C 22608 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE (2014 SCHEME) EXAMINATION, APRIL 2017

Mechanical Engineering

ME 14 604—MACHINE DESIGN—I

Time : Three Hours Maximum : 100 Marks

Part A

Answer any **eight** *questions.*
Each question carries 5 *marks.*

1. State advantages and limitations of standardization.
2. Give the factors influencing fatigue stress concentrations factor.
3. Name the different modes of failure of riveted joints with engineering applications.
4. What are stress concentrations in welded joints ? How to reduce the effects ?
5. Write about Wahl's stress factor for helcal springs.
6. How to ensure alignment of shaft before fixing coupling bolts in a flange coupling ?
7. List few detachable joints. What are its draw backs ?
8. What is the advantage and limitations of hollow shaft over solid shaft ?
9. Sketch a flange coupling and mark its major dimensions.
10. Differentiate between shaft and axle.

(8 × 5 = 40 marks)

Part B

Answer **all** *questions.*
Each question carries 15 *marks.*

11. (a) A steel member is subjected to 3-dimensional stress system and the resulting principal stresses are 120 N/mm^2 tension 80 N/mm^2 and 40 N/mm^2 compression. If the proportional limit of the material in simple tension is 280 N/mm^2 and its Poisson ratio is 0.3. Determine factor of safety according to (i) maximum principal stress theory, (ii) maximum principal strain theory ; (iii) maximum shear stress theory.

Or

(b) The stresses induced at a critical point in a machine component made of C45 steel are as a machine component made of C45 steel are as follows : σ_x = 120 N/mm.^{2} ; σ_y = 50 N/mm.^{2}. Calculate the factor of safety by (i) Maximum normal stress theory ; (ii) Maximum shear stress theory ; (iii) Distortion energy theory.

Turn over

12. (a) Design a cotter joint to transmit an axial force of 120 kN. Material to be used is C 40. A factor of safety of 2 may be taken at yield point.

Or

(b) Design and prepare working drawings of triple riveted butt joint suitable for longitudinal seam and double riveted lap joint for the circumferential seam of Lancashire, boiler of 2.5 m. diameter. Maximum working pressure is 100 N/cm^2 yield stress are 90 N/mm^2 for plates in tension, 70 N/cm^2 for rivets in shear, 120 N/mm^2 for rivets/plates in crushing. Indicate how you will make joints seam tight after riveting.

13. (a) A 60 mm. diameter solid shaft is to be welded to a flat plate by a fillet weld around the circumference of the shaft. Determine the size of the weld if the torque on the shaft is 3 kN-m. The allowable shear stress in the weld is 70 $N/mm.^2$

Or

(b) Design a close coiled helical compression spring for a service load ranging from 3000 N to 4000 N. The axial deflection of the spring for the load range is 10 mm. Take spring index as 6. Permissible shear stress is 42 kN/m^2 and $G = 0.84 \times 10^7$ N/cm^2. Draw a fully dimensioned sketch.

14. (a) A hollow shaft is used to transmit 15 kW at 250 r.p.m. The loading is such that the maximum bending moment is 150 kN-cm. maximum, torsional moment is 50 kN-cm. and the axial compressive load is 20 kN. The shaft is supported on rigid bearing is 150 cm. apart and is subjected to minor shock load. The maximum allowable stress = 2 kN/cm^2. The inside diameter is 0.75 times the outside diameter. Calculate the diameter of the shaft.

Or

(b) A bushed pin type flexible coupling (flange coupling) is required to transmit 10 kW at 1440 r.p.m. of the shaft speed. The diameters of the shafts to be connected are 40 mm. Select suitable dimensions of the coupling and check for the safety. Shafts are made of C15 steel.

(4 × 15 = 60 marks)