U.S.N.										

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

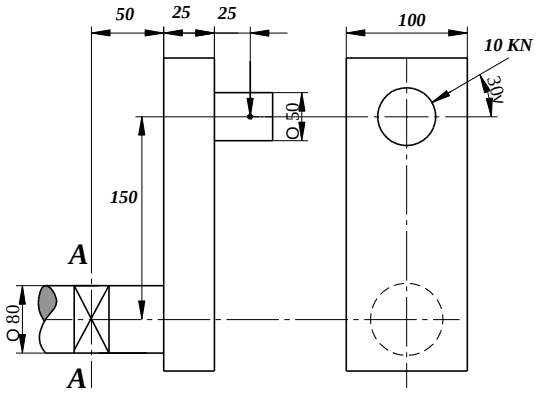
Autonomous Institute Affiliated to VTU

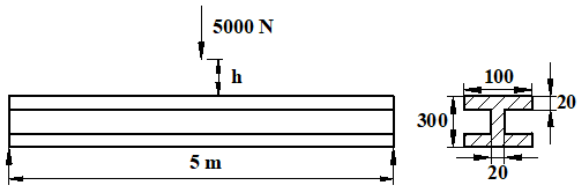
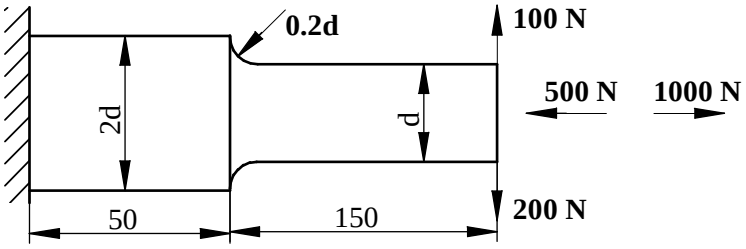
August 2024 Semester End Main Examinations

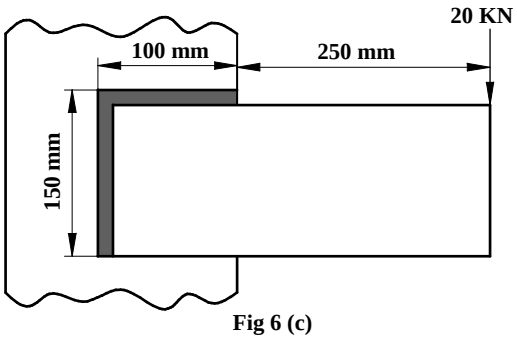
Programme: B.E. **Semester: IV**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 23ME4PCDM1 / 22ME4PCDM1 **Max Marks: 100**
Course: Design of Machine Elements -I

Instructions: 1. Answer any FIVE full questions, as per the choice indicated.
2. Missing data, if any, may be suitably assumed.
3. **Use of design data handbook is permitted.**

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 a stress tensor. On a rectangular stress element show the triaxial stress components and the corresponding stress tensor.	CO1	PO1	**06**
	b)	Determine the maximum normal stress and the maximum shear stress at section A-A for the overhung crank shown in fig. Neglect the effect of transverse shear. 	CO1	PO2	**08**
	c)	What are theories of failure? Explain their significance. Also name the important theories of failure.	CO1	PO1	**06**
		OR			
2	a)	Define stress concentration and stress concentration factor. Discuss the methods to minimize the effect of stress concentration with relevant sketches.	CO1	PO1	**10**
	b)	A beam of symmetrical I-section of flange width 100 mm, total depth 300 mm & uniform thickness 20 mm is resting on two supports 5m apart. It is loaded by a weight of 5000 N falling through a height 'h' and striking the beam at its mid-point. Modulus of elasticity is 210 GPa. Determine the permissible value of ***h*** if the stress is limited to 130 MPa.	CO1	PO2	**10**

						
			UNIT - II			
3	a)		Derive Soderberg's equation for design of a component subjected to fluctuating load taking all the modifying factors into account.	*CO2*	*PO1*	**08**
	b)		Determine the required diameter d for the steel cantilever member loaded as shown based on a factor of safety 2. The yield strength and endurance strength of the material of the beam are 480 MPa and 270 MPa respectively. Take the surface factor as 0.9 and size factor 0.8.  **Fig 3 (b)**	*CO2*	*PO3*	**12**
			UNIT - III			
4	a)		Give the ASME code recommendations for the values of maximum normal & maximum shear stress for shafts.	*CO3*	*PO1*	**06**
	b)		A horizontal piece of commercial shafting is supported between two bearings 1.5 m part. A keyed gear 20^0 involute gear of 175 mm diameter is located 400 mm to the left of the right bearing and is driven by a gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The ratio of tensions of the belt drive is 3:1. The shaft rotates clockwise when viewed from the right-side bearing. The drive transmits 45 kW at 330 rpm. Assuming that $K_b=K_t=1.5$, calculate the necessary diameter of the shaft and angular twist in degrees. Use allowable shear stress 40 MPa & G=80 GPa.	*CO3*	*PO3*	**14**
			OR			
5	a)		What are the purposes of shaft couplings? Give the classification of couplings.	*CO3*	*PO1*	**06**

		b)	In a flange coupling used to connect two coaxial shafts of diameter 80 mm to transmit 60 kW at 200 rpm, 6 bolts of M14x1.5 on a bolt circle diameter of 210 mm are 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*	**08**
		c)	What is a 'cotter joint'? Mention its practical applications, merits & demerits.	*CO3*	*PO1*	**06**
			UNIT - IV			
	6	a)	List and explain the various failure modes of a riveted joint with neat sketches.	*CO3*	*PO1*	**08**
		b)	Mention the advantages of welded joints	*CO3*	*PO1*	**04**
		c)	Determine the size of the weld shown, if permissible shear stress τ = 75 MPa  **Fig 6 (c)**	*CO3*	*PO2*	**08**
			UNIT - V			
	7	a)	Discuss the various types of stresses in threaded fastener screws.	*CO3*	*PO1*	**06**
		b)	The jaws of a machine vice weigh 5000 N and are slided by a double start acme thread, 50 mm diameter and 8 mm pitch at a speed of 0.8m/min. The coefficient of thread friction is 0.14 and that of the collar friction is 0.15. The mean diameter of the thrust washer is 56 mm. Determine the power of the motor required in kW and the efficiency of the drive.	*CO3*	*PO3*	**10**
		c)	Explain self-locking & overhauling of power screws. What is the condition for self-locking of screws?	*CO3*	*PO1*	**04**

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