AJ Institute of Engineering and Technology
Mangaluru.

VTU Question Papers

Mechanical Engineering
Make-Up Exam
III to VIII Semester

2022 SCHEME

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CBCS SCHEME - Make-Up Exam

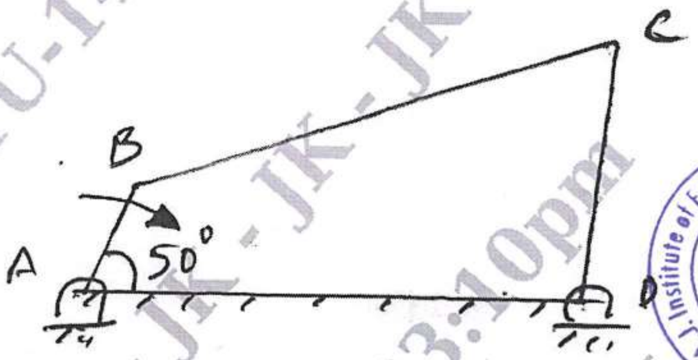
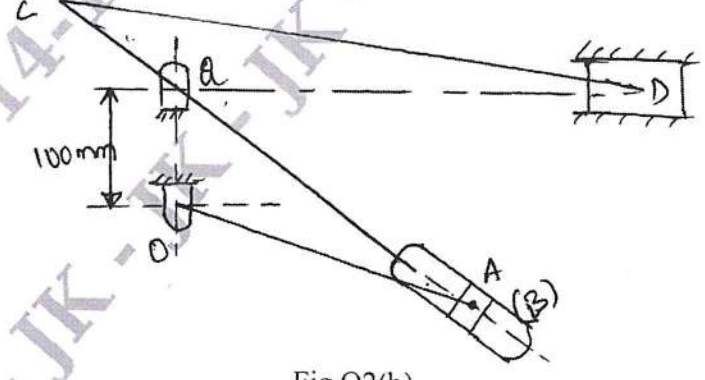
USN | | | | | | | | | |

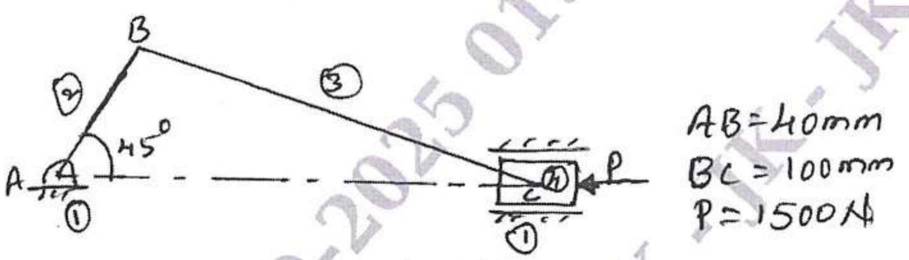
BME/BMR503

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Theory of Machines

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 kinematic link, kinematic pair, structure lower pair and higher pair. Explain double crank mechanism.	10	L2	CO1
	b.	In a four bar mechanism ABCD, 'AD' is fixed and crank 'AB' rotates at 200 rpm in clockwise direction. The dimensions of various links are as follows : BC = AD = 150 mm, CD = 800 mm, AB = 40 mm. find the angular velocity of link 'BC' and CD.  Fig.Q1(b)	10	L3	CO1
		OR			
Q.2	a.	Define kinematic chain, machine mechanism, rigid link and fluid link. Explain crank and slotted mechanism.	10	L2	CO1
	b.	Fig.Q2(b) shows a quick return motion mechanism in which the driving crank 'OA' rotates at 120 rpm in clock wise direction. For the position shown determine the magnitude and direction. i) The acceleration block 'D' ii) The angular acceleration of the slotted bar 'QB' CD = 500 mm, QC = 150 mm and OA = 200 mm.  Fig.Q2(b)	10	L3	CO1

			Marks	L	CO
		Module – 2			
Q.3	a.	Explain 2 force, 3 force and 4 force equilibrium condition.	6	L2	CO2
	b.	Determine the required input torque on the crank of single slider mechanism shown in Fig.Q3(b) for the static equilibrium when the applied piston load is 1500 N.  Fig.Q3(b)	14	L3	CO2
		OR			
Q.4	a.	Explain D'Alembert's principle.	6	L2	CO2
	b.	A punching machine punches 38 mm holes in 32 mm thick plate required 7 $N/m/mm^2$ of sheared area and punches one hole in every 10 sec. The mean speed of flywheel is 25 m/sec. The punch has to stroke of 100 mm find : i) Power required to drive the machine ii) Mass of flywheel, if total fluctuation of speed is not to exceed 3%.	14	L3	CO2
		Module – 3			
Q.5	a.	State and explain law of gearing with mathematical expression.	10	L2	CO3
	b.	Two gear wheels mesh externally and are to give a velocity ratio of 3 : 1. The teeth are of involutes form ; module = 6 mm, addendum = 1 module. Pressure angle = 20°C, the pinion rotates at 90 rpm. Find : i) Number of teeth on pinion to avoid interference on it and corresponding number of teeth on wheel ii) The length of path of contact and arc of contact iii) The number of pairs of teeth in contact iv) The maximum velocity of sliding.	10	L3	CO3
		OR			
Q.6	a.	Sketch and explain i) Compound gear train ii) Epicyclic gear train.	10	L2	CO3
	b.	In an epicyclic gear train, the internal gears 'A' and 'B' and compound gears C and D rotates independently about point '0'. All the gears have same module and the number of teeth are $Z_C = 28$, $Z_D = 26$, $Z_E = Z_F = 18$. The gear 'E' and 'F' rotates on pin fixed to the arm 'G' gear E meshes with gear 'A' and 'C' where as gear 'F' meshes with 'B' and 'D'. Sketch the arrangement and find : i) Number of teeth on gears A and B ii) Speed of gear 'B' if arm 'G' makes 200 rpm in clockwise and gear 'A' is fixed iii) Speed of gear 'B' if arm 'G' makes 200 rpm in clockwise and gear 'A' makes 20 rpm in anticlockwise direction.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Five masses M_1, M_2, M_3, M_4 and M_5 revolve in the same plane magnitudes of M_1, M_2 and M_3 are 5, 2.5 and 4 kg respectively. Angular position M_2, M_3, M_4 and M_5 are 60°, 135°, 210° and 270° from M_1. Determine M_4 and M_5.	6	L3	CO4
	b.	Four masses M_1 = 100 kg, M_2 = 175 kg, M_3 = 200 kg and M_4 = 125 kg are fixed to the crank of 200 mm radius and revolve in planes 1, 2, 3, and 4 respectively. The angular position of the planes 2, 3, and 4 with respect to 1 are 75°, 135° and 240° taken in same sense. Distance of planes 2, 3, and 4 from '1' are 600 mm, 1800 mm and 2400 mm. Calculate the magnitude and position of balancing masses at radius 600 mm in planes 'L' and 'M' located in the middle of 1 and 2 and middle of 3 and 4 respectively.	14	L2	CO4
		OR			
Q.8	**a.**	Derive the relation for speed and height of the porter governor.	6	L3	CO4
	b.	A porter governor has all four arms 300 mm long. The upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35 mm from axis. The mass of each ball is 7 kg and the load on the sleeve is 540 M. Calculate the equilibrium speed and range of speed for the two extreme radii of 200 mm and 260 mm of rotation of governor balls.	14	L2	CO4
		Module – 5			
Q.9	**a.**	List and explain the types of free vibration.	10	L2	CO5
	b.	Define logarithmic decrement and derive the relation for logarithmic decrement.	10	L3	CO5
		OR			
Q.10	**a.**	A vibrating system consists of a mass of 50 kg a spring of stiffness of 30 KN/m and a dumper. The damping provided is only 20% of the critical value. Calculate : i) The damping factor ii) Critical damping co-efficient iii) The natural frequency of damped vibration iv) The logarithmic decrement v) The ratio of two consecutive amplitudes.	10	L2	CO5
	b.	Define transmissibility ratio and derive the relation fro transmissibility ratio for a transmitted force.	10	L3	CO5

