



ROLL NO: _____

PRESIDENCY UNIVERSITY, BENGALURU
SCHOOL OF ENGINEERING

Weightage: 20 %

Max Marks: 40

Max Time: 1 hr.

Saturday, 22 September, 2018

TEST – 1

Odd Semester 2018-19 Course: **MEC 210 Design of Machines Elements-I** V Sem. Mechanical

Instruction:

- (i) Read the question properly and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.
- (iv) Design hand book is permitted

Part A

(3 Q x 4 M = 12 Marks)

1. State maximum shear stress theory of failure.
2. Determine the required thickness of the steel bracket at section A-A, when loaded as shown in Fig.1. in order to limit the tensile stress to 100 N/mm^2 . All dimensions are in mm.

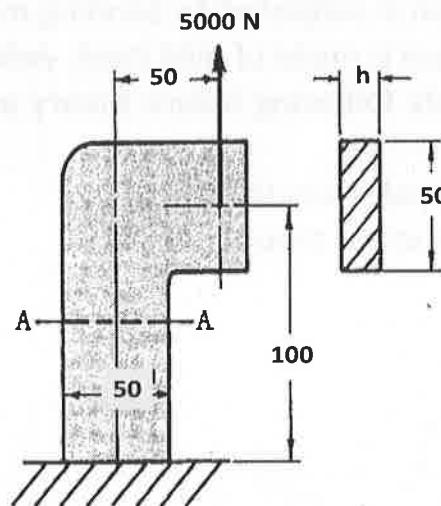


Fig.1

3. What are the methods of reducing stress concentration?

Part B

(2 Q x 8 M = 16 Marks)

4. A machine element is subjected to bi-axial stress shear stress as shown in Fig.2. Determine the maximum shear stresses.

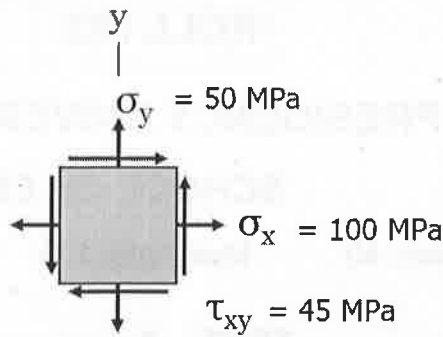


Fig.2

5. A circular bar subjected to a axial load of 5 k N is shown in Fig.3. If the $D = 2d$ mm, $r = 0.1d$ mm and factor of safety is 2. Determine the diameter (d) of the beam. ($\sigma_{ut} = 200 \frac{N}{mm^2}$).

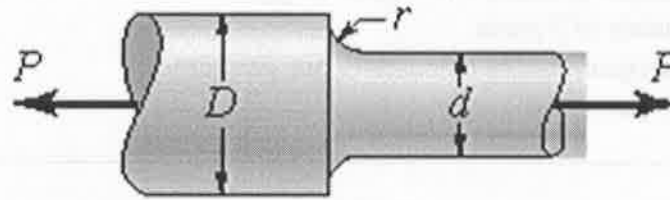


Fig.3.

Part C

(1Q x 12 M = 12 Marks)

6. A bar of circular cross section is subjected to bending moment 20 N.m and twisting moment of 12 N.m . The beam is made of mild steel, yield strength is 370 N/mm^2 and factor of safety is 1.85. Apply following failure theory and find out the diameter of the circular beam.
- Maximum principal stress theory
 - Maximum shear stress theory



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TEST 2

Odd Semester: 2018-19

Course Code: MEC 210

Course Name: Design of Machine Elements-I

Branch & Sem: MEE & V Sem

Date: 24 November 2018

Time: 1 Hour 15 minutes

Max Marks: 40

Weightage: 20%

Instructions:

- (i) Read the question properly and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and Non-programmable calculators are permitted.
- (iv) Design hand book is permitted

Part A

Answer **all** the Questions. **Each** question carries **four** marks. (2x4=8)

1. The standard cross-section for a flat key, which is fitted on a 50 mm diameter shaft, is 16x10 mm. The key is transmitting 475 N-m torque from the shaft to the hub and is made of commercial steel with yield strength 230 N/mm². Determine the length of key, if the factor of safety is 3
2. Derive the Soderberg Equation for the component subjected to fluctuating load.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (2x10=20)

3. Design a protected type cast iron flange coupling for a steel shaft transmitting 30 kW at 200 rpm. The allowable shear stress in the shaft and key material is 40 N/mm². The maximum Torque transmitted to be 20% greater than the full load torque. The allowable shear stress in the bolt is 60 N/mm² and allowable shear stress in the flange is 40 N/mm².
4. A connecting rod is subjected to an axial load that fluctuated from 120 kN tension to 60 kN Compression. The material has a ultimate stress is 480 N/mm² yield stress of 360 N/mm² and normal endurance stress of 300 N/mm². Taking factor of safety as 2.1, find suitable diameter of the connecting rod.

