Registration No. : | | | | | | | | | | |

Total number of printed pages – 4

B. Tech

PCME 4303

Fifth Semester (Back/Special) Examination – 2013

DESIGN OF MACHINE ELEMENTS

BRANCH : MECH

QUESTION CODE : D 290

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **four** from the rest.*
The figures in the right-hand margin indicate marks.
Draw neat sketches wherever necessary. Assume any missing data suitably..
Use of only Specified Design Data Book is permitted inside the examination hall.

1. Answer the following questions : 2×10

(a) What are the different stages for designing a machine component ?

(b) What do you mean by the terms Interchangeability ?

(c) Where the designers use diamond riveting ?

(d) What types of stresses are induced in key ?

(e) A shaft is made of 40Ni8Cr8V2 material. Name the percentage of different alloying element present in the shaft material.

(f) What do you mean by rigidity of a shaft ?

(g) What is lever ? Explain the principle on which it works.

