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Question Paper Code : 11041

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fifth Semester

Mechanical Engineering

080120025 – DESIGN OF MACHINE ELEMENTS

(Common to B.E. Automobile Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List any two factors that influence magnitude of factor of safety.
2. State maximum shear stress theory of failure.
3. How is the strength of a shaft affected by the keyway?
4. What is the use of register in a flange coupling?
5. How is a bolt designated?
6. Why are welded joints preferred over riveted joints?
7. Define surge in a spring.
8. What is nipping of a leaf spring?
9. List any two advantages of rolling contact bearings.
10. Define coefficient of steadiness.

PART B — (5 × 16 = 80 marks)

11. (a) A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of the bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to en durance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. (16)

Or

(b) A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 120 N-m, simultaneously; it is subjected to an axial thrust of 10 kN and a bending moment of 80 N-m. Calculate the maximum compressive and shear stresses. (16)

12. (a) A rigid type of coupling is used to connect two shafts transmitting 15 kw at 200 rpm. The shaft keys and bolts are made of C45 steel and the coupling is cast iron. Design the coupling. (16)

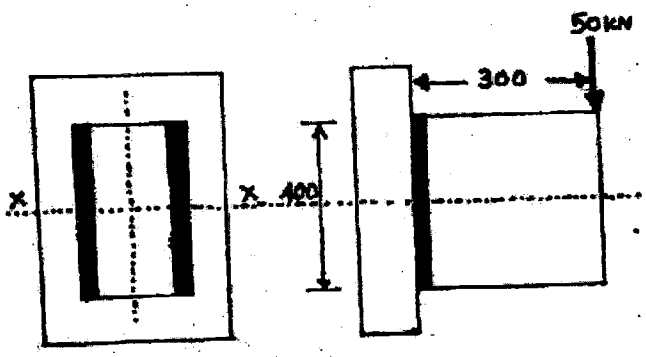
Or

(b) A turbine shaft transmits 500 kw at 900 rpm. The permissible shear stress is 80 N/mm^2 while twist is limited to 0.5° in a length of 2.5 m. Calculate the diameter of the shaft. Take $G = 0.8 \times 10^5$ N/mm^2. If the shaft chosen is hollow with d_i/d_o, = 0.6. Calculate the percentage of saving in material. (16)

13. (a) A steam engine cylinder has an effective diameter of 350 mm and the maximum steam pressure acting on the cylinder cover is 1.25 N/mm^2. Calculate the number and size of studs required to fix the cylinder cover. Assume the permissible stress in the studs to be 70 N/mm^2. (16)

Or

(b) A bracket is welded to the vertical plate by means of two fillet welds as shown in figure. Determine the size of the welds, if the permissible shear stress is limited to 70 N/mm^2. (16)



NOTE: DIMENSIONS ARE IN 'mm'

14. (a) A spring loaded safety valve for a boiler is required to blow-off at a pressure 1.5 N/mm^2. The diameter of the valve is 60 mm. Design a suitable compression spring for the safety valve, assuming spring index to be 6, and 25 mm initial compression. The maximum lift of the valve is 15 mm. The shear stress in the spring material is to be limited to 450 MPa. Take $G = 0.84 \times 10^5$ MPa. (16)

Or

(b) A foot lever is 1 m from the centre of the shaft to the point of application of 800 N load. Find

(i) Diameter of the shaft (5)

(ii) Dimensions of the key (5)

(iii) Dimensions of the rectangular arm of the foot lever at 60 mm from the centre of the 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. (6)

15. (a) Design a journal bearing for a centrifugal pump from the following data.

Load on the journal = 20 kN, Speed of the journal = 900 rpm, Type of oil is SAE 10 for which the absolute viscosity at 55°C = 0.017 kg/m-s, Ambient temperature of the oil is 15.5° C, Maximum bearing pressure for the pump = 1.5 N/mm^2. Calculate the mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited 10°C. Heat dissipation coefficient = 1232 W/m^2/°C. (16)

Or

(b) A multi cylinder engine is to run at a constant load at a speed of 600 rpm. On drawing the crank effort diagram to scale of 1 mm = 250 N-m and 1 mm 3°, the areas in square mm above and below the mean torque line were measured and found to be in order +160, –172, +168, –191, +197, and –162. The speed is to be kept within ± 1% of the mean speed of the engine. Determine the moment of inertia of the flywheel. (16)