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

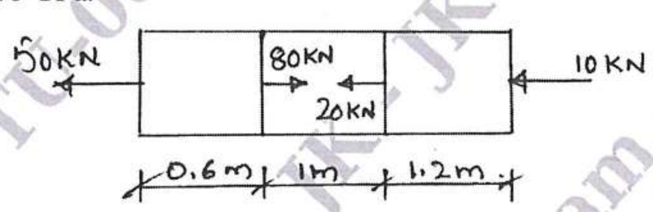
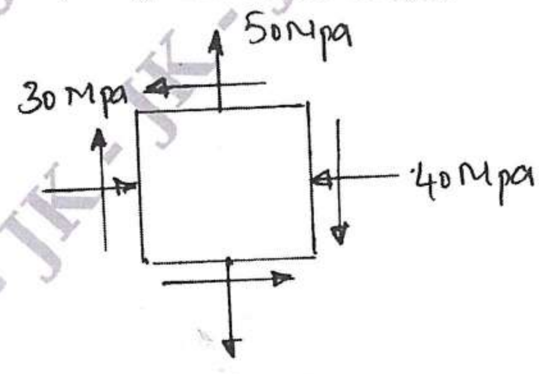
BME301

Thrid Semester B.E./B.Tech. Degree Examination, June/July 2025

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 : i) Stress ii) Strain iii) Possion's ratio iv) Volumetric strain v) Bulk Modulus	5	L1	CO1
	b.	With a neat diagram, explain the salient points in stress- strain curve of mild steel material.	5	L2	CO1
	c.	A brass bar having cross sectional area of 1000 mm^2 is subjected to axial forces as shown in Fig Q1(c). Find the total elongation of the bar. Take E = 100 GPa.  Fig Q1(c)	10	L1/3	CO1
		OR			
Q.2	a.	Establish the relationship between Young's Modulus and Modulus of Rigidity.	10	L2	CO1
	b.	A steel rod of 30 mm diameter is enclosed centrally in a hollow copper tube of external diameter 50 mm and internal diameter 40 mm. The composite bar is subjected to axial pull of 45 kN, if the length of the each bar is equal to 190 mm. Find : i) Stress in rod and hollow tube ii) Load carried by each member iii) Deformation	10	L1/3	CO1
		Module – 2			
Q.3	a.	Define the following : i) Plane stress ii) Principle plane and Principle stress.	5	L1	CO2
	b.	An element is subjected to state of stress as shown in Fig Q3(b). Determine principle stresses and its direction Max. shear stress and its direction. Also verify using Mohr's circle method.  Fig Q3(b)	15	L3	CO2

		OR			
Q.4	**a.**	Derive an expression for stresses in thin cylinder.	**10**	**L2**	**CO2**
	b.	A cylindrical pressure vessel has inner and outer radii of 200 mm and 250 mm respectively. The material of the cylinder has allowable stress of 75 MPa. Determine the maximum internal pressure that can be applied and draw a sketch of radial pressure and circumferential stress distribution.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	List the different types of Beams and Loads.	**5**	**L1**	**CO3**
	b.	Derive the relationship between load intensity, shear force and bending moment.	**5**	**L2**	**CO3**
	c.	Draw the shear force and bending moment diagram for the beam shown in Fig Q5(c).	**10**	**L3**	**CO3**

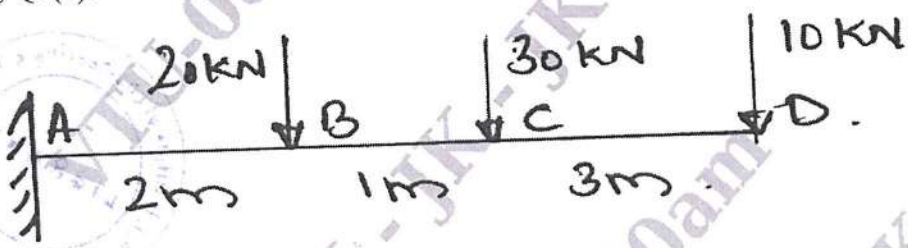


Fig Q5(c)

		OR			
Q.6		For the beam shown in Fig Q6. Draw the shear force and bending moment diagram. Locate the point of contra – flexure if any.	**20**	**L3**	**CO3**

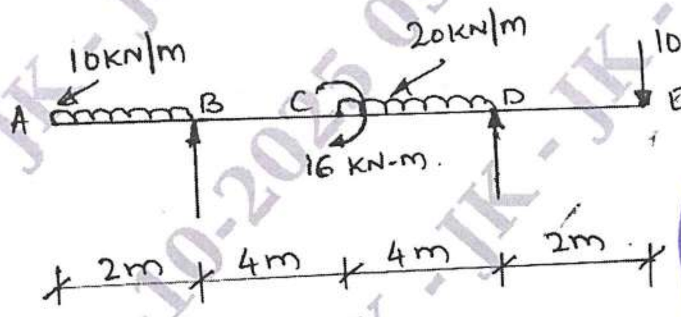


Fig Q6

		Module – 4			
Q.7	**a.**	List the assumptions made in theory of pure bending.	**5**	**L1**	**CO4**
	b.	Establish the relation between Bending stress and Radius of curvature.	**5**	**L2**	**CO4**
	c.	A 2 cm long beam with rectangular section (100 mm × 50 mm) is simply supported at its ends and is subjected to point load 10 kN at its midspan. Draw a sketch showing bending stress distribution along with depth of the section under maximum bending moment.	**10**	**L3**	**CO4**

		OR			
Q.8	**a.**	Show that the maximum shear stress in rectangular section is 1.5 times average shear stress.	**10**	**L2**	**CO4**
	b.	An 'I' section of a beam has equal flanges of each (120 mm × 10 mm) and web of size (200 mm × 10 mm) when the section is subjected to a shear force of 50 kN. Draw a sketch showing shear stress distribution.	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Derive Torsion Equation with usual notation.	**10**	**L2**	**CO5**
	b.	A shaft transmits 180 kW at 240 rpm. The allowable shear stress is 72 MPa. Find the diameter of solid shaft. Also, find the diameter of the hollow shaft if, the inside diameter is 0.6 times the outside diameter. What is the percentage of saving in material if, both shaft are made of same material and same length.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive Euler's Equation for long column having both ends hinged.	**10**	**L2**	**CO5**
	b.	A 2 m long column has a square cross section of side 40 mm. Taking FoS as 4. Find the safe load for the following condition. i) Both ends hinged ii) One end fix other end free iii) Both ends fixed iv) One end fix other end hinged	**10**	**L3**	**CO5**

