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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E.
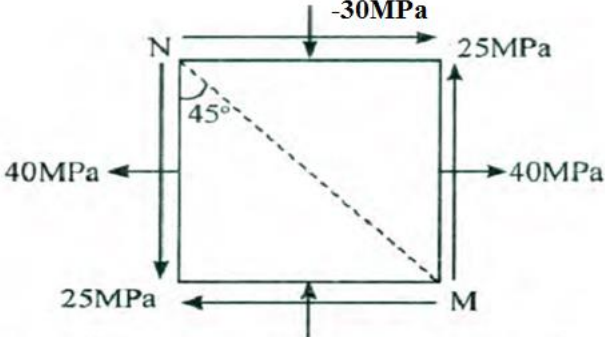**Branch: Mechanical Engineering**
Course Code: 22ME4PCDM1
Course: Design of Machine Elements - 1

Semester: IV
Duration: 3 hrs.
Max Marks: 100

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

			UNIT - 1	*CO*	*PO*	**Marks**
1	a)		i. Discuss the factures influencing the selection of appropriate value of a factor of safety. ii. Define standard and Codes	*CO1*	*PO1*	**05**
	b)		Point in a structural member is subjected to plane state of stress as shown in Fig. l(b). Determine the following: i) Normal and tangential stress intensities at an angle of θ= 45° ii)Principal stresses and their directions. Fig1(b)	*CO1*	*PO1*	**08**
	c)		A shaft is stepped down from 80 mm diameter to 40 mm diameter with a fillet radius of 6 mm. Determine the maximum stress induced in the shaft when subjected to; (i) Bending moment of 200Nm. (ii) Twisting moment of 400Nm.	*CO1*	*PO2*	**07**
			OR			
2	a)		A circular rod of diameter 50 mm is subjected to loads as shown in Fig. 2. Determine the nature and magnitude of stress at the critical points.	*CO1*	*PO2*	**12**

Fig.2

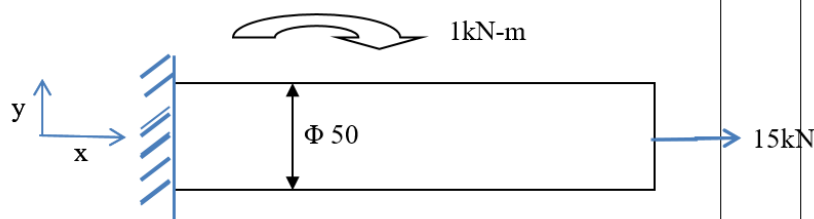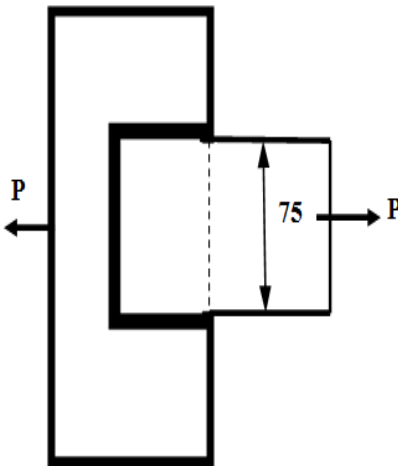|					
	b)	An infinite plate with an elliptical cut-out having major axis of 60 mm and minor axis of 30 mm is subjected to uniaxial tension. Determine the stress concentration factor when i) Load is at right angle to the major axis ii) Load is parallel to the major axis	CO1	PO2	**08**
		UNIT-2			
3	a)	i. Define endurance limit and list out the types of variable stress What are the causes of fatigue failure	CO2	PO1	**06**
	b)	A hot rolled steel shaft is subjected to a tensional load that various from 330Nm clockwise to 110Nm counter clockwise as an applied bending moment at a critical section varies from +440Nm to -220Nm. The shaft is of uniform c/s and no key way is present at the critical section. Determine the required shaft diameter, the material has a σ_u=550N/mm^2, σ_y =410N/mm^2, FOS is 1.5. Choose endurance limit as half the ultimate strength. Assume A=1, B=0.85, C=0.62 for bending and A=0.6 for torsion.	CO2	PO2	**14**
		UNIT-3			
4	a)	A steel solid shaft transmitting 15kW at 200rpm is supported on two bearing750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54Mpa in shear. Determine the diameter of the shaft.	CO3	PO2	**15**
	b)	In a flange coupling used to connect two coaxial shafts of diameter 80 mm to transmit 60KW at 200rpm,6 bolts of M14x1.5 on a bolt circle diameter of 210 mm is used. If the flange thickness is 20 mm and the hub diameter is 145 mm. Determine; (i)Shear stress induced in the shaft,(ii)Shear stress induced in the bolt,(iii)Shear stress induced in the flange.	CO3	PO2	**05**
		OR			
5	a)	With usual notations prove that a square key is equally strong both in shear and crushing.	CO3	PO3	**10**
	b)	Design a bush and pin type flexible coupling to transmit 12 kW at 500 rpm by considering the following stresses. i) Bearing pressure on the rubber bush is 0.7 N/mm^2	CO3	PO3	**10**

		ii) Permissible shear stress in the key and bush is 65 N/mm^2 iii) Permissible crushing stress in the key is 130 N/mm^2 iv) Permissible maximum stress in the pin is 130 N/mm^2			
		UNIT - 4			
6	a)	A double riveted lap joint (chain type) is to be made of 10mm plates. Design the riveted joint if the safe working stresses in tearing Of plates, shearing &crushing Are 124MPa, 93MPa&165MPa respectively. Add a neat sketch of the joint showing the important design parameters.	CO3	PO2	**10**
	b)	A plate 75 mm wide and 12.5 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in Fig4(b). And shear stresses are 70MPa and 56 MPa, respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading. Fig4(b)	CO3	PO2	**10**
		UNIT-5			
7	a)	Explain self -locking and overhauling of power screw?	CO3	PO1	**08**
	b)	A triple-threaded power screw used in a screw jack, has a nominal diameter of 50 mm and a pitch of 8 mm. The threads are square and the length of the nut is 48 mm. The screw jack is used to lift a load of 7.5 KN. The coefficient of friction at the threads is 0.12 and the collar friction at the threads is 0.12 and the collar friction is negligible. Calculate, i). The principal shear stress in the screw body ii.) The transverse shear stresses in the screw and the nut, and iii.) The unit bearing pressure. Iv)Also state whether the screw is self-locking	CO3	PO2	**12**

****