BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - V MECHANICAL : WINTER- 2022
SUBJECT : MACHINE DESIGN-I

Day : Tuesday | Time : 02:30 PM-06:30 PM

Date : 06-12-2022 | **W-13445-2022** | Max. Marks : 60

N.B.

1) All questions are **COMPULSORY.**
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

Q.1 Explain in detail BIS system of designation of steels. **(10)**

OR

How the Aesthetic and Ergonomic consideration is important in machine design.

Q.2 Design a mild steel shaft which can transmits 20 kw and 200 rpm. It carries a central load of 900 N and is simply supported between the bearing 2.5 m apart. Determine the size of the shaft. If the allowable shear stress is 42 MPa and maximum tensile or compressive stress is not to exceed 56 MPa. what size of shaft will be required if it is subjected to gradually applied loading. **(10)**

OR

Design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kw power at 180 rpm to the o/p shaft through coupling. The service factor for the application is 1.5 and the design torque is 1.5 times of the rated torque.

i) the shaft are subjected to torsional shear stress on the basis of strength plain carbon steel of grade 40 C_8 having Syt = 380 N/mm^2.
Take FOS = 2.5.

ii) for key and bolt – 30 C_8 (syt = 400 N/mm)

iii) flanges – FG 200 (Sut = 200 N/m^2)

It is assumed that ultimate shear strength is one half of ultimate tensile strength. The FOS for flange = 6 . The permissible stress is based an ultimate strength and not on the yield strength.

Q.3 The mean diameter of the square threaded screw having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and the efficiency of the screw when: **(10)**

i) the load rotates with the screw.

ii) the load rests on the loose head which does not rotate with the screw.

The external and internal diameter of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw and the bearing surface may be taken as 0.08.

OR

The screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 200 MPa and in shear 120 MPa. The material for nut is phosphor bronze for which the elastic limit may be taken as 100 MPa in tension 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut and the screw is not to exceed 18 N/m^2. Design and draw the screw for :

1) Screw **2)** nut **3)** handle and cup . Take FOS = 2 Table to be provide.

P.T.O.

Q.4 Explain the terms used in compression spring with diagram: **(10)**
1) solid length **2)** free length **3)** spring index **iv)** spring rate **v)** pitch

OR

Explain the stresses in Helical spring of circular wire with neat sketch.

Q.5 Prove that the length of welds at the top and bottom of an unsymmetrical welded section which is loaded axially are given by **(10)**

$$\mu = \frac{b \times l}{a+b} \text{ and } l_2 = \frac{a \times l}{a+b}$$

Where l_1 = length of weld at top
l_2 = length of weld at bottom
l = total length of weld
a = distance of the top edge of the angle section from gravity axis.
b = distance of the bottom edge of the angle section from neutral axis.

OR

Two plates 10 mm thick are joined by a single riveted lab joint. The plates are subjected to a load of 200 kN if the permissible tensile shear and bearing stresses are 120 N/mm^2, 100 N/m^2 and 160 N/m^2 respectively. Determine:
1) diameter of the rivets
2) pitch of rivets
3) number of the rivets
4) efficiency of joint

Q.6 A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm^2. The connected endurance limit stress for the machine component is 270 N/mm^2. The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm^2 respectively. Find the factor of safety using : **(10)**
1) Gerber theory **2)** Soderberg line **3)** Goodman line
Also find the factor of safety against static failure.

OR

How to use Soderberg criterion and Goodman criterion for fatigue design.

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