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CBCS SCHEME - Make-Up Exam

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BME302

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
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. Explain the steps involved in sand casting with flow diagram.	10	L2	CO1
	b.	List the function of pattern in casting explain match plate Pattern and Gatted pattern with neat sketch.	10	L1	CO1
		OR			
Q.2	a.	With neat sketch explain the working principle of sand slinger moulding machine.	10	L2	CO1
	b.	Explain the procedure involved in making shell mould.	10	L1	CO1
		Module – 2			
Q.3	a.	Explain the construction and working principle of direct electric Arc furnace.	10	L2	CO2
	b.	With respect to different zones and their chemical reaction, explain Cupola Furnace with a neat sketch.	10	L2	CO2
		OR			
Q.4	a.	Explain the steps involved in squeeze casting process. Write their advantages and disadvantages.	10	L2	CO1
	b.	Explain the different casting defects, their features and remedies.	10	L2	CO1
		Module – 3			
Q.5	a.	Differentiate between Cold working and Hot working in forming.	10	L2	CO3
	b.	Explain any four types of rolling mills with neat sketches.	10	L1	CO3
		OR			
Q.6	a.	With neat sketch explain wire drawing by slab method.	10	L1	CO3
	b.	List the types of dies used in sheet metal forming process. Explain compound die with neat sketch.	10	L2	CO3
		Module – 4			
Q.7	a.	With neat sketch explain the working principle and Flux shielded metal Arc Welding.	7	L2	CO4
	b.	Explain the different flames obtained in gas welding.	7	L1	CO4
	c.	List the advantages, disadvantages and application of Arc Welding.	6	L2	CO4
		OR			
Q.8	a.	Explain Oxy-Acetylene welding process, write their advantages and disadvantages.	10	L2	CO4
	b.	Explain Gas Tungstes arc welding process. Write their advantages disadvantages and applications.	10	L2	CO4
		Module – 5			
Q.9	a.	Explain : i) Strinkage in Welds ii) Residual stresses in welded structures.	5 5	L2	CO5
	b.	Explain with neat sketch, common defects in welding and their causes.	10	L2	CO5
		OR			
Q.10	a.	Differentiate between Soldering and Brazing.	10	L3	CO5
	b.	Explain : i) Projection Welding ii) Resistance Butt Welding.	5 5	L1	CO5

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CBCS SCHEME - Make-Up Exam

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BME303

Third Semester B.E./B.Tech. Degree Examination, June/July 2025

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.	Define Material Science. Compare crystalline and Non-Crystalline material.	8	L1	CO1
	b.	Define Atomic Packing Factor. Also deduce APF of HCP structure.	7	L1	CO1
	c.	What are the steps involved in measuring hardness using Rockwell test method?	5	L1	CO1
		OR			
Q.2	a.	What is meant by point imperfections? With related diagrams explain point imperfections types.	8	L1	CO2
	b.	Describe plastic deformation by slip and twinning. Draw related diagram.	6	L1	CO1
	c.	How impact strength is determined using Izod test and Charpy test?	6	L1	CO1
		Module – 2			
Q.3	a.	Draw Iron-Carbon equilibrium diagram. Depict all phases and salient point with brief description.	8	L1	CO1
	b.	Define solid solution. Enumerate Hume-Rothary rules related to solid solution.	6	L1	CO1
	c.	Define 1st law of diffusion. Calculate the value of diffusivity in m^2/s for the diffusion of carbon in γ - iron (FCC) at 927°C (1200 K). Use constant $D_0 = 2 \times 10^{-5}$ m^2/s, activation energy $Q = 142 \times 10^3$ J/mol, gas constant R = 8.314 J/mol-K.	6	L3	CO2
		OR			
Q.4	a.	Two metals A and B have 100% mutual solubilities in the liquid as well as solid states. The melting point of pure metal A and B are 800°C and 600°C respectively. Details of start and end of solidification is tabulated below. Draw phase diagram and predict the amount of liquid and solid present at 700°C for the alloy 40% A and 60% B. Also mention the type of phase at this point.	9	L2	CO3

Alloy of composition	Start of solidification	End of solidification
90% A + 10% B	798°C	750°C
70% A + 30 % B	785°C	705°C
50% A + 50% B	757°C	675°C
30% A + 70% B	715°C	645°C
10% A + 90% B	650°C	615°C

	b.	Describe the methodology to prepare specimen for micro structural examination.	6	L1	CO1
	c.	Explain Gibb's phase rule in brief.	5	L1	CO1
Module – 3					
Q.5	a.	Deduce the expression for critical radius of nucleation.	10	L1	CO1
	b.	Draw and explain the process of induction hardening.	10	L2	CO2
OR					
Q.6	a.	Define heat treatment, with steps involved. Explain Normalizing heat treatment with relevant diagram.	10	L1	CO1
	b.	Draw a typical TTT diagram for 0.8% C and briefly explain the steps involved in drawing T-T-T diagram.	10	L3	CO2
Module – 4					
Q.7	a.	Write short notes on ball milling and crushing as a part of powder production techniques.	10	L2	CO1
	b.	Explain the methodology of Physical Vapour Deposition (PVD).	10	L2	CO1
OR					
Q.8	a.	Explain Die-Compaction (Die pressing) with related diagram.	8	L1	CO2
	b.	Explain the tensile test procedure of mild steel on UTM. Also draw general stress-strain diagram.	12	L1	CO2
Module – 5					
Q.9	a.	Define composite material, with neat diagram Metal Matrix Composites (MMC) and Polymer Matrix Composites (PMC).	10	L3	CO2
	b.	Classify cast iron and explain grey cast iron.	10	L2	CO1
OR					
Q.10	a.	Describe selection criteria for materials with brief.	7	L1	CO2
	b.	Explain original design and adaptive (developmental) design.	8	L1	CO1
	c.	Explain applications of composite materials.	5	L1	CO1

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BME304

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
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 Thermodynamic data hand book and steam table is permitted.

		Module – 1	M	L	C
Q.1	a.	State and explain Zeroth law of thermodynamics.	4	L2	CO1
	b.	The readings t_A and t_B of two Celsius thermometers, A and B agree at the ice point (0°C) and the steam point (100°C), but elsewhere are related by the equation $t_A = \ell + mt_B + nt_B^2$ where ℓ, m and n are constants, when both thermometers are immersed in a well stirred oil bath, A registers 51°C, while B registers 50°C. Determine the reading on B when A reads 25°C	10	L3	CO1
	c.	Define Thermodynamic Work. Compare Heat and Work.	6	L4	CO1
		OR			
Q.2	a.	Explain the Path and Point function with PV diagram.	6	L2	CO1
	b.	Derive an expressions for displacement work in various processes through P-V diagrams.	10	L3	CO1
	c.	Gas from a bottle of compressed helium is used to inflate in elastic flexible balloon, originally folded completely flat to a volume of 0.5 m^3. If the barometer reads 760 mm Hg, what is the amount of work done upon the atmosphere by the balloon? Sketch the system before and after the process.	4	L3	CO1
		Module – 2			
Q.3	a.	Explain first law for a closed system executing a cycle with neat sketch.	6	L2	CO2
	b.	Demonstrate the concept of enthalpy and its relation with heat transfer.	6	L3	CO2
	c.	A fluid is confined in a cylinder by a spring loaded frictionless piston so that the pressure in the fluid is a linear function of the volume (P = a + bV). The internal energy of the fluid is given by the following equation, $U = 34 + 3.15PV$ Where "U" is in KJ, P in KPa and V in cubicmetre. If the fluid changes from an initial state of 170 KPa, 0.03 m^3 to a final state of 400 KPa, 0.06 m^3, with no work other than that done on the piston. Find the direction and magnitude of the work and heat transfer.	8	L3	CO2
		OR			
Q.4	a.	Derive steady flow energy equation for an open system using First law of thermodynamics.	10	L3	CO2

