Total No. of Questions : 6]

SEAT No. :

P42

[Total No. of Pages : 4

Oct./TE/Insem.-156

T.E. (Mechanical)

DESIGN OF MACHINE ELEMENTS - I

(2015 Course) (Semester - I)

Time : 1½ Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.***
2) ***Draw neat labelled diagrams wherever necessary.***
3) ***Figures to right indicate full marks.***
4) ***Assume relevant data if necessary and clearly mention the assumed data.***

Unit - I

Q1) a) Standardize five speeds between 250 to 1440 rpm and state series of torque for 0.5 kW drive. **[4]**

b) A knuckle joint is subjected to an axial load of 30 kN. It is made of plain carbon steel with yield strength of 400 N/mm^2 and factor of safety 2.5. Assume the compressive strength of material to be 20% more than the tensile strength. Allowable shear stress is 0.577 of the tensile strength. **[6]**

Calculate :

i) Diameter of rod

ii) Diameter of knuckle pin

iii) Diameter of pin head

iv) Calculate thickness of fork

v) Calculate thickness of single eye

vi) Calculate diameter of eye

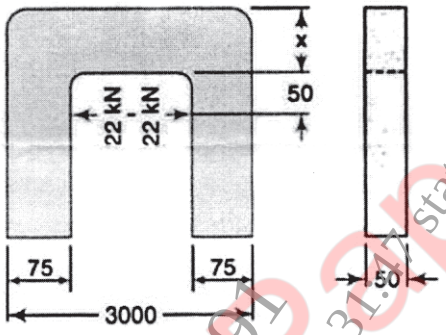
OR

P.T.O.

SPPUQuestionPapers.com
CEGP013091 49.248.216.238 24/08/2019 10:31:47 static-238

Q2) a) Explain eccentric loading with a neat sketch. Show the stress distribution across the cross section due to eccentric loading as per the considerations shown in sketch. **[4]**

b) A steel bracket of dimensions as shown in Fig. (a) is loaded with 22 kN forces. The weight of the bracket as well as any stress concentration present is to be neglected. If the maximum tensile stress in the bracket is not to exceed 35 MPa, what is the minimum value that the length *x* can be made? **[6]**



Unit - II

Q3) a) Draw neat sketches for key failure in shear and crushing. Prove that compressive stress induced in square key due to the transmitted torque is twice of shear stress. **[4]**

b) A protective coupling is used to connect two shafts and transmit 15kW power at 1440 rpm. The design torque for the coupling is 200% of the rated torque. The shafts and bolts are made of plain carbon steel 40C8 (S_{yt} = 380 MPa) and the factor of safety for the connection is 4.5. The compressive strength of the material is 1.5 times the yield strength. The flanges are made of cast iron. Calculate the **[6]**

i) Diameter of Shafts

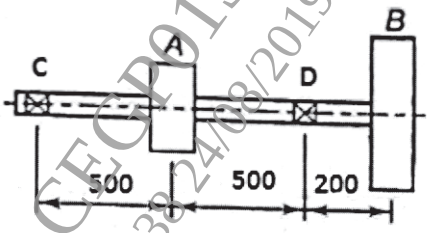
ii) Number of bolts and

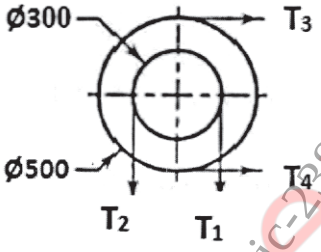
iii) Bolt diameter.

OR

SPPUQuestionPapers.com
CEGP013091 49.248.216.238 24/08/2019 10:31:47 static-238

Q4) A line shaft supporting two pulleys A and B is shown in fig. Power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to the pulley B, carrying a horizontal belt. The ratio of belt tension on tight and loose sides is 3 for both pulleys. The limiting value of tension in the belt on pulley A is 3 kN. The shaft is made of plain carbon steel 40C8 (S_{ut} = 650 N/mm^2 and S_{yt} = 380 N/mm^2). The pulleys are keyed to the shaft. Determine the diameter of the shaft according to the ASME code if K_b = 1.5 and K_t = 1.0. **[10]**

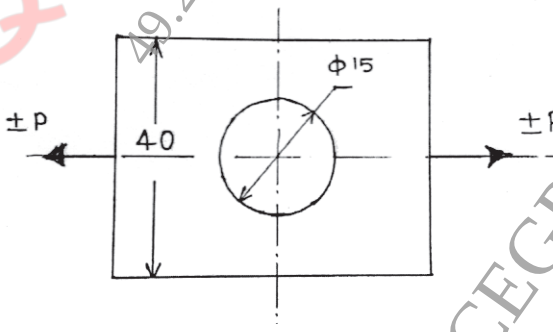




Unit - III

Q5) a) Explain Gerber, Goodman and Soderberg equation along with neat sketch. **[4]**

b) A plate made of plain carbon steel 30C8 (S_{ut} = 450 N/mm^2) in hot rolled condition as shown in fig. below. The thickness of the plate is 35mm. The theoretical stress concentration factor is 2.51 and notch sensitivity is 0.8. The surface finish factor and size factor are 0.67 and 0.85, reliability factor is 0.897 and temperature factor is 1. If the factor of safety is 1.5, determine maximum completely reversed axial force the plate can take for the infinite life. **[6]**



OR

SPPUQuestionPapers.com
CEGP013091 49.248.216.238 24/08/2019 10:31:47 static-238

Q6) a) Draw schematic diagram of R. R. Moore's Rotating Beam Fatigue Testing Machine and explain its use. **[4]**

b) A circular bar made up of steel is subjected to a load which varies from 43.5 kN to –14.5 KN. The ultimate tensile strength of the steel is 580 MPa and yield strength is 310 MPa. If required factor of safety is 1.8 calculate the diameter of the bar using Soderberg's criterion and goodman's Criterion. Use following data: Theoretical stress concentration factor 2.27; Notch sensitivity 0.8; Surface finish factor 0.75; Size factor 0.85; Load factor 0.923; Reliability factor 0.897. **[6]**

⌘⌘⌘

CEGP013091 49.248.216.238 24/08/2019 10:31:47 static-238
SPPUQuestionPapers.com