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Question Paper Code : 23851

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fifth Semester

Mechanical Engineering

ME 2303 — DESIGN OF MACHINE ELEMENTS

(Common to Manufacturing Engineering/Automobile Engineering/ Industrial Engineering/Industrial Engineering and Management and Mechanical and Automation Engineering)

(Regulations 2008)

(Also Common to PTME 2303 – Design of Machine Elements for B.E. (Part-Time) Fourth Semester – Mechanical Engineering – Regulations 2009)

Time : Three hours Maximum : 100 marks

Special Instructions :

(i) Approved design data Book is permitted.

(ii) Assume suitable data wherever it is necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List any three fits used in engineering applications.

2. Define fatigue stress concentration factor.

3. State the function of couplings.

4. Why shafts are designed based on rigidity?

5. What are the advantages of welded joints?

6. List the applications of knuckle joints.

7. Explain following terms used in helical springs.
   (a) Free length
   (b) Spring rate.

8. Define coefficient of fluctuation of speed in flywheels.

9. Why I section is preferred in connecting rod design?

10. What do you mean by Rain mondi and Boyd graphs?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The dimensions of the mating parts, according to basic hole system, are given as follows :

Hole : 25.00 mm Shaft : 24.90 mm
25.08 mm 24.96 mm

Find the hole tolerance, shaft tolerance and allowance. (4)

(ii) The crane hook carries a load of 20 kN as shown in Fig. 1. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres at the given section. (12)

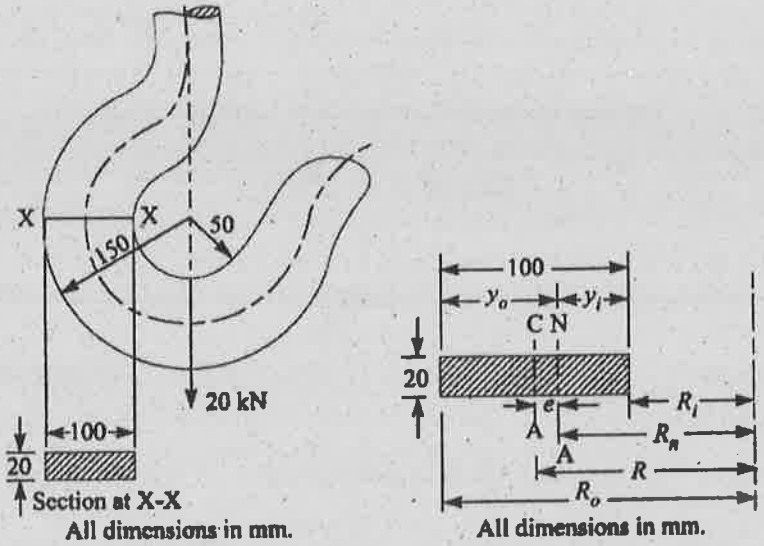

Fig. 1

Or

(b) (i) The circular cross section of a bolt is required to resist an axial tensions of 15 kN and a transverse shear of 10 kN. Estimate the diameter of the bolt by

(1) Maximum strain energy theory

(2) Shear strain energy theory

Given : Elastic limit for the material = 300 N/mm². Poisson's ratio : 0.25; Factor of safety = 3. (8)

(ii) Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows:

Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa.

The factor of safety based on yield point may be taken as 1.5. (8)

12. (a) Design a Crankshaft for an IC Engine to the following specifications :

Bore	:	150 mm
Stroke Length	:	190 mm
Length of Connecting Rod	:	380 mm
Maximum Pressure	:	3.2 N/mm^2
Speed	:	600 rpm
Distance between Bearings	:	400 mm

Select suitable Material. (16)

Or

(b) Design a unprotective flange coupling to transmit a torque of 250 N-m between two coaxial shafts. The shaft is made of alloy steel, flanges out of cast iron and bolts out of steel. The shafts are keyed to the flange hub. The permissible stresses are given below :

Shear stress on shaft = 100 MPa

Crushing stress on shaft = 250 MPa

Shear stress on keys = 100 MPa

Crushing stress on keys = 250 MPa

Shearing stress on cast iron = 200 MPa

Shear stress on bolts = 100 MPa. (16)

13. (a) Two lengths of mild steel tie rod having width 200 mm and thickness 12.5 mm are to be connected by means of a butt joint with double cover plates. Design the joint if the permissible stresses are 80 MPa in tension, 65 MPa in shear and 160 MPa in crushing. Draw the joint. (16)

Or

(b) A bracket, as shown in Figure 2. supports a load of 30 kN. Determine the size of bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. Four bolts are used. The distances are :

L_1 = 85 mm, L_2 = 250 mm and L = 500 mm. (16)

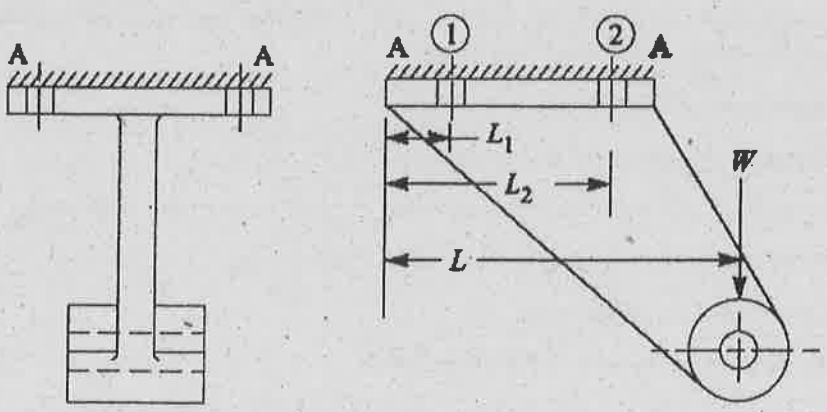

Figure 2

14. (a) The intercepted areas between the output torque curve and the mean resistance line of a turning moment diagram for a multi cylinder engine, taken in order from one end are as follows : –35, +410, –285, +325, –335, +260, –365, +285, –260 mm^2. The diagram has been drawn to a scale of 1 mm = 70 N-m and 1 mm = 4.5°. The engine speed is 900 r.p.m. and the fluctuation in speed is not to exceed 2% of the mean speed. Find the mass and cross-section of the flywheel rim having 650 mm mean diameter. The density of the material of the flywheel may be taken as 7200 kg /m^3. The rim is rectangular with the width 2 times the thickness. (16)

Or

(b) Design a helical spring for a spring loaded safety valve for the following conditions :

Diameter of valve seat = 65 mm; Operating pressure = 0.7 N/mm^2;

Maximum pressure when the valve blows off freely = 0.75 N/mm^2;

Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm^2 = 3.5 mm;

Maximum allowable stress = 550 MPa;

Modulus of rigidity = 84 kN/mm^2; Spring index = 6;

Draw a neat sketch of the free spring showing the main dimensions. (16)

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

Load on the journal = 20000 N;

Speed of the journal = 900 r.p.m.;

Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s;

Ambient temperature of oil = 15°C;

Rise of temperature of oil be limited to 10°C.

Heat dissipation coefficient = 1232 W/m^2/°C. (16)

Or

(b) Determine the dimensions of an I-section connecting rod for a petrol engine from the following data :

Diameter of the piston = 120 mm;

Mass of the reciprocating parts = 3 kg;

Length of the connecting rod from centre to centre = 450 mm;

Stroke length = 170 mm; Speed = 1500 r.p.m;

Compression ratio = 4:1;

Maximum pressure = 2.5 N/mm^2. (16)