	b.	In a gas turbine the gas enters at the rate of 5 kg/sec with a velocity of 50 m/sec and enthalpy of 900 KJ/kg and leaves the turbine with a velocity of 150 m/sec and enthalpy of 400 KJ/kg. The loss of heat from the gases to the surroundings is 25 KJ/kg. Assume for gas R = 0.285 KJ/kg.K and C_V = 1.004 KJ/kgK and the inlet conditions to be at 100 KPa and 27°C. Determine the power output of the turbine and the diameter of the inlet pipe.	10	L3	CO2
		Module – 3			
Q.5	a.	Explain the heat engines in both closed and open system with neat sketch.	6	L2	CO3
	b.	State and explain Kelvin-Planck and Clausius statements of second law of thermodynamics.	8	L2	CO3
	c.	Establish the equivalence of Kelvin-Planck and Clausius statements.	6	L3	CO3
		OR			
Q.6	a.	Define Entropy and prove that it is a property of the system.	10	L3	CO3
	b.	State and prove the corollary of Carnot's theorem.	10	L3	CO3
		Module – 4			
Q.7	a.	Explain the concept of available energy and unavailable energy.	6	L2	CO4
	b.	Explain the relation between increase in unavailable energy and increase in entropy.	6	L2	CO4
	c.	State and prove the maximum work in a reversible process.	8	L3	CO4
		OR			
Q.8	a.	With a neat sketch, explain P-T diagram for a pure substance.	8	L2	CO4
	b.	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, the entropy and the internal energy.	12	L3	CO4
		Module – 5			
Q.9	a.	Distinguish between Ideal and Real gas.	5	L2	CO5
	b.	Derive an expressions for the constants a, b and R interms of the critical properties for a Vander Waal gas.	10	L3	CO5
	c.	1 kg of propane (C_3H_8) is at a pressure of 7 MPa and a temperature of 150°C. The critical properties of propane are P_C = 4.26 MPa, T_C = 370 K and V_C = 0.00454 m^3/kg. Compressibility factor is 0.54. Calculate (i) the reduced pressure, volume and temperature (ii) Specific volume of propane using ideal gas equation.	5	L3	CO5

		OR			
Q.10	a.	Explain the following : (i) Joule-Kelvin effect (ii) Clausius-Clapeyron equation.	8	L2	CO5
	b.	State and explain Dalton's law of partial pressure and Amagat's law of additive volumes.	8	L2	CO5
	c.	Explain generalized compressibility chart.	4	L2	CO5

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | **BME401**

Fourth Semester B.E/B.Tech. Degree Examination, June/July 2025

Applied 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 Thermodynamic data handbook is permitted.

		Module – 1	M	L	C
1	a.	Derive expression for efficiency of otto cycle.	8	L3	CO1
	b.	An air stand old dual cycle has a compression ratio of 16 and compression begins at 1 bar , 50°C. The maximum pressure is 70 bar. The heat transferred to air at constant pressure is equal to that at constant volume. Estimate a1 pressure and temperature at cardinal point b1 cycle efficiency. Assume $C_v = 0.718$ kJ/kg k , $C_p = 1.00.5$kJ/kg k , R = 0.287 kJ/kg k.	12	L2	CO1
		OR			
2	a.	Explain with neat diagram, combustion in CI engine.	10	L2	CO1
	b.	The following observations were recorded in a test of one hour duration on single cylinder oil engine working on h-s cycle. Bore = 300mm , stroke = 450mm, Fuel used = 8.8 kg, Calorific value = 41800 kJ/kg. Speed = 200 ℓpm , Mean effective pressure = 5.8 bar, Brake friction load = 1860 N , Quantity of cooling water = 650 kg , Temperature rise = 22°C. Diameter of brake wheel = 1.22m. Find i) Mechanical efficiency ii) Draw heat balance sheet on minute basis ϕ percentage basis.	10	L3	CO1
		Module – 2			
3	a.	Derive expression for efficiency of Brayton cycle (Gas turbine cycle).	8	L3	CO2
	b.	Air enters the compressor of a turbine plant operating on Brayton cycle at 101.325 Kpa , 27°C and pressure ratio is 6. If turbine works equals 2.5 time the compressor work, determine the maximum temperature in the cycle and cycle efficiency. Take Cp = 1.005 kJ/kg k , r = 1.4.	12	L3	CO2
		OR			
4	a.	Explain briefly with T – S diagram the following gas turbine cycle : i) Regeneration ii) Intercooling iii) Reheating.	10	L2	CO2
	b.	With a neat sketch, explain working of Turbojet and Ramjet engine.	10	L2	CO2

		Module – 3			
5	a.	With a schematic diagram and its T – S diagram , explain the Rankine cycle and also derive its thermal efficiency.	**10**	**L2**	**CO5**
	b.	In a Carnot cycle the upper and lower limit pressure are 28 bar and 0.15 bar. Dry saturated steam is supplied to the plant. Evaluate i) Dryness fraction of steam of the beginning of compression ii) Find Carnot efficiency and Rankine efficiency.	**10**	**L3**	**CO3**
		OR			
6	a.	With a schematics and T – S diagram, explain working of reheat vapour power cycle and deduce an expression for cycle efficiency.	**10**	**L2**	**CO3**
	b.	In a single – heater regenerative cycle, the steam enters the turbine at 30 bar , 400°C and the exhaust pressure is 0.10 bar. The feed water heater is a direct contact type which operates at 5 bar. Find efficiency and steam rate of cycle.	**10**	**L3**	**CO3**
		Module – 4			
7	a.	Explain the working of vapour compression refrigerator and analyse it for i) Heat rejected ii) COP iii) Power consumption iv) Compressor displacement.	**10**	**L2**	**CO4**
	b.	A vapour compression refrigeration of 10 tonnes capacity. Using Freon - 12 as the refrigerant has an evaporator temperature of -10°C and condenser temperature of 30°C. Determine i) Compressor superheated discharge temperature ii) Cop iii) Mass flow rate of refrigerant. Obtain properties using data hand book.	**10**	**L3**	**CO4**
		OR			
8	a.	Analyse the following Psychrometric processes : i) Mixing of air steams ii) Cooling and dehumidification iii) Heating and humidification.	**9**	**L4**	**CO4**
	b.	Saturated air at 3°C is required to be supplied to a room where the temperature must be held at 22°C with a relative humidity of 55%. The air is heated and then water at 10°C is sprayed to give the required humidity. Determine i) Mass of spray water required per m^3 of air at room conditions. ii) Temperature to which air must be heated. Neglect an power. Assume total pressure as constant at 1.0132 bar.	**11**	**L3**	**CO4**
		Module – 5			
9	a.	Derive expression for work done by a reciprocating compressor with clearance volume.	**8**	**L3**	**CO5**

	b.	A reciprocating air compressor has 5 percent clearance with a bore of 25cm and length of stroke 30cm. The compressor operates at 500 rpm. The air enters the cylinder at 27° and 95 kPa and discharges at 2000 kPa. If n = 1.3 for compression and expansion processes. Determine i) Volumetric efficiency ii) Volume of air handled at inlet condition iii) Power required	12	L3	CO5
		OR			
10	a.	Derive an expression of critical pressure ratio which gives maximum discharge through the nozzle.	8	L3	CO5
	b.	Steam at a pressure of 6.85 bar and 0.9 dry expands through a nozzle having a throat area of 4.65 cm^2. The back pressure is 1.03 bar. Determine i) Mass of steam flow per minute ii) Area of mouth of nozzle for maximum discharge iii) Final velocity of steam	12	L3	CO5

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | BME402

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Machining Science and Metrology

