

PRN No.	
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PAPER CODE	U314 - 2114 (ESE)
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(AY:2024-25) December 2024 (ENDSEM) EXAM

TY BTECH (SEMESTER - I)

COURSE NAME: DESIGN OF MACHINE  
ELEMENTS

BRANCH: MECHANICAL COURSE CODE: MEUA31204

(PATTERN 2020)

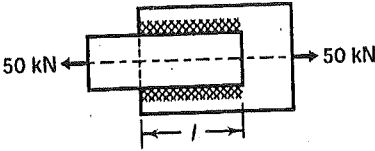
Time: [1Hr 30 Min]

[Max. Marks: 40]

(\*) Instructions to candidates:

- 1) Figures to the right indicate full marks. Use of scientific calculator is allowed
- 2) Use suitable data wherever required
- 3) All questions are compulsory. Solve any two sub question each from Questions 1 and 2
- 4) Solve any one sub question (2 marks) from Questions 3 ,4 ,5 and 6 and sub question of 4 marks is compulsory from questions 3,4,5 and 6

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) Explain the fundamental process for a knuckle joint design.	[4]	1	2
	b) Discuss the numbers of R20/4 (100, ...,1000) derived series.	[4]	1	2
	c) Two rods are connected by means of a cotter joint. The inside diameter of the socket and outside diameter of the socket collar are 50 and 100 mm respectively. The rods are subjected to a tensile force of 50 kN. The cotter is made of steel 30C8 (Syt = 400 N/mm <sup>2</sup> ) and the factor of safety is 4. The width of the cotter is five times of thickness. Determine: (i) width and thickness of the cotter on the basis of shear failure; and (ii) width and thickness of the cotter on the basis of bending failure.	[4]	1	2
Q2	a) A shaft is transmitting 97.5 kW at 180 rpm. If the allowable shear stress in the material is 60 MPa, Determine the suitable diameter for the shaft on the basis of strength and stiffness. The shaft should not to twist more than 10 in a length of 3 meters. Take G = 80 GPa.	[4]	2	2
	b) Consider a square key for fixing a pulley on the shaft, which is 50 mm in diameter. The pulley transmits 10 Kw power at 200 rpm to the shaft. The key is made of steel 45C8 (Syt= Syc = 380 N/mm <sup>2</sup> and FOS is 3. Find the dimensions of the key. Assume Ssy = 0.577 Syt.	[4]	2	2
	c) Discuss the bushed pin flexible coupling design.	[4]	2	2

Q3	a) Define the nominal, core and mean diameter of power screw. OR	[2]	3	2
	b) Summarize the screw jack assembly terms.	[2]	3	2
	c) A double-threaded power screw, with ISO metric trapezoidal threads is used to raise a load of 300 kN. The nominal diameter is 100 mm and the pitch is 12 mm. The coefficient of friction at the screw threads is 0.15. Neglecting collar friction, calculate (i) torque required to raise the load; (ii) torque required to lower the load and (iii) efficiency of the screw.	[4]	3	2
Q4	a) Produce the types of welded joints. OR	[2]	4	
	b) Present an introduction to threaded joints.	[2]	4	
	c) A steel plate, 100 mm wide and 10 mm thick, is welded to another steel plate by means of double parallel fillet welds as shown in Fig. The plates are subjected to a static tensile force of 50 kN. Determine the required length of the welds if the permissible shear stress in the weld is 94 N/mm <sup>2</sup> .	[4]	4	
				
Q.5	a) Demonstrate the types of springs. OR	[2]	5	
	b) Describe in short, the surge in springs.	[2]	5	
	c) A helical compression spring, made of circular wire, is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends and assume the gap is 0.5 mm between coils. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1050 N/mm <sup>2</sup> and modulus of rigidity of 81370 N/mm <sup>2</sup> . The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate (i) wire diameter; (ii) mean coil diameter; (iii) number of active coils; (iv) total number of coils; (v) solid length of the spring.	[4]	5	
Q.6	a) Interpret the equations for stresses in pressure vessels. OR	[2]	6	
	b) List the stress equation resulting from seismic loads.	[2]	6	
	c) The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packing and stuffing box is equivalent to 10% of the operating force. The pressure in	[4]	6	

	the cylinder is 10 MPa. The cylinder is made of cast iron FG 200 and the factor of safety is 5. Determine the diameter and the thickness of the cylinder.			
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Note: [BT Level: 1- Remember; 2-Understand; 3-Apply; 4-Analyse; 5-Evaluate; 6- Create]

