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**Question Paper Code : 31394**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010.

Fifth Semester

Mechanical Engineering

ME 1302 — DESIGN OF MACHINE ELEMENTS

(Regulation 2004)

(Common to B.E. (Part-Time) Fourth Semester – Regulation 2005)

Time : Three hours

Maximum : 100 marks

Use of approved design data book is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How do you classify materials for engineering use?
2. How is the working stress calculated from the yield stress of a material?
3. On what basis are the shafts designed?
4. What are the effects of introducing keyways in shafts?
5. What are the different stresses setup in a bolt due to initial tightening?
6. Why is reinforcement normally required in welded joints?
7. What are constant width and constant strength springs?
8. Name the applications of levers.
9. State the merits of hydrostatic bearings.
10. What is meant by coefficient of fluctuation of energy with reference to flywheels?

## PART B — (5 × 16 = 80 marks)

11. (a) A bolt is subjected to a tensile load of 25 kN and to a shear load of 10 kN. Suggest a suitable size of a bolt according to various theories of failure. Take allowable yield stress is  $300 \text{ N/mm}^2$ , Poisson's ratio is 0.25.

Or

- (b) A 50 mm diameter shaft is made from carbon steel having ultimate tensile strength of 600 MPa. It is subjected to a torque which fluctuates between 2000 N-m to -900 N-m. Using Soderberg method, calculate the factor of safety.
12. (a) A hollow shaft for a rotary compressor is to be designed to transmit a maximum torque of 3500 N-m. The shear stress in the shaft is limited to 50 MPa. Determine inside and outside diameters of the shaft, if the ratio of inside and outside diameters is 0.4.

Or

- (b) Design a protective type flange coupling to connect two shafts to transmit 15 kW at 600 rpm.
13. (a) The cylinder head of a steam engine is subjected to a steam pressure of  $0.7 \text{ N/mm}^2$ . It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa.

Or

- (b) A plate of 200 mm width is welded to a vertical plate by fillet welding on three sides to form a cantilever with an overlap of 150 mm and overhang of 400 mm. A vertical downward load of 35 kN is applied at free end for a weld stress of  $75 \text{ N/mm}^2$ . Determine the size of the weld.
14. (a) Design a closed coiled helical compression spring for a load range varying from 2.25 kN to 2.75 kN and corresponding axial deflection of 6 mm. Spring index is 5. Permissible shear stress is  $400 \text{ N/mm}^2$  and modulus of rigidity is  $80 \text{ kN/mm}^2$ .

Or

- (b) A foot lever is 1 m from the centre of shaft to the point of application of 800 N load. Find
- (i) Diameter of the shaft
  - (ii) Dimensions of the key
  - (iii) Dimensions of rectangular arm of foot lever at 60 mm from the centre of shaft assuming width of the arm as 3 times thickness.

The allowable tensile stress may be taken as 73 MPa and allowable shear stress as 70 MPa.

15. (a) A single row deep groove ball bearing operating at 2000 rpm is acted by a 10 kN radial load and 8 kN thrust load. The bearing is subjected to a light shock load and the outer ring is rotating. Determine the rating life of the bearing.

Or

- (b) The turning moment diagram of an engine has areas above and below the mean torque line of +530, -330, +380, -470, +180, -360, +350 and -280 sq.mm.

The scales of the diagram are :

Turning Moment : 1 mm = 1000 Nm

Crank angle = 1 mm = 6°

The mean speed is 150 rpm and the total fluctuation of speed is not to exceed 3% of the mean speed.

Design a suitable flywheel.