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.	Differentiate between orthogonal and oblique cutting process.	6	L1	CO1
	b.	Using Merchant circle diagram derive the relation for chip thickness ratio and shear angle.	8	L2	CO1
	c.	Explain different types of cutting materials.	6	L3	CO1
		OR			
Q.2	a.	List the difference between Capstan and Turret lathe.	6	L1	CO1
	b.	Explain with a neat sketch part of a lathe.	8	L2	CO1
	c.	Explain the following operation i) Taper turning ii) Threading iii) Knurling	6	L2	CO1
		Module – 2			
Q.3	a.	Explain any three milling operations.	6	L2	CO2
	b.	With neat sketch, explain radial drilling machine.	8	L2	CO2
	c.	What is Indexing and discuss the need of indexing.	6	L2	CO2
		OR			
Q.4	a.	Differentiate between shaping and planning operation.	6	L1	CO2
	b.	Explain centerless grinding machine with a neat diagram.	8	L2	CO2
	c.	Explain the driving mechanism of a shaper.	6	L2	CO2
		Module – 3			
Q.5	a.	With a neat sketch, explain the temperature distribution in metal cutting.	6	L2	CO3
	b.	Explain the Tool-work thermocouple technique used for measurement of cutting temperature.	8	L2	CO3
	c.	Discuss the parameters which influences the tool life.	6	L2	CO3

		OR			
Q.6	**a.**	Explain the basic requirements of cutting tool materials.	**6**	**L2**	**CO3**
	b.	A 60 mm diameter steel bar was turned at 300 rpm and the tool failed after 8 minutes of cutting. Then the speed was reduced to 240 rpm and the tool lasted for 50 minutes. Using Talyor's tool life equation, determine the cutting speed required to obtain a tool life of 20 minutes.	**8**	**L3**	**CO3**
	c.	List the properties of cutting fluids and explain the functions of cutting fluids.	**6**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the objectives of metrology.	**6**	**L2**	**CO3**
	b.	What is slip gauge? Explain the wringing phenomenon.	**8**	**L3**	**CO3**
	c.	Write a short note on line and end standard.	**6**	**L2**	**CO3**
		OR			
Q.8	**a.**	With a neat sketch, explain International prototype meter.	**6**	**L2**	**CO4**
	b.	What is a Fit? Explain different types of Fits and their designation.	**8**	**L2**	**CO4**
	c.	Discuss shaft based and hole – based system of fit.	**6**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	What are GO and NOGO gauges? Explain how Taylor's principle is used in designing them.	**6**	**L2**	**CO5**
	b.	Explain Solex pneumatic comparator.	**8**	**L2**	**CO5**
	c.	With a neat sketch, explain snap gauges.	**6**	**L2**	**CO5**
		OR			
Q.10	**a.**	Write a short note on wear allowances on gauges.	**6**	**L2**	**CO5**
	b.	With a neat sketch, explain the Johansson Mikrokator type comparator.	**8**	**L2**	**CO5**
	c.	Explain the principle and working of a sine bar.	**6**	**L2**	**CO5**

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | | **BME403**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Fluid Mechanics

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 fluid properties, i) Density ii) Specific weight iii) Specific gravity iv) Specific volume v) Viscosity.	15	L1	CO1
	b.	With diagram, explain simple manometer.	5	L2	CO1
		OR			
Q.2	a.	Define : i) Total pressure ii) Centre of pressure.	4	L1	CO1
	b.	The pressure intensity at a point in a fluid is given as 3.924 N/cm^2. Find the corresponding height of fluid when the fluid is : i) water ii) oil of specific gravity = 0.9.	6	L5	CO1
	c.	The weight of 5.024 liters of oil is 62.8 N calculate : i) Specific weight of oil ii) Density of oil iii) Specific gravity of oil iv) Specific volume.	10	L5	CO1
		Module – 2			
Q.3	a.	Distinguish between : i) Uniform flow and non uniform flow ii) Steady flow and unsteady flow iii) Laminar flow and turbulent flow.	12	L2	CO3
	b.	The diameter of a pipe at section A and B are 8 cm and 12 cm respectively. If velocity of water flowing through the pipe at section. A is 2 m/sec. Determine the discharge through the pipe, and the velocity at section B.	8	L4	CO3

			Marks	L	CO
		OR			
Q.4	**a.**	Define : i) Velocity potential function ii) Stream function.	6	L1	CO3
	b.	The velocity components in a flow are given by : U = 6y and v = 6x. Find : i) Whether the flow is possible ii) Stream function ψ.	8	L4	CO3
	c.	Define flow net, state its uses.	6	L1	CO3
		Module – 3			
Q.5		Derive Euler's equation of motion and obtain Bernoulli's equation from Euler's equation of motion.	20	L5	CO4
		OR			
Q.6	**a.**	Derive an expression for discharge through a venturimeter.	10	L5	CO4
	b.	A vertical venturimeter has an area ratio of 5. It has a throat diameter of 10 cm. When oil of specific gravity 0.8 flows through it, the mercury in the differential gauge indicates a difference in height of 12 cm. Find the discharge through venturimeter. Take $C_d = 0.98$.	10	L4	CO4
		Module – 4			
Q.7	**a.**	Define with diagram : i) Stream line body ii) BLUFF body.	6	L1	CO5
	b.	A circular disc of 4 m in diameter is held normal to a 30 m/sec wind of density 0.0012 gm/cc. What force is required to hold it at rest? Assume co-efficient fog rag of disc = 1.1.	6	L4	CO5
	c.	A man descends to the ground from an aeroplane with the help of a parachute which is hemispherical having a diameter of 4 m against the resistance of air with a uniform velocity of 25 m/sec. Find the weight of the man, if the weight of the parachute is 9.81 N. Take co-efficient of drag as 0.6.	8	L4	CO5
		OR			
Q.8	**a.**	Mention the advantages and applications of dimensional analysis.	10	L1	CO6
	b.	A partially submerged body is towed in water the resistance R to its motion depends on the density (ρ), the viscosity (μ) of water, length (τ) of the body, velocity (v) of body and acceleration due to gravity (g). Show that the resistance to the motion can be expressed in the form : $R = \rho L^2 V^2 \phi\left[\left(\frac{\mu}{\rho V L}\right)\cdot\left(\frac{\tau g}{V^2}\right)\right]$.	10	L4	CO6

Module – 5

Q.9	a.	Obtain an expression for velocity of sound in terms of bulk modulus for a compressible fluid.	10	L5	CO6
	b.	A projectile travels in air of pressure 15 N/cm^2 at 10°C at a speed of 1500 KM/hour. Find : i) Mach number ii) Mach angle Assume adiabatic constant $\gamma = 1.4$ and gas constant, R = 2875/kg°K.	8	L4	CO6
	c.	Define SONIC flow.	2	L1	CO6
		OR			
Q.10	a.	Define computational fluid dynamics, state its limitations and applications.	12	L2	CO7
	b.	Define Mach number, obtain an expression for the same.	8	L4	CO7

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BME405A

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Non – Traditional Machining

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 Non-Traditional Machining. Why it is necessary? Explain briefly.	08	L2	CO1
	b.	Classify the non-traditional machining based on the nature of energy employed in machining.	06	L2	CO1
	c.	List the factors influencing for selection of NTM process and explain any two.	06	L2	CO1
		OR			
Q.2	a.	Distinguish between conventional and non-conventional machining processes.	10	L2	CO1
	b.	List any four applications of NTM.	04	L1	CO1
	c.	List any three advantages and limitations of NTM.	06	L1	CO1
		Module – 2			
Q.3	a.	What is Ultrasonic Machining (USM)? Explain the ultrasonic machining (USM) process with schematic diagram.	10	L2	CO2
	b.	List the applications, advantages and disadvantages of ultrasonic (USM) process.	10	L1	CO2
		OR			
Q.4	a.	Explain the working principle of Abrasive Jet Machining (AJM) with the help of neat sketch.	10	L2	CO2
	b.	Explain any five process parameters of Abrasive Jet Machining (AJM).	10	L2	CO2
		Module – 3			
Q.5	a.	What are the elements of Electro Chemical Machining (ECM) process? Explain any three.	08	L2	CO3
	b.	Explain with neat sketch Electro Chemical Horning (ECH).	06	L2	CO3
	c.	Explain the following Electro Chemical Machining (ECM) process parameters : (i) Current Density (ii) Tool Feed Rate (iii) Gap between Work piece and tool	06	L2	CO3

