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10ME62

Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of design data hand book permitted.***
3. ***Missing data, if any may be suitably assumed.***

PART – A

1 a. Determine the dimensions of I-section, shown in Fig. Q1 (a) in which maximum fibre stresses are numerically equal in pure bending, given $b_i + b_0 = 120$ mm. **(10 Marks)**

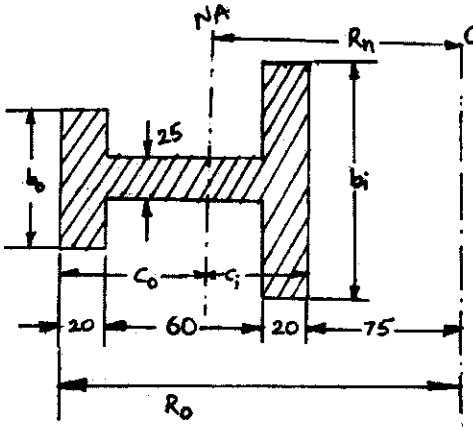

Fig. Q1 (a)

b. A solid shaft of 125 mm diameter is to be pressed into a steel flange which has an outside diameter of 150 mm and length of 100 mm. Take E = 210 GPa, v = 0.3. Determine,
i) Pressure between hub and shaft.
ii) Proper size of bore, if maximum stress does not exceed 160 MPa.
iii) Force required to press the parts together. Assume $\mu = 0.1$ for press fit.
iv) Torque capacity of press fit. **(10 Marks)**

2 a. Select a V-belt drive to transmit 18 kW at 1500 rpm to another pulley to run at 750 rpm. The dia of smaller pulley is 100 mm. The centre distance is 2 times the diameter of larger pulley. **(10 Marks)**

b. Select a number of wire ropes required to be used with a drum diameter of 2 meter. A load of 30 kN is to be lifted by 25 mm diameter 6×7 ropes form a height of 480 meter. A velocity of 15 m/sec is to be attained in 10 second. Assume the skip weight to be 30% of load capacity and factor of safety of 6. **(10 Marks)**

3 a. A free end of a torsional spring deflects through 60° when subjected to a torque of 6 N-m. The allowable stress in the spring material is 400 MPa and the spring index is 6. Determine the wire diameter and the number of effective turns. Take $E = 206.8 \times 10^3$ N/mm^2. **(08 Marks)**

b. A Belleville spring made from 5 mm thick steel sheet having outside diameter 150 mm and inside diameter 70 mm. The height of the spring is 10 mm. Using $\gamma = 0.3$, $E = 20 \times 10^4$ MPa. Find i) The deflectionn of spring. ii) The load the spring can carry. iii) Stress at the outer edge.
Limit the maximum stress at the inner edgee to 450 MPa. **(12 Marks)**

4 a. Design a pair of spur gear to transmit 40 kW at 4000 rpm of pinion to the gear 800 rpm. Select Chromium – Nickel steel for both gears. Assume pinion teeth as 20 and service factor as 1.5. Determine dynamic load, wear load and recommend BHN values. Assume $\alpha = 20^0$ FDI. **(12 Marks)**

b. A 24 teeth cast steel gear pinion (σ_{0_1} = 51.7 MPa) drives a high grade C.I. gear having (σ_{0_2} = 31 MPa) 50 teeth. The teeth are 20° full depth involute in the normal plane. The helix angle is 45°. Normal module is 3 mm. Find the safe power that can be transmitted by these gears at a pinion speed of 500 rpm. Assume face width is 10 times normal module and scant lubrication $C_W = 1.25$. **(08 Marks)**

PART – B

5 a. Design a pair of mitre bevel gears to transmit 9 kW at 1200 rpm. The pitch line velocity of gear is not exceed 15 m/sec. **(12 Marks)**

b. A hardened steel worm at 1250 rpm transmits power to a phosphor bronze gear with a transmission ratio of 20 : 1. The centre distance is 200 mm. Determine the input power capacity. Assume $\alpha = 14\frac{1}{2}^{\circ}$ FDI. **(08 Marks)**

6 a. Design a cone clutch to transmit 15 kW at 1200 rpm. Assume semi cone angle as 12.5°, co-efficient of friction for lining 0.4 and P = 0.2 MPa. **(08 Marks)**

b. A single band brake shown in Fig. Q6 (b) is to be designed to stop the rotation of a shaft transmitting a power of 45 kW at a rated speed of 500 rpm. Selecting suitable materials determine,
i) Dimensions of rectangular cross section of band.
ii) Dimensions of rectangular cross section of brake lever. (Assume $h_1 = 2\ b_1$).
iii) Diameter of fulcrum pin.
Assume $l_p = 1.5$ dp, bearing stress σ_b = 10 MPa. **(12 Marks)**

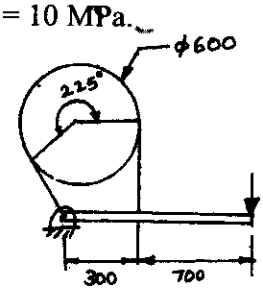

Fig. Q6 (b)

7 a. A full journal bearing of length 100 mm and the journal diameter of 80 mm supports a load of 2.5 kN at 600 rpm. What viscosity oil should be used to limit the bearing surface temperature to 60°C . The room temperature is 20°C and the clearance ratio is 0.001, use Mckee's equation. **(08 Marks)**

b. Determine the power loss for a Petroff bearing 100 mm in diameter and 150 mm long. The radial clearance is 0.05 mm. Speed of the journal is 1000 rpm. The lubricating oil is SAE10 and bearing operating temperature is 60°C. **(12 Marks)**

8 a. List and explain the functions of parts of internal combustion engine. **(04 Marks)**

b. Design a cast iron trunk type piston for four stroke internal combustion engine for the following data: Cylinder bore = 150 mm, Stroke = 200 mm, Indicated mean effective pressure = 6 bar, Fuel consumption = 4 kg/hr, Maximum gas pressure = 5 MPa,
Higher calorific value of fuel = 4100 KJ/kg, Speed of engine = 600 rpm,
Mechanical efficiency = 75% , Allowable stress for piston = 30 N/mm^2,
Allowable tensile stress for piston ring = 90 MPa,
Allowable bending stress in piston pin = 80 MPa. **(16 Marks)**

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