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21AU53

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Design of Automobile Components

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 118 Nm, a axial thrust of 9806 N bending moment of 79 Nm. Calculate the maximum compressive and shear stress. **(10 Marks)**
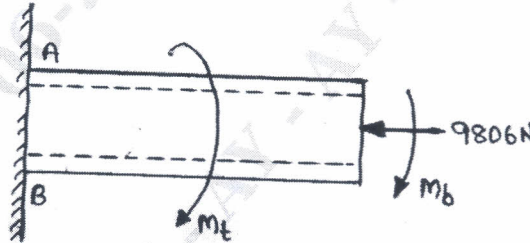

Fig.Q.1(a)

   b.   A 50 mm diameter steel rod supports a 9 kN load in addition is subjected to a torsional moment of 100 N-m as shown in Fig.Q.1(b). Determine maximum tensile and maximum shear stress. **(10 Marks)**
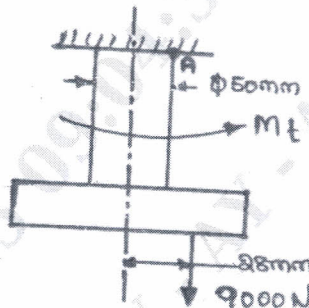

Fig.Q.1(b)

OR

2   a.   A mild steel shaft 60 mm diameter is subjected to a bending moment of 25×10^5 N-mm and torque M_t. If the yield point of steel in tension is 230 N/mm^2, find the maximum value of this torque without causing yielding of the shaft according to i) MSST   ii) MNST. **(10 Marks)**

   b.   A piston rod is subjected to a maximum reversed axial load of 110 kN. It is made of steel having an ultimate stress of 900 N/mm^2 and surface is machined. The average endurance limit is 50% of the ultimate strength. Take the size correction coefficient as 0.85 and FOS = 1.75, Determine diameter of rod. **(10 Marks)**

Module-2

3 a. A belt pulley is fastened to a 50 mm shaft running at 400 rpm by means of a key 14 mm wide by 150 mm long. The permissible stress in the key are 60 MPa and 100 MPa in shear and compression respectively. Determine i) Power transmitted   ii) Depth of key. **(10 Marks)**

   b. Draw the shear force and bending moment diagrams for a cantilever loaded as shown in Fig.Q.3(b). **(10 Marks)**
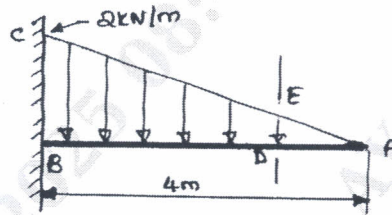

Fig.Q.3(b)

OR

4 a. A mild steel shaft has to transmit 75 kW at 200 rpm. The allowable stress in the shaft material is limited to 40 MPa and angle of twist is not to exceed one degree in a length of 20 diameters. Calculate suitable diameter of the shaft. **(10 Marks)**

   b. Prove that a hollow shaft is stronger and stiffer than a solid shaft of same length, weight and material. **(10 Marks)**

Module-3

5 a. Design a helical compression spring of service load ranging from 2250 N to 2750 N. The axial deflection of spring for the load range is 6 mm. Assume spring index of 5, permissible shear stress of 420 MPa and modulus of rigidity 84 kN/mm^2. **(10 Marks)**

   b. Determine the width and thickness of 6 leaves cantilever spring 300 mm long to carry a load of 1550 N with a deflection of 30 mm. The maximum stress in the spring should not exceed 0.330 GPa. Take E = 204 GPa. **(10 Marks)**

OR

6 a. Design a single plate clutch consists of two pairs of contacting surface for a torque capacity of 200 Nm, outside diameter of clutch is 250 mm. Take $\mu = 0.4$ and p = 0.135 N/mm^2. **(10 Marks)**

   b. A band brake shown in Fig.Q.6(b) use a V-belt. The pitch diameter of the V grooved pulley is 400 mm. The groove angle is 45° and co-efficient of friction is 0.3. Determine the power rating. **(10 Marks)**
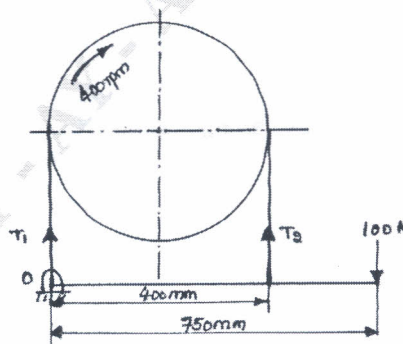

Fig.Q.6(b)

Module-4

7 Design a connecting rod for a petrol engine from the following data:
Diameter of piston = 0.1 m
Length of connecting rod = 0.35 m
Maximum gas pressure = 3 N/mm^2
Length of stroke = 150 mm
Engine speed = 1500 rpm
Weight of reciprocating parts = 25 N
Compression ratio = 4:1
Assume any further data. **(20 Marks)**

OR

8 Explain the design procedure for a centre crankshaft at top dead centre position with necessary figure and equations, also state the assumptions. **(20 Marks)**

Module-5

9 Design a cast iron piston for a single acting 4-stroke diesel engine from the following data:
Cylinder bore = 0.1 m
Length of stroke = 12.5 cm
Speed = 2000 rpm
Brake mean effective pressure = 0.5 MPa
Maximum gas pressure = 5 MPa
Fuel consumption = 0.25 kg/BP in kw/hr. **(20 Marks)**

OR

10 a. With a neat sketch, explain single row overhead valve mechanism. **(10 Marks)**
   b. Sketch and explain :
   i) Flat plate type head piston
   ii) Cup type head piston. **(10 Marks)**

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