		OR			
Q.6	**a.**	What are the elements of Chemical Machining Process? Explain.	**08**	**L2**	**CO3**
	b.	Explain with neat sketch of Chemical Blanking Process.	**06**	**L2**	**CO3**
	c.	List the advantages and disadvantages of Chemical Machining Process.	**06**	**L1**	**CO3**
		Module – 4			
Q.7	**a.**	Explain with sketch, the mechanism of metal removal in electric discharge machining (EDM).	**10**	**L2**	**CO4**
	b.	List the advantages , disadvantages and applications of Electric Discharge Machining (EDM).	**10**	**L2**	**CO4**
		OR			
Q.8	**a.**	Explain with neat sketch working principle of Plasma Arc Machining (PAM).	**10**	**L2**	**CO4**
	b.	Discuss some of the important considerations in design of plasma torch in Plasma Arc Machining (PAM).	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat sketch, explain working principle of Laser Beam Machining (LBM).	**10**	**L2**	**CO5**
	b.	Explain with neat sketch types of LASER used in Laser Beam Machining (LBM).	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain with the help of neat sketch working principle of Electron Beam Machining (EBM).	**10**	**L2**	**CO5**
	b.	List the advantages, disadvantages and applications of Electron Beam Machining (EBM).	**10**	**L1**	**CO5**

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BME502

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Turbo Machines

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 turbomachine. Differentiate positive displacement machine and turbomachines with respect to various parameters.	8	L1	CO1
	b.	Obtain an expression for specific speed of a turbine.	6	L2	CO1
	c.	A $\frac{1}{5}^{th}$ scate model turbine working under a head of 15 m the prototype turbine is required to work under a head of 30 m and running at 450 rpm. Determine the speed of model if it develops 98 KW at his speed. If the specific speed is same, determine the power developed by the prototype turbine and name the type of turbine.	6	L3	CO1
		OR			
Q.2	a.	Obtain the expressions for a turbomachine by applying the first law and second law of thermodynamics.	10	L2	CO1
	b.	A two-stage steam turbine develop 22 MW at the shaft. The inlet temperature is 1500 K. The overall pressure ratio of the turbine is 8 and the isentropic expansion efficiency is 0.9. Assume pressure ratio of each stage is same. Calculate : i) Pressure ratio of each stage ii) Polytrophic efficiency iii) Mass flow rate. Assume overall drive efficiency = 0.9.	10	L3	CO1
		Module – 2			
Q.3	a.	Define Degree of Reaction and utilization factor obtain an expression for relation between two.	10	L2	CO2
	b.	In a radial inward flow turbine, the runner outer diameter is 75 cm and the inner diameter is 50 cm. The runner speed is 400 rpm. Water enters the runner at a velocity of 15 m/s at an angle of 15°. The velocity of fluid at the exit is 5 m/s and discharges radiantly. Find : i) Blade angles at inlet and exit ii) Degree of reaction iii) Utilization factor iv) Power output for unit mass flow rate.	10	L3	CO2
		OR			
Q.4	a.	A radial outward flow turbomachine has no inlet whirl The blade speed at the exit is twice that the inlet. Radial velocity is constant throughout. Inlet blade angle is 45° . Show that the degree for action. $R = \frac{2+\cot\beta_2}{4}$	10	L3	CO2
	b.	Obtain an expression for theoretical head-capacity relationship and effect on blade discharge angles in the performance of centrifugal pump or compressor.	10	L2	CO2

Module – 3					
Q.5	**a.**	What is compounding in turbomachines? Mention the different types of compounding methods. Explain any one method of compounding in turbines.	**10**	**L1**	**CO3**
	b.	Steam issues from a De Laval Turbine at a velocity of 1000 m/s. The nozzle angle is 20°. The mean blade velocity is 400 m/s. The blades are symmetrical. The mass flow rate is 1000 kg/h, blade friction coefficient is 0.8. Determine : i) Blade angles ii) Axial thrust iii) Power developed iv) Blade efficiency.	**10**	**L3**	**CO3**
OR					
Q.6	**a.**	Obtain an expression for maximum blade efficiency of single stage impulse turbine.	**10**	**L2**	**CO3**
	b.	In a parson turbine running at 1500 rpm, the available enthalpy drop (total) is 63 kJ/kg. If the mean diameter of the rotor is 100 cm, Find the number of moving rows required stage efficiency = 0.8, blade outlet angle = 20°, speed ratio = 0.7.	**10**	**L3**	**CO3**
Module – 4					
Q.7	**a.**	With a neat sketch, explain the working principle of Pelton wheel with parts and represent the velocity diagrams.	**10**	**L1**	**CO4**
	b.	A Pelton wheel develops 5800 KW under a net head of 180 m at a speed of 195 rpm. Find the discharge through the turbine, the wheel diameter, the number of jets required and the specific speed. Take $\eta_{overall}$ = 86%, D/d = 12, ϕ = 0.45 and C_v = 0.985.	**10**	**L3**	**CO4**
OR					
Q.8	**a.**	With a neat sketch, explain the working of Kaplan turbine. Draw its velocity triangles. Also explain the functions of draft tube.	**10**	**L2**	**CO4**
	b.	For a Francis turbine, the Net Head = 70 m speed = 600 rpm, Shaft power = 370 KW, Overall efficiency is 85%, Hydraulic efficiency is 95%, flow ratio = 0.25, Breadth ratio = 0.1, outer diameter of the runner is 2 times inner diameter of runner, the thickness of vanes occupies 10% of the circumferential area of the runner, velocity of flow is constant and discharge is radial at outlet. Determine : i) The guide blade angle ii) The runner vane angles iii) Diameter of runner at inlet and outlet iv) Width of wheel at inlet.	**10**	**L3**	**CO4**
Module – 5					
Q.9	**a.**	With a neat sketch, explain the working principle of centrifugal pump and represent its velocity triangles.	**7**	**L1**	**CO5**
	b.	Explain pumps in series and pumps in parallel.	**6**	**L2**	**CO5**
	c.	A centrifugal pump delivers 50 liters of water/sec against a head of 24 m running at 1500 rpm. The velocity of flow is 2.4 m/s and is constant, and the blades are set back at 30°. The inner diameter is half the outer diameter. If the manometric efficiency is 80%, determine the blade angles and power required to drive the pump	**7**	**L3**	**CO5**

OR

Q.10	a.	Explain the experimental study of centrifugal flower representing tabulations, observations and formulae used.	10	L4	CO5
	b.	An axial compressor stage has the following data inlet conditions are 1 bar and 25°C, degree of reaction is 0.5, mean blade ring diameter is 360 mm, rotational speed is 18,000 rpm, blade height at entry is 180 mm, air angles at rotor and stator exit are 25° (with respect to axial direction) axial velocity is 180 m/s, work done factor is 0.88, stage efficiency is 85% and mechanical efficiency is 96.7% Determine the : i) Air angles at rotor and stator entry ii) Mass flow rate of air iii)Power required to drive compressor.	10	L3	CO5

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BME601

Sixth Semester B.E/B.Tech. Degree Examination, June/July 2025
Heat Transfer

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 thermodynamics and Heat transfer data hand book is permitted.
4. Any missing data can be suitably assumed.

