



Code No. : 5185/S

FACULTY OF ENGINEERING
B.E. 3/4 (M/P/AE) I Semester (Suppl.) Examination, June 2012
DESIGN OF MACHINE ELEMENTS

Time: 3 Hours]

[Max. Marks : 75

Note : Answer all questions from Part A. Answer any five questions from Part B.

PART – A

25

1. List the design considerations of machine elements. 3
2. What are preferred numbers ? Explain their importance in design. 3
3. What is stress concentration ? 2
4. Briefly explain Miner's rule. 2
5. What is an axle ? How it differs from a shaft ? 2
6. Differentiate between rigid coupling and flexible coupling. 2
7. What is the purpose of using a gib along with a cotter in a cotter joint ? 2
8. What is the effect of gasket, on the resultant load on the bolt, in a bolted joint ? 3
9. Differentiate between boiler and structural joints. 3
10. What is an eccentrically loaded welded joint ? 3



PART – B

50

11. A bolt is subjected to an axial pull of 10 kN and a transverse shear force of 5 kN. The yield strength of the bolt material is 300 MPa. Considering a factor of safety of 2.5, determine the diameter of the bolt, using

- i) Maximum normal stress theory,
- ii) Maximum shear stress theory, and
- iii) Maximum principal strain theory.

Take Poisson's ratio as 0.25.

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12. A leaf spring in an automobile is subjected to cyclic stresses. The mean stress is 150 MPa. Amplitude of stress is 5 MPa. Estimate under what factor of safety the spring is working, by Goodman and Soderberg considerations ? Ultimate strength of the material is 300 MPa. Yield strength of the material is 200 MPa. Endurance limit is 150 MPa.

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13. An overhang shaft carries a 1 m diameter pulley, whose centre is 250 mm from the centre of the nearest bearing. The weight of the pulley is 600 N and the angle of lap of the belt may be assumed as 180° . The pulley is driven by a motor, placed below it, at an angle of 45° . If the permissible tension in the belt is 2500 N and coefficient of friction is 0.3, determine the size of the shaft. Assume the permissible shear stress in the shaft material as 50 MPa. Take shock and fatigue factors for torsion and bending as 2 and 1.5 respectively. State the position of the motor so that the size of the shaft required is the least, and also determine its size.

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14. Design a cotter joint of socket and spigot type, which may be subjected to a pull or push of 30 kN. All the parts of the joint are made of the same material with the permissible stresses 55 MPa in tension, 70 MPa in compression and 40 MPa in shear.

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15. A boiler is made by welding the plates longitudinally and circumferentially. The diameter of the boiler is 1m. The maximum pressure is 1.5 N/mm^2 . Design both the joints using single - V butt weld for both the joints. The permissible tensile stress in the plate material is 30 MPa. Assume that the strength of the plate and weld is same. 10
16. a) A shaft is subjected to twisting and bending moments of 1500 N-m and 1000 N-m respectively. If the permissible stresses are 65 MPa in tension (compression) and 45 MPa in shear; determine the diameter of the shaft. 5
- b) A 30 kW power is transmitted at 240 rpm from 40 mm diameter shaft by means of two Kennedy keys of $12 \times 12 \text{ mm}$ cross-section. Determine the length of the keys. For the keys, take permissible shear stress as 60 MPa, and crushing stress as 90 MPa. 5
17. Write short notes on : 10
- a) S-N diagrams.
 - b) Design of gasket joints.
 - c) Locking devices for nuts.