U.S.N.										

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

Autonomous Institute Affiliated to VTU

December / January 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Industrial Engineering and 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 factory of safety. Discuss factors influencing selection of appropriate value for the factor of safety.	*CO1*	*PO1*	**05**
	b)		A shaft of 50 mm diameter is stepped down to 40 mm with a fillet radius of 5 mm. if the allowable shear stress is 50 MPa, determine the power that can be transmitted at 1200 rpm.	*CO2*	*PO2*	**05**
	c)		A plate of C45 steel (σ_y = 353 MPa) is subjected to the following stresses. σ_x = 150 MPa, σ_y = 100 MPa and τ_{xy} = 50 MPa. Find the factor of safety by i) Maximum principal stress theory ii) Maximum shear stress theory iii) Hencky Mises theory	*CO3*	*PO1* *PO3* *PO4*	**10**
			OR			
2	a)		Derive Soderberg criterion for reversed bending load.	*CO2*	*PO2*	**10**
	b)		Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa. The factor of safety based on yield point may be taken as 1.5.	*CO3*	*PO1* *PO3* *PO4*	**10**
			UNIT - II			
3	a)		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*	*PO1* *PO3* *PO4*	**10**

		b)	Design a sleeve coupling to transmit 10 kW at 200 rpm. The allowable values of shear stress and compressive stress for the shaft and key material may be taken as 60 MPa & 130 MPa. The allowable shear stress in cast iron sleeve is equal to 15 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. State the assumptions under which the equation is valid.	*CO2*	*PO2*	**08**
		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 5:2. Calculate i) No of teeth required for gear ii) Pitch circle diameters d_1& d_2 iii) Torque on each shaft iv) Normal force v) Tangential force and vi) Radial force	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**12**
			OR			
	5	a)	Design a pair of spur gears to transmit 18KW from a shaft rotating at 1200 rpm to a parallel shaft to be run at 450 rpm maintaining a distance of 160 mm between the center lines of the shaft.	*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*	**10**
		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*	**10**
			UNIT - V			
	7	a)	Derive Petroff's equation using suitable notations. State the assumptions made.	*CO2*	*PO2*	**08**
		b)	Design the main bearing for a stationary slow speed steam engine for the following data. Journal diameter = 200 mm, Maximum load on the piston =80 kN. Engine speed =200 rpm.	*CO3* *CO4*	*PO1* *PO3* *PO4* *PO12*	**12**

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