		Module – 1	M	L	C
1	a.	Derive one dimensional time dependent heat conduction equation with internal heat generation and constant thermal conductivity in cortegion coordinate system.	10	L2	CO1
	b.	With neat sketch explain boundary conditions of first, second and third kinds.	10	L1	CO1
		OR			
2	a.	A wall is constructed of several layers. The first layer consists of brick ($k = 0.66$ w/m^k) 25 cm thick, the second layer 2.5 cm thick mortar (k = 0.7 W/m.k), the third layer 10 cm thick limestone (k = 0.66 w/m.k) and outer layer of 1.25 cm thick plaster (K = 0.7 w/m.k). The heat transfer co-efficients on interior and exterior of the wall fluid layers are 5.8 w/m^2 k and 11.6 w/m^2 k respectively. Find : i) Overall hear transfer co-efficient ii) Overall thermal resistance per m^2 iii) Rate of heat transfer per m^2, if the interior of the room is at 26°C while outer air is at - 7°C.	10	L3	CO1
	b.	Derive a critical thickness of insulation for a cylinder.	10	L2	CO1
		Module – 2			
3	a.	Obtain an expression for temperature distribution and heat flow through a uniform cross section Longfin.	10	L2	CO3
	b.	A very long 25 mm diameter copper (k = 380 W/m.k) rod extends from a surface at 120°C. The temperature of surrounding air is 25°C and the heat transfer co-efficient over the rod is 10 W/m^2 k. Calculate: i) Heat loss from the rod ii) How long the rod should be in order to be considered infinite?	10	L3	CO3
		OR			
4	a.	With usual notations derive an expression for temperature distribution through a body for lumped parameter analysis.	10	L3	CO3
	b.	A 50 mm thick iron plate is initially at 225°C. Its both surface are suddenly exposed to air at 25°C with convection co-efficient of 500 W/m^2 k. i) Calculate the center temperature at the depth of 10 mm from the surface after 2 minute of exposure. Take thermophysical properties of iron plate : K = 60 W/mk, ρ = 7850 kg/m^3, C_p= 460 J/kok α= 1.6×10^{-5} m^2/s	10	L3	CO3

		Module – 3			
5	a.	Explain the finite difference formulation of differential equation of 1 – dimensional steady heat conduction.	10	L2	CO1
	b.	What are the limitations of analytical solution used in the engineering problem? Discuss the advantages of numerical method over analytical method.	10	L2	CO1
		OR			
6	a.	Define solid angle and intensity of radiation and show that $E = \pi I$ where, E = Total emissive power and I = Intensity of radiation.	10	L1, 2	CO3
	b.	Two large parallel plates at temperature 1000 k and 600 k have emissivity of 0.5 and 0.8 respectively. A radiation shield having emissivity 0.1 one side and 0.05 on the other side is placed between the plates. Calculate the heat transfer rate by radiation per square meter with and without radiation shield.	10	L3	CO3
		Module – 4			
7	a.	With a neat sketch explain velocity boundary layer and thermal boundary layer for a flow over a flat plate.	8	L1	CO2
	b.	Define the following and write its significances: i) Reynold's Number ii) Prondtl Number	6	L1	CO2
	c.	Write the procedure, tabular column and corresponding equations to determine the heat transfer co-efficient in e forced convection.	6	L3	CO2
		OR			
8	a.	Air at velocity of 3 m/s and at 20°C flows over a flat plate along its length. The length width and thickness of the plate are 100cm, 50 cm and 2 cm respectively. The top surface of the plate is maintained at 100° C. Calculate the heat lost by the plate.	10	L3	CO2
	b.	Consider a rectangular plate 0.2 m × 0.4 m is maintained at a uniform temperature of 80° C. It is placed in atmospheric air at 20°C. Calculate the heat transfer rate from the plate by considering plate is placed as vertical and its height is 0.4 m.	10	L3	CO2
		Module – 5			
9	a.	Explain Drop wise and Film wise condensation with neat sketch.	6	L1	CO4
	b.	With neat sketch explain the regimes of pool boiling.	6	L1	CO4
	c.	The outer surface of a vertical tube 80 mm in outer diameter and 1 m long is exposed to saturated steam at atmospheric pressure. The tube surface is maintained at 50°C by flow of water through the tube. What is the rate of heat transfer to coolant. Take $h_{fg} = 2257$ kJ/kg, $\rho = 975$ kg/m^3, $\rho_v = 0.596$ kg/m^3, $k_f = 0.668$ w/mk, $\mu_L = 375 \times 10^{-6}$ per sec.	8	L3	CO4
		OR			
10	a.	Derive an expression for Log Mean Temperature Difference (LMTD) for parallel flow heat exchanger. State the assumptions mode.	10	L2	CO4
	b.	Consider the following parallel flow heat exchanger specifications Cold flow enters at 40°C. $M_n C_{p_c} = C_c = 20000 \frac{w}{k}$ Hot flow enters at 150°C : $M_n C_{pn} = C_n = 10000 \frac{w}{k}$ $A = 30m^2, U = 500 \frac{w}{m^2k}$ Determine the heat transfer rate and the exit temperatures.	10	L3	CO4

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CBCS SCHEME - Make-Up Exam

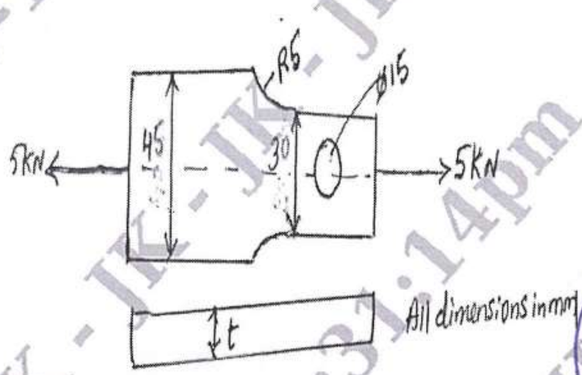
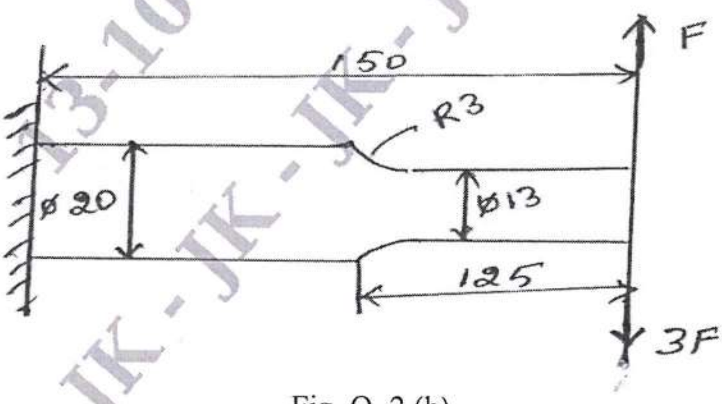
USN | | | | | | | | | | |

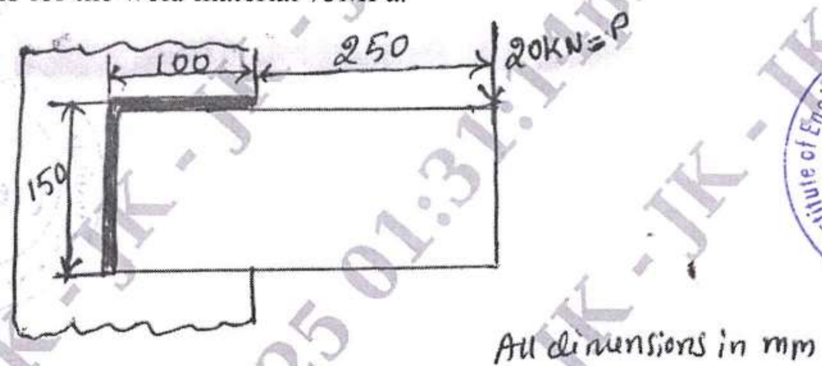
BME602

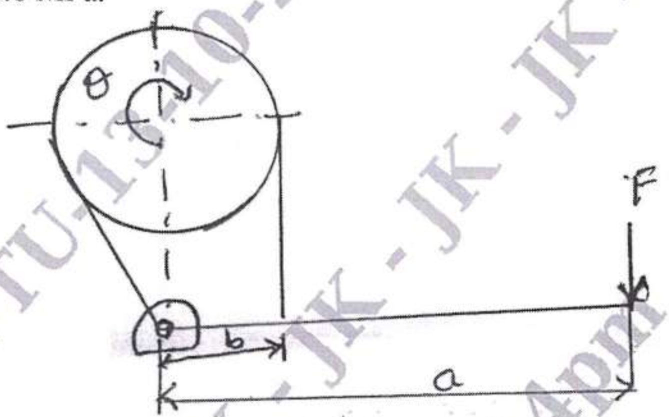
Sixth Semester B.E/B.Tech. Degree Examination, June/July 2025
Machine Design

