Code No: P18MET11

HALL TICKET NUMBER

PACE INSTITUTE OF TECHNOLOGY & SCIENCES::ONGOLE

(AUTONOMOUS)

III B.TECH I SEMESTER END SUPPLEMENTARY EXAMINATIONS, MARCH/APRIL – 2023

DESIGN OF MACHINE ELEMENTS-I

(ME Branch)

Time: 3 hours Max. Marks: 60

Note: Question Paper consists of Two parts (Part-A and Part-B)

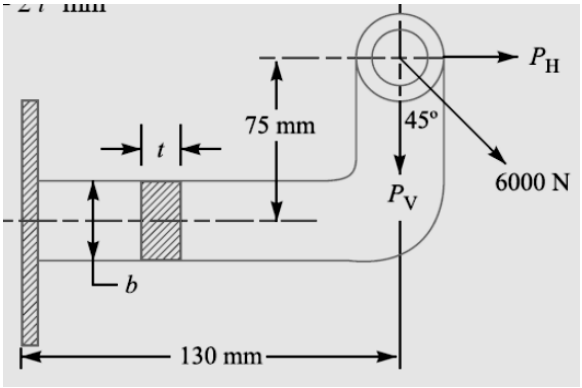
PART-A

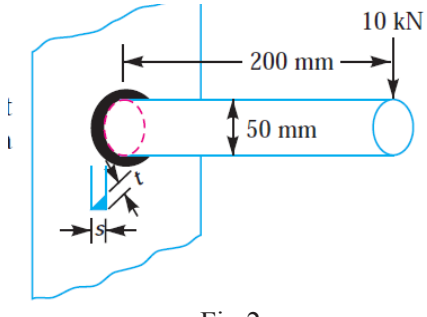
Answer all the questions in Part-A (5X2=10M)

Q.No.		Questions	Marks	CO	KL
1.	a)	Define tolerance and fit	[2M]	1	1
	b)	Define stress concentration and notch sensitivity?	[2M]	2	1
	c)	Explain any two types of welding joints with neat sketch	[2M]	3	2
	d)	Define equivalent twisting moment and equivalent bending moment?	[2M]	4	1
	e)	Write different applications of springs?	[2M]	5	2

PART-B

Answer One Question from each UNIT (5X10=50M)

Q.No.		Questions	Marks	CO	KL
		UNIT-I			
2.	a)	Explain general procedure in machine design?	[5M]	1	2
	b)	A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. The maximum shear stress; and 2. The maximum distortion strain energy theory of yielding.	[5M]	1	4
		OR			
3.	a)	Explain different types of fits?	[5M]	1	3
	b)	A mild steel bracket as shown in Fig. 1, is subjected to a pull of 6000 N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60 MPa.  Fig.1	[5M]	1	4
		UNIT-II			
4.	a)	Explain S-N curve for mild steel?	[3M]	2	3

	b)	A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to 4 P. The span of the beam is 500 mm and its cross-section is circular with a diameter of 60 mm. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9.	[7M]	2	4
		OR			
5.	a)	Explain Goodman failure theory.	[5M]	2	3
	b)	A hot rolled steel shaft is subjected to a torsional moment that varies from +350 Nm to -115 Nm and an applied bending moment at a critical section varies from 445 Nm to 225 Nm. The shaft is of uniform cross section. Determine the required shaft diameter. The material has an ultimate strength of 550 MPa and yield strength of 410 MPa. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and a surface finish factor of 0.62. (Using Goodman's	[5M]	2	4
		UNIT-III			
6.	a)	Explain different types of failures in riveted joint with neat sketches?	[5M]	3	3
	b)	Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 56 MPa.	[5M]	3	4
		OR			
7.	a)	Derive the strength of the transverse fillet welded joints?	[5M]	3	3
	b)	A 50 mm diameter solid shaft is welded to a flat plate as shown in Fig.2 10.25. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld.  Fig.2	[5M]	3	4
		UNIT-IV			
8.	a)	45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 Mpa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2.	[5M]	4	3
	b)	Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.	[5M]	4	4
		OR			

9.		A shaft is supported on bearings A and B, 800 mm between centres. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3 : 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa.	[10M]	4	4
		UNIT-V			
10.	a)	Write the design procedure for split-muff coupling with neat sketch	[5M]	5	3
	b)	Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : Shear stress for shaft, bolt and key material = 40 MPa Crushing stress for bolt and key = 80 MPa Shear stress for cast iron = 8 MPa Draw a neat sketch of the coupling.	[5M]	5	4
		OR			
11.	a)	Derive the energy storage in helical springs with circular wire?	[5M]	5	3
	b)	A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400 N to 1000 N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, find : 1. Size of the spring wire, 2. Diameters of the spring, 3. Number of turns of the spring, and 4. Free length of the spring. The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80 kN/mm^2.	[5M]	5	4

******