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: 23IM4ESDME **Max Marks: 100**
Course: Design of Machine Elements

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)		What is factor of safety what are the factors considered for deciding factor of safety	*1*	*1*	**04**
	b)		A SAE 1045 Steel rod of 80 mm diameter is subject to bending moment of 3000 Newton metre and torque t assuming a factor of safety of 2.5 find the maximum value of torque tea that can be safely carried by rod according to maximum normal stress theory maximum shear stress theory.	*3*	*1,3,4*	**10**
	c)		A circular hole of 10 mm diameter is drilled exactly at the centre of a rectangular plate of cross section 60 mm wide is subjected to a tensile load of 54 k N. Determine suitable thickness of the plate if it is made of c 40 Steel. assume FOS as 2.5.	*3*	*1,3,4*	**06**
			OR			
2	a)		Derive the Soderberg's relation for the members subjected to variable stresses	*2*	*2*	**06**
	b)		A steel member of circular cross section is subject to a torsional stress ranging from zero to 35 MPA and at the same time it is subject to axial stress ranging from -14 to 28 MPA neglecting stress concentration and column effect and assuming maximum stress of both kinds occur at the same time determine maximum Equivalent shear stress FOS based on the yield stress the material as an endurance limit of 206 MPa and yield strength of 480 MPa. The diameter of the member is less than 12 mm take load correction factor and surface correction factor as 1.	*3*	*1,3,4*	**14**
			UNIT - II			
3	a)		Design a rigid flange coupling to transmit 18 kW at 1440 rpm. the allowable shear stress for CI flange is 4MPa. the shafts , keys and bolts are made of annealed Steel having allowable shear stress of 93 MPa. Allowable crushing stress for key is 186 MP a.	*3*	*1,3,4*	**10**

		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.	*3,4*	*1,3,4, 12*	**10**
			UNIT - III			
	4	a)	Derive an expression for beam strength of a spur gear tooth using standard notation.	*2*	*2*	**10**
		b)	A pair of mating spur gears have 20º 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	*3,4*	*1,3,4, 12*	**10**
			OR			
	5		Design a pair of spur gears to transmit power of 18 kW from a shaft running at 1000 rpm to a parallel shaft to be run at 250 rpm maintaining a distance of 160 mm between the shaft centres. Suggest suitable hardness for the pair of gears.	*3,4*	*1,3,4, 12*	**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.	*3,4*	*1,3,4, 12*	**10**
		b)	A section of commercial shaft 2 m long between bearings carries a 900 N pulley at its midpoint. The shaft transmits 21 kW at 300 rpm. The belt drive is horizontal. The sum of tensions is 6 kN. Find suitable diameter of shaft and angle of twist between the bearings. take G as 80 GPa.	*3,4*	*1,3,4, 12*	**10**
			UNIT - V			
	7	a)	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 k N, and engine speed 200 rpm.	*2*	*2*	**15**
		b)	Explain hydrodynamic theory of lubrication	*3,4*	*1,3,4, 12*	**05**

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