever of the same material 40 mm wide, 60 mm deep and 3 m long?	**10**	**L3**	**CO4**
		OR			
Q.8	a.	Derive an expression for section modulus of solid rectangular and circular sections.	**10**	**L2**	**CO4**
	b.	Fig.Q8(b) shows the cross-section of a beam which is subjected to a shear force of 20 kN. Draw the shear stress distribution across the depth making values at salient points.  Fig.Q8(b)	**10**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Define the following with necessary equations: (i) Torque (ii) Polar modulus (iii) Torsional rigidity	06	L1	CO5
	b.	State the assumptions made in theory of torsion.	04	L1	CO5
	c.	Derive torsion equation in the form of $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$.	10	L2	CO5
		OR			
Q.10	**a.**	Define the following: (i) Column (ii) Buckling load (iii) Slenderness ratio (iv) Long column (v) Short column	10	L1	CO5
	b.	Derive an expression for Euler buckling load when both ends of the column are fixed.	10	L2	CO5

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CBCS SCHEME

USN | | | | | | | | | | | **BME302**

Third Semester B.E./B.Tech. Degree Examination, June/July 2024

Manufacturing Process

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Casting. List the steps involved in making a sand casting.	4	L1	CO1
	b.	Briefly discuss the importance of binders and additives in sand moulding.	8	L2	CO2
	c.	Enlist and explain in detail various allowances given to the pattern and reasons to provide the allowances.	8	L2	CO2
		OR			
Q.2	a.	Differentiate between gravity and pressure die casting.	4	L1	CO1
	b.	With a neat sketch, explain the working of the Jolt machine.	8	L2	CO2
	c.	With a neat sketch, explain continuous casting process and mention its merits and demerits.	8	L2	CO2
		Module – 2			
Q.3	a.	List and explain in brief the four types of furnaces classification.	6	L2	CO3
	b.	Explain with a neat sketch of working of coreless induction furnace.	6	L2	CO3
	c.	With a neat sketch, explain the different zones present in CUPOLA furnace.	8	L2	CO3
		OR			
Q.4	a.	Give the differences between direct arc electric furnace and indirect arc electric furnace.	8	L1	CO3
	b.	With a neat sketch, explain centrifuge casting. State the advantages and disadvantages of centrifugal casting.	12	L2	CO3
		Module – 3			
Q.5	a.	Give the detailed relationship between stress strain.	6	L1	CO1
	b.	Enumerate the concept of annealing with sketch.	6	L2	CO3
	c.	Differentiate between soldering and brazing with respect to joint strength and give its applications?	8	L2	CO3

		OR			
Q.6	a.	Give the detailed classification of metal forming process.	4	L1	CO1
	b.	With the help of neat sketch explain blanking process.	6	L2	CO3
	c.	With the help of the neat sketch, explain V-bending and edge bending operation.	10	L2	CO3
		Module – 4			
Q.7	a.	Sketch and explain tig welding process. Mention its advantages, disadvantages and applications.	12	L2	CO3
	b.	With the help of neat sketch explain oxyacetylene welding.	8	L2	CO3
		OR			
Q.8	a.	Explain with neat sketch submerged arc welding process and its applications.	10	L2	CO4
	b.	Explain with neat sketch laser welding and mention its advantages and disadvantages.	10	L2	CO4
		Module – 5			
Q.9	a.	Explain the following: i) Residual stress in welding ii) Distortion in welding iii) Shrinkage in welding.	10	L2	CO4
	b.	With a neat sketch, explain the friction stir. Discuss the advantages and disadvantages.	10	L2	CO4
		OR			
Q.10	a.	List and explain welding defects and remedies.	10	L2	CO4
	b.	Explain the concept of weldability and the thermal effects.	10	L2	CO4

