CBCS Scheme

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15MT51

Fifth Semester B.E. Degree Examination, June/July 2018
Design of Machine Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer any FIVE full questions, choosing one full question from each module.*
2. *Use of Design data band book is permitted.*

Module-1

1 a. Define stress concentration factor and explain the stress concentration phenomenon. **(02 Marks)**

b. A bar of rectangular section as shown in Fig.Q1(b) is subjected to an axial pull of 500 kN. Calculate its thickness if the allowable stress in the bar material is 200 MPa.

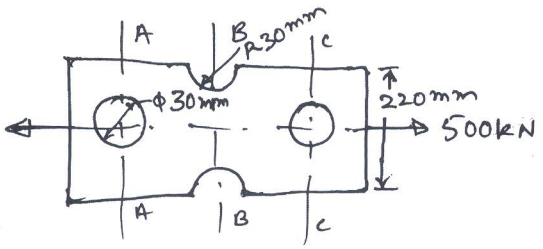

Fig.Q1(b) **(10 Marks)**

c. Determine the maximum stress induced in a stepped shaft with a maximum dia of 50 mm and a minimum dia of 25 mm, fillet radius is 5 mm, subjected to tensile load of 12 kN. **(04 Marks)**

OR

2 a. Explain the following theories of failure:
i) Maximum normal stress theory
ii) Maximum shear stress theory. **(08 Marks)**

b. The stress at a point in a body are $\sigma_x = 91$ MPa, $\sigma_y = 21$ MPa, $\tau_{xy} = 84$ MPa, $\sigma_{yt} = 280$ MPa, find the FOS. By:
i) Maximum principal stress theory
ii) Maximum shear stress theory **(08 Marks)**

Module-2

3 Design Flange coupling for the following specification P = 20 KW, speed = 1440 rpm. Draw assembled sketch. Design following parts:
i) Design of shaft ii) Design of hub
iii) Design of key iv) Design of bolts **(16 Marks)**

OR

4 Design screw jack for the following specification, capacity 40 kN, maximum lift = 200 mm, following parts to be designed:
i) Screw spindle with head
ii) Design of nut
iii) Design of handle.
Draw assembled view. Draw assembled sketch. **(16 Marks)**

Module-3

5 A horizontal commercial shaft is supported by two bearings 1.5 m apart. A keyed gear, 20° involute and 175 mm in dia is located 400 mm to the left of the right hand bearing and is driven by a gear directly behind it. A 600 mm dia pulley is keyed to the shaft 600 mm to the right of the left hand bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1 with a slack side on top. The drive transmits 45 KW at 330 rpm. Take $C_m = C_t = 1.5$ calculate the necessary diameter of the shaft. Use allowable shear stress 40 MPa and G = 80 GPa. **(16 Marks)**

OR

6 a. A line shaft at 500 rpm is to transmit 600 KW. The allowable shear stress for the material of the shaft is 42 MPa. If the shaft carries a central load of 900 N and is simply supported between the bearings 3 m apart, determine the dia of the shaft. The maximum tensile stress is not to exceed 50 MPa. **(08 Marks)**

b. A shaft is required to transmit 1 MW at 240 rpm. The shaft must not twist more than 1° on a length of 15 dia. If G = 80 GPa, find the dia of the shaft and shear stress induced. **(08 Marks)**

Module-4

7 Design a spur gear for following specification, power transmitted 20 KW, speed of pinion 1000 rpm. Determine the module. **(16 Marks)**

OR

8 Design a helical gear for following specification, power transmitted 40 KW, speed 1400 rpm. Determine module. **(16 Marks)**

Module-5

9 Design a main bearing of a steam turbine that runs at 1800 rpm, the load on bearing is estimated as 2500 N. **(16 Marks)**

OR

10 a. Derive an expression for the shear stress induced in a Helical compression spring, with usual notation. **(06 Marks)**

b. Design a helical compression spring to support an axial load of 3000 N. The deflection under load is limited to 60 mm. The spring index is 6. The spring is mode of Chrome-Vanadium steel and FOS is 2. **(10 Marks)**

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