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 to Data Hand Book is permitted (Vol. 1 & Vol. 2)

		Module – 1	M	L	C
1	a.	Explain standards and codes used in design?	4	L1	CO1
	b.	Explain any four Mechanical Properties?	6	L1	CO1
	c.	A Flat plate subjected to tensile force of 5 kN is show in fig. Q.1 (c). The material is grey cast iron having σ_u value 200 MPa. Determine thickness of H plate FOS 2.5  Fig. Q 1(c)	10	L3	CO1
		OR			
2	a.	Derive soderberg equation with respect to fatigue loading.	8	L3	CO2
	b.	A cantilever beam made of cold drawn carbon steel (σ_u = 550 MPa, σ_y = 470 MPa, σ_{-1} = 275 Mpa) of circular cross section is subjected to Load which varies from –F to 3F. Determine the maximum load that this member can with stand for an infinite life FOS = 2  Fig. Q. 2 (b)	12	L3	CO2

			Marks	Level	CO
		Module – 2			
3		A steel shaft 600 mm long supported between bearings carries a pulley of diameter 400 mm weighing 400 N and is mounted in the middle of the shaft. This shaft receives 40 kw at 600 rpm by a flat belt drive, power from the shaft is transmitted through another pulley of diameter 600 mm weighing 600 N overhanging the right bearing by 200 mm. The belt drives on the pulleys are at right angles to each other. Taking ratio of belt tensions as 3, determine the diameter of the shaft required taking design shear stress as 40 MPa.	20	L3	CO3
		OR			
4	a.	A rectangular sunk key 14 mm wide x 10 mm thick x 75 mm long is required to transmit 1200 N – M torque from a 50 mm diameter solid shaft. Determine whether the length is sufficient or not if the permissible shear stress and crushing stress are limited to 56MPa and 168 MPa respectively.	5	L3	CO3
	b.	Design a protected type CI flange coupling for steel shaft transmitting 30 KW at 200 rpm. The allowable shear stress in the shaft and key material is 40 MPa. The maximum torque transmitted to be 20% greater than full load torque. The allowable shear stress in the bolt is 60 MPa and allowable shear stress in the flange is 40 MPa.	15	L3 L4	CO3
		Module – 3			
5	a.	Explain the following : i) Failure of riveted joints ii) Efficiency of riveted joints.	8	L2	CO3
	b.	Determine the size of weld A 16 mm thick plate is welded to a vertical supported by two fillet welds as show in fig. Q. 5 (b). and if the permissible shear stress for the weld material 75MPa.  Fig. Q. 5(b)	12	L3	CO4
		OR			
6		Design a pair of spur gears to transmit 20 KW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume number of teeth on pinion 31 and 20° FDI. The material for pinion is C45 steel untreated and for gear cast steel D.20% C untreated (FDI – Full depth Involute).	20	L3	CO4
		Module – 4			
7		Design a pair of helical gears to transmit power of 15 KW at 3200 rpm with high speed reduction 4:1 Pinion is made of cast steel 0.4% C untreated. Gear is made of high grade CI. Helix angle is limited to 26° and not less than 20 teeth are to be used on either gear . Suggest suitable surface hardness for the gear pair.	20	L3	CO4

		OR			
8		Design a worm gear drive to transmit 12 kw at 1200 rpm speed, reduction designed is 30:1. The worm is made of hard need steel. (σ_o = 210 MPa) and gear of phosphor bronze (σ_u = 90 MPa). The teeth are 14½°. Check the heating capacity of the gears.	**20**	**L3**	**CO4**
		Module – 5			
9	a.	Design a single plate clutch used in automobile transmission for the following specification power to be transmitted = 20 KW, speed = 1500 rpm. Take μ =0.35, pressure (p) = 1N/mm^2, yield stress for shaft material 328.6 MPa.	**8**	**L3**	**CO3**
	b.	A simple band brake is required to transmit a torque of 980 N – M. The brake drum is 400 mm diameter and co-efficient of friction is 0.25. Find the effort required to operate the brake. Also design the band and the lever. Take θ = 270°, a = 680 mm and b = 80 mm. σ_y for both band and lever = 328.6 MPa.  Fig. Q. 9 (b)	**12**	**L3**	**CO3**
		OR			
10	a.	Derive Petroff's equation with usual notations.	**10**	**L3**	**CO5**
	b.	A lightly loaded bearing of 70 mm long and 70 mm in diameter is acted on by 1.5 KN radial load. The radial clearance is 0.07 mm and journal is rotating at 25000 rpm. The viscosity of the oil is 3.45 × 10^{-3} pas. Determine frictional power loss using Petroff's equation.	**10**	**L3**	**CO5**

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CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

BME613A

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Total Quality Management

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 TQM. With the help of a block diagram explain TQM framework.	10	L2	CO1
	b.	i) What are the six basic approach of TQM?	6	L2	CO1
		ii) What are the benefits of TQM?	4	L2	CO1
		OR			
Q.2	a.	Explain the following in brief : ISO 9000 Series of Standards.	10	L2	CO1
	b.	What are different dimensions of quality? Explain dimensions of CNC lathe machine.	10	L2	CO1
		Module – 2			
Q.3	a.	Define Leadership. Explain 12 characteristics of a successful quality leader.	13	L2	CO2
	b.	Elaborate the seven basic steps to strategic quality planning.	7	L2	CO2
		OR			
Q.4	a.	Explain briefly 7 habits of highly effective people.	7	L2	CO2
	b.	Explain in detail Deming philosophy.	13	L2	CO2
		Module – 3			
Q.5	a.	List the methods of taking the customer feedback. Explain in brief any two methods.	10	L2	CO3
	b.	What are the characteristics of successful team?	10	L2	CO3
		OR			
Q.6	a.	Explain concept of KANO MODEL with figure.	10	L2	CO3
	b.	List the different performance appraisal methods. Explain in brief any two methods.	10	L2	CO3
		Module – 4			
Q.7	a.	Explain the concept of Juran's triology and with a neat sketch elaborate chronic waste and sporadic waste of quality control.	10	L2	CO4
	b.	Write a note on : i. KAIZEN ii. Six –Sigma briefly.	10	L2	CO4
		OR			
Q.8	a.	Write a note on : i. Pareto diagram ii. Histograms.	10	L2	CO4
	b.	With an example sketch and discuss the construction and applications of a control chart. Explain state of control and out of control process.	10	L2	CO4
		Module – 5			
Q.9	a.	Define TPM. Explain pillars of TPM.	10	L2	CO5
	b.	Define Quality by Design (QbD). Explain its key components of QbD.	10	L2	CO5
		OR			
Q.10	a.	Write a note on : i. 5S implementation ii. Planned maintenance.	10	L2	CO5
	b.	i. Define Ems. Explain EMS under ISO 14001.	5	L2	CO5
		ii. Role of QbD in pharmaceutical industry.	5	L2	CO5

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