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CBCS SCHEME

USN | | | | | | | | | | **BME303**

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Material Science and Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	List the three primary classifications of solid materials. Explain briefly the distinctive chemical features of each.	06	L2	CO1
	b.	Classify and briefly explain primary atomic bonds.	08	L2	CO1
	c.	Define unit cell of a crystal lattice. Name and sketch the various crystal structures (unit cells) commonly present in materials. Show the value of edge length (a).	06	L2	CO1
		OR			
Q.2	a.	Explain the following terms related to crystal structure: (i) Size of unit cell (ii) Coordination number (iii) Atomic packing factors	06	L2	CO1
	b.	Determine the Atomic Packing Factor (APF) for FCC structure (Unit Cell).	08	L2	CO1
	c.	Classify and briefly explain crystal lattice imperfections.	06	L2	CO1
		Module – 2			
Q.3	a.	Explain the term diffusion. State and briefly explain the various types of diffusion mechanisms.	08	L2	CO2
	b.	State and explain Fick's laws of diffusions.	08	L2	CO2
	c.	State and explain any two factors that influence diffusion process.	04	L3	CO2
		OR			
Q.4	a.	Define the following : i) Phase ii) Phase diagram iii) Phase equilibrium iv) Solubility limit.	04	L2	CO2
	b.	Explain 'Lever rule' for the construction of phase diagram.	06	L2	CO2
	c.	Name and explain the three invariant reactions that take place in $Fe\text{-}Fe_3C$ phase diagram.	10	L2	CO2
		Module – 3			
Q.5	a.	Name and explain the various mechanisms by which the nucleation of solid particles in liquid metal occurs.	10	L2	CO3
	b.	Explain with suitable diagrams the process of precipitation hardening.	10	L2	CO3
		OR			
Q.6	a.	Explain briefly the following heat treatment processes : (i) Annealing (ii) Normalizing (iii) Tempering (iv) Nitriding	16	L2	CO3
	b.	What do you understand by critical radius for nucleation?	04	L2	CO2
		Module – 4			
Q.7	a.	Classify the various surface coating techniques used in surface engineering.	04	L1	CO4
	b.	Briefly explain Chemical Vapour Deposition (CVD).	10	L2	CO4
	c.	Write a note on Lubrication and binders.	06	L1	CO4
		OR			
Q.8	a.	Briefly explain the powder-metallurgy process using flow chart.	08	L2	CO4
	b.	State and briefly explain the various methods of atomization processes used for preparing the metallic powder.	12	L2	CO4

		Module – 5			
Q.9	a.	What is the Chemical Composition of grey cast iron? Show the microstructure by stating the various properties and uses of grey cast iron.	06	L2	CO5
	b.	Name the various alloying elements and their influence over steel alloys.	08	L2	CO5
	c.	How are copper alloys classified? Designate and state the properties and uses of copper alloys.	06	L2	CO5
		OR			
Q.10	a.	How composite materials are classified. State their constituents used.	06	L2	CO5
	b.	Name and briefly explain the various types of fibers and matrix materials used for Fiber Reinforces Plastics (FRP).	08	L2	CO5
	c.	Explain the process of obtaining Material data.	06	L2	CO5

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CBCS SCHEME

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BME304

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of the thermodynamic data book is permitted.

		Module – 1	M	L	C
Q.1	**a.**	Define Zeroth law of thermodynamics.	2	L1	CO1
	b.	With neat diagram, explain the working of constant volume gas thermometer for measurement of temperature.	8	L1	CO1
	c.	Two Celsius thermometers A and B agree at Ice Point and Steam point and the related equation is $T_A = L + MT_B + NT_B^2$, wehre L, M and N are constants. When both thermometers are immersed in fluid A reads $26^\circ C$ while B reads $25^\circ C$. Determine the reading of A when B reads $37.4^\circ C$.	10	L3	CO1
		OR			
Q.2	**a.**	Distinguish between heat and work in Thermodynamics.	4	L1	CO1
	b.	Derive an expression for the non-flow displacement work done during adiabatic process given by $PV^\gamma = C$. To a closed system 150 kJ of work is done on it.	6	L2	CO1
	c.	If the initial volume is 0.6 m^3 and pressure of system varies as follows $P = (8 - 4V)$ where P is pressure in bar and V is volume in m^3. Determine the final volume and pressure of the system.	10	L3	CO1
		Module – 2			
Q.3	**a.**	Show that energy is a property of the system. Define the specific heats at constant volume and constant pressure.	10	L2	CO2
	b.	A piston and cylinder machine contains a fluid system, which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfer is -170 kJ. The system completes 100 cycles per min. Complete the following table showing the method for each item, and compute the net rate of work output in KW.	10	L3	CO2

