Exam Date & Time: 05-May-2024 (02:30 PM - 05:30 PM)





MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2024 DESIGN OF MACHINE ELEMENTS [MIE 2221]

Marks: 50

2)

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A flat plate subject to a tensile force of 5 kN is shown Fig. 1. The plate material is grey cast iron having an ultimate tensile strength of 200 MPa. Determine the thickness of the plate by considering the effect of stress concentration. Take factor of safety as 2.5. All dimensions are in mm.



A crane hook having an approximate trapezoidal cross-section is shown in Fig. 2. It is made of plain carbon steel 45C8 ($\sigma_y = 380 \text{ N/mm}^2$) and the factor of safety is 3.5. Determine the load carrying capacity of the hook. All dimensions are in mm.

(5)

Duration: 180 mins.



- 3) A C50 steel shaft (σ_y =392.3 MPa, σ_u =706.1 MPa) transmitting 15 kW at 210 rpm is supported between two bearings 750 mm apart has two gears keyed to it. The pinion having diameter of 144 mm is located 100 mm to the left of right bearing. This gear delivers power to the right when viewed from the lefthand bearing. The gear having 480 mm diameter is located 150 mm to the right of left bearing and receives power from a pinion from below. Take C_m=1.75, C_t=1.25 and pressure angle as 18⁰. Design the shaft for its diameter.
- 4) A welded connection of steel plates as shown in the Fig. 3 is subjected to an eccentric load of 10 kN. Determine the throat dimension of weld, if permissible shear stress is limited to 95 MPa. All dimensions are in mm.



Fig. 3

5)

A pair of high-grade cast-iron (allowable static stress of 103 MPa and BHN = 180) spur gears with 20^0 (10) full depth teeth transmit 8 kW at 900 rpm of the pinion. The speed ratio required is 4 and the pinion has

5/11/24, 5:16 PM	MIE 2221	
	20 teeth. Design the gears by considering strength and check for dynamic and wear loads. Assume service factor as 1.	
6)	A full journal bearing supporting a shaft running at 750 rpm is carrying a load of 8000 N. The oil used has a viscosity of 8 cP at 80° C and ambient temperature is 30° C. The journal is made of soft steel and bearing is made of Babbitt. Determine the proportions of the bearing and check the design from heat dissipation point of view. Assume heavy construction well ventilated bearing with c/r = 0.001 and L/D=1.5.	(5)
7)	Select a suitable ball bearing for the shaft of an axial flow compressor having the following details: F_r = 2000 kN, F_a =1500 kN, speed = 1000 rpm, diameter = 40 mm. Bearing life is 50 hours per week for 4 years.	(5)
8)	Write any five advantages of belt drives over other types of drives.	(5)

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