Part C

Answer the Question. Question carries **twelve** marks.

(1x12=12)

5. A solid shaft 900 mm long between bearings receives 18 kW of power at 900 rpm through a 20° involute spur gear of diameter 200 mm, located at 200 mm to the right of left bearing. It is driven by another gear with downward tangential force. The power is transmitted by a 400 mm diameter pulley downward. The pulley is located at 300 mm to the left of right bearing. The tensions' ratio is 3. Find suitable diameter of the shaft taking the allowable shear stresses as 50 MPa. $C_m = 1.5$ $C_t = 1.5$

Roll No.

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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Odd Semester: 2018-19

Course Code: MEC 210

Course Name: Design of Machine Element - I

Programme & Sem: MECH & V Sem

Date: 27 December 2018

Time: 2 Hours

Max Marks: 80

Weightage: 40%

Instructions:

- (i) Read the question properly and answer accordingly.
- (ii) All questions are compulsory
- (iii) Scientific and Non-programmable calculators are permitted.
- (iv) Use of Design hand book is allowed

Part A

Answer **all** the Questions. **Each** question carries **five** marks.

(4Qx5M=20)

1. Derive an equation for the torque required to lower the load in square threaded screw with usual notation:-
2. Explain the modes of failure in riveted joint.
3. It is required to design a square key for fixing a gear on a shaft of 25 mm diameter. The shaft is transmitting 15 kW power at 720 rpm to the gear. The key is made of steel 50C4 ($S_{yt} = 460 \text{ N/mm}^2$) and the factor of safety is 3. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key.
4. Write different types of welded joints. What are advantages of welded joints over riveted joints?

Part B

Answer **all** the Questions. **Each** question carries **ten** marks.

(4Qx10M=40)

5. Design a triple riveted longitudinal butt joint with equal width of cover plates for a boiler of diameter 1200 mm subjected to an internal pressure of 0.9 MPa. A joint efficiency of 75% can be assumed at this stage. For practical reason the pitch of rivets is to be restricted, a value not less than 3d and not more than 3.5d where d is the diameter of rivet. $\sigma_t = 120 \text{ MPa}$, $\tau = 80 \text{ MPa}$, $\sigma_c = 160 \text{ MPa}$.
6. It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 60 kN. The rods are co-axial and a small amount of angular movement

between their axes is permissible. Design the joint and specify the dimensions of its components. $\sigma_t = 100 \text{ MPa}$, $\tau = 60 \text{ MPa}$, $\sigma_c = 130 \text{ Mpa}$.

7. A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2 , find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw and length of nut.
8. An eccentrically loaded bracket is welded to the support as shown in Fig.1. The permissible shear stress for the weld material is 55 N/mm^2 and the size of weld in 10mm. load is static. Determine how much force to be applied on the bracket.

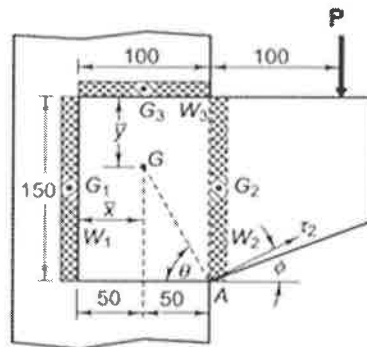


Fig.1

Part C

Answer **both** the Questions. **Each** question carries **ten** marks. (2Qx10M=20)

9. A bracket, as shown in Fig.2. carries a load of 20 kN. Find the size of the weld if the allowable shear stress is not to exceed 80 MPa .
10. A bracket is attached to a steel channel by means of four identical rivets as shown in Fig.3. Determine the diameter of rivets, if the permissible shear stress is 80 N/mm^2 .

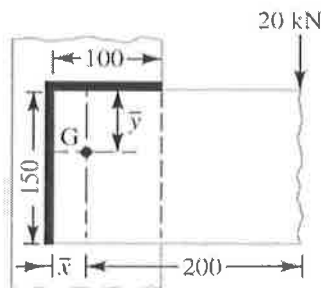


Fig. 2

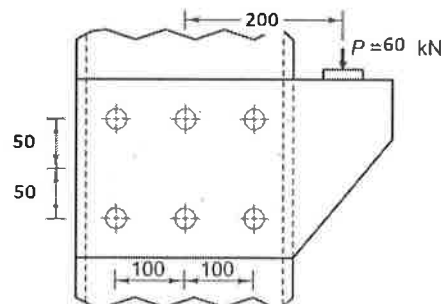


Fig. 3