Process	Q (KJ/min)	W(KJ/min)	ΔE(KJ/min)
a – b	0	2,170	-
b – c	21,000	0	-
c – d	-2,100	-	-36,600
d – a	-	-	-

		OR	M	L	C
Q.4	**a.**	Apply steady flow energy equation to each of the following : (i) Boiler (ii) Nozzle (iii) Centrifugal pump	6	L3	CO2

	b.	Air flows steadily at the rate of 0.5 kg/s through an air compressor, entering at 7 m/s velocity, 100 kPa pressure and 0.95 m^3/kg volume and leaving at 5 m/s, 700 KPa and 0.19 m^3/kg. The internal energy of the air leaving 93 kJ/kg greater than that of the air entering cooling water in the compressor jackets absorbs heat from the air at the rate of 58 kW. Compute the rate of shaft work input to the air in kW.	7	L3	CO2
	c.	Steam at rate of 0.42 kg/s and enthalpy of 2785 KJ/kg and a velocity of 33.3 m/s is supplied to a steadily operating turbine. The steam leaves the turbine at 100 m/s and an enthalpy of 2512 kJ/kg. The Inlet pipe is 3 m above the exit pipe. Rate of heat loss from the turbine casing is 0.29 kJ/s. What is the power output of the turbine?	7	L3	CO2
		Module – 3			
Q.5	a.	State the Kelvin-Planck and Clausius statements of II law of thermodynamics. Show that Kelvin-Planck statement is equivalent to Clausius statement.	10	L1	CO3
	b.	Prove that $COP_{Heat\ pump} = 1 + COP_{Refrigerator}$.	4	L2	CO3
	c.	What is thermal energy reservoir? Explain source and sink.	6	L1	CO3
		OR			
Q.6	a.	Show that entropy is a property of a system.	6	L1	CO3
	b.	State and prove Clausius inequality.	7	L1	CO3
	c.	A heat engine is supplied with 2512 KJ/min of heat at 650°C and the heat rejections takes place at 100°C. The following results were reported : (i) 867 kJ/min of heat rejected. (ii) 1015 kJ/min of heat rejected. (iii) 1494 kJ/min of heat rejected. Classify which of the results report a reversible cycle. Irreversible cycle or Impossible cycle.	7	L3	CO3
		Module – 4			
Q.7	a.	Define the following : (i) Available energy (ii) Unavailable energy (iii) Effectiveness (iv) Irreversibility	8	L1	CO4
	b.	Air expands through a turbine from 500 KPa 520°C to 100 KPa, 300°C. During expansion 10 kJ/kg of heat is lost to the surroundings which is at 98 KPa, 20°C. Neglecting the kinetic energy and potential energy changes. Determine per kg of air : (i) The decrease in availability (ii) The maximum work (iii) The Irreversibility. For air take $C_p = 1.005$ kJ/kgK, $h = C_pT$ where C_p is constant and T is in degree Kelvin.	12	L3	CO4
		OR			
Q.8	a.	Define dryness fraction. With a neat sketch, explain the measurement of dryness fraction of steam by using separating and throttling calorimeter.	8	L1	CO4
	b.	Define the following : (i) Pure substance (ii) Triple point (iii) Critical point	6	L1	CO4

	c.	A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250 °C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy and the entropy.	6	L3	CO4
		Module – 5			
Q.9	a.	State and explain Dalton's law of partial pressure and Amagat's law of additive volumes.	8	L1	CO5
	b.	A mixture of 0.5 kg of CO_2 and 0.3 kg of N_2 is compressed from $P_1 = 1$ atm, $T_1 = 20$ °C to $P_2 = 5$ atm in a polytropic process for which n = 1.3. Find, (i) Final temperature (ii) Work (iii) Heat transfer (iv) Change in entropy. Assume C_P for CO_2 is 0.821 kJ/kgK and C_P for N_2 is 1.017 KJ/kgK.	12	L3	CO5
		OR			
Q.10	a.	Explain the following : (i) Compressibility factor (ii) Reduced properties (iii) Law of corresponding states (iv) Generalized compressibility chart.	12	L1	CO5
	b.	One kg of CO_2 has a volume of 1 m^3 at 100 °C. Compute the pressure using, (i) Vander Waal's equation (ii) Ideal gas equation.	8	L3	CO5

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