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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: ME401

Course Name: DESIGN OF MACHINE ELEMENTS – I

Max. Marks: 100 Duration: 3 Hours

Use of approved design data book is permitted

PART A

Answer any two full questions, each carries 15 marks.

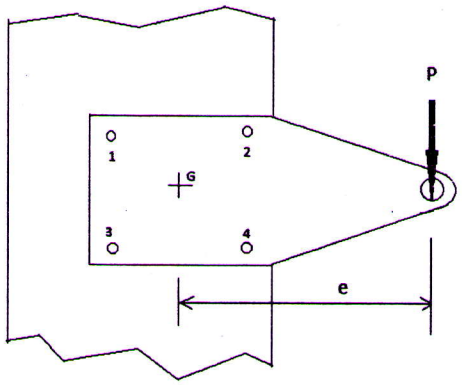
			Marks
1	a)	Explain the steps involved in the design process.	(2)
	b)	What is factor of safety? What are the factors affecting factor of safety?	(4)
	c)	What are the endurance strength modification factors?	(3)
	d)	Explain the effect of stress concentration on ductile and brittle materials under static and variable loading.	(6)
2	a)	Explain impact factor.	(2)
	b)	A 50 mm diameter steel shaft with a 20 mm transverse hole is simultaneously subjected to a bending stress which varies from + 100 MPa to – 70 MPa. and a torsional stress which varies from + 80 MPa to -50 MPa. Find the factor of safety for infinite life assuming the following properties. Ultimate strength in tension 800MPa, Yield strength 550MPa. Surface correction factor = 0.85, size factor =0.85 and Notch sensitivity factor = 0.9. Use maximum distortion energy theory.	(13)
3	a)	How will you design a component made of steel subjected to variable load for a finite life?	(4)
	b)	A carbon steel rod of circular cross section is subjected to a bending moment which varies from 300 Nm to 500 Nm and an axial load which varies from 6 kN to 9 kN .Determine the diameter of the rod for a factor of safety of 3.Take σ_u= 600 MPa, σ_y=400 MPa	(11)

PART B

Answer any two full questions, each carries 15 marks.

4	a)	What is the tensile stress area of screw thread?	(2)
	b)	Determine the safe tensile load for M12,M20 and M30 coarse grade bolts, assuming a safe tensile stress of 43 MPa.	(3)
	c)	A plate as shown in figure below is subjected to an eccentric force (P) of 15 kN	(10)

with an eccentricity (e) of 450 mm from the CG of the bolts. The centre distance between bolts 1 and 2 is 210 mm, and the centre distance between bolts 1 and 3 is 150 mm. All the bolts are identical. The bolts are made from plain carbon steel 25C8 and the factor of safety is 2.5. Find the size of the bolts.



5 Design a screw jack using C40 carbon steel having a capacity of 15 kN to lift 250 mm height. Take a factor of safety of 4. (15)

6 a) Explain with sketches confined and unconfined gaskets. (2)

b) Explain the effect of confined and unconfined gaskets on the spring constant. (2)

c) Two plates bolted to form an assembly is initially tightened by a spanner so as to induce a preload of 3 kN in the bolt. Then it is subjected to an external load of 8 kN .The bolt with coarse thread, made of plain carbon steel is having a tensile yield strength of 400 MPa. The effective stiffness of the parts held together by the bolt is 3 times the stiffness of the bolt. Determine the size of the bolt assuming a factor of safety of 3. (11)

PART C

Answer any twofull questions, each carries 20 marks.

7 a) Derive the expression for the stress in graduated semi-elliptical leaf spring. (5)

b) A railway wagon weighing 3 tons is moving with a velocity of 3 m/s. It is brought to rest by two buffer springs of diameter 200 mm. The maximum deflection allowed is 160 mm. The allowable shear stress in spring material is 600 MPa. Take G=84 GPa. Design the spring. (15)

8 a) How to ensure alignment of shaft before fixing coupling bolts in a flange (3)

couplings?

b) Distinguish between rigid and flexible coupling (5)

c) A rectangular sunk key 14 mm wide, 10 mm thick and 75 mm long is required to transmit 1200 N-m torque from a 50 mm diameter solid shaft. Determine whether the length is sufficient or not if the permissible shear stress and crushing stress are limited to 56 MPa and 168 MPa respectively. (12)

9 a) What is critical speed of a shaft? (2)

b) Explain shock and fatigue factor. (3)

c) Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 rpm. The angle of lap of the belt is 180^0 and the coefficient of friction between the belt and pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0. The allowable shear stress in the shaft may be taken as 35 MPa. (15)

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