U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Industrial Engineering & Management **Duration: 3 hrs.**
Course Code: 22IM4PCMCD **Max Marks: 100**
Course: Machine Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	CO	PO	Marks
1	a)	Define stress concentration. What are the methods to reduce stress concentration?	CO1	PO1	**10**
1	b)	A circular shaft of 45 mm diameter is stepped down to 30 mm with a fillet radius of 6 mm. Determine the maximum stress if the shaft is subjected to a twisting moment of 150 N-m.	CO3	PO1 PO3 PO4	**10**
		OR			
2	a)	Derive Soderberg equation.	CO2	PO2	**10**
2	b)	A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design.	CO3	PO1 PO3 PO4	**10**
		UNIT - II			
3	a)	Design the assembly of a knuckle joint to connect two mild steel rods subjected to an axial pull of 100kN. The allowable stresses for rods and pins are 100 MPa, 130 MPa, and 60 MPa in tension, crushing and shear respectively.	CO3	PO1 PO3 PO3	**10**
3	b)	Design a socket and spigot type cotter joint to connect two mild steel rods for a pull of 30 kN. Maximum permissible stresses are σ_t = 55 MPa σ_c = 70 MPa and τ = 40 MPa.	CO3 CO4	PO1 PO3 PO4 PO12	**10**
		UNIT - III			
4	a)	Derive an expression for beam strength of a spur gear tooth using standard notation.	CO2	PO2	**10**

	4	b)	A pair of mating spur gears have 20^0 FDI teeth of 8 mm module. The number of teeth on pinion is 20 and 5kW will be transmitted At 1500 rpm. The transmission ratio(i) is 2.5. Calculate i) No of teeth required for gear ii) Pitch circle diameters d_1& d_2 iii) Torque on each shaft	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**10**
			OR			
	5	a)	Design a pair of spur gear. It transmits 20KW from a shaft rotating at 750 rpm to a parallel shaft which is to rotate at 280 rpm. The number of teeth on pinion is 28 and 20^0 full depth tooth form. The material for pinion is C40 steel untreated and for gear forged steel about 0.30% C untreated.	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**20**
			UNIT - IV			
	6	a)	A mild steel shaft transmits 29 kW at 200 rpm. It carries a central load of 2000 N and is simply supported between bearings 1.5 m apart. Determine the commercial size of the shaft if the allowable shear stress for the material is 60 MPa.	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**10**
	6	b)	A solid shaft is subjected to a maximum torque of 1000 N-m and a maximum bending moment of 150 N-m. The shaft is subjected to minor shocks and is made up of commercial steel for which the yield stress is 300 MPa. Determine the size of the shaft required assuming a factor of safety of 2.5.	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**10**
			UNIT - V			
	7	a)	Derive Petroff's equation using suitable notations.	*CO2*	*PO2*	**10**
		b)	A lightly loaded journal bearing has a load of 1KN. The oil used is SAE 60 and mean effective temperature of operation is 40^0 C. The journal has a diameter of 50 mm and the bearing has a diameter of 50.5mm. The speed of journal is 1500rpm. The L/d ratio is limited to 1.2. Determine the co-efficient of friction and power loss in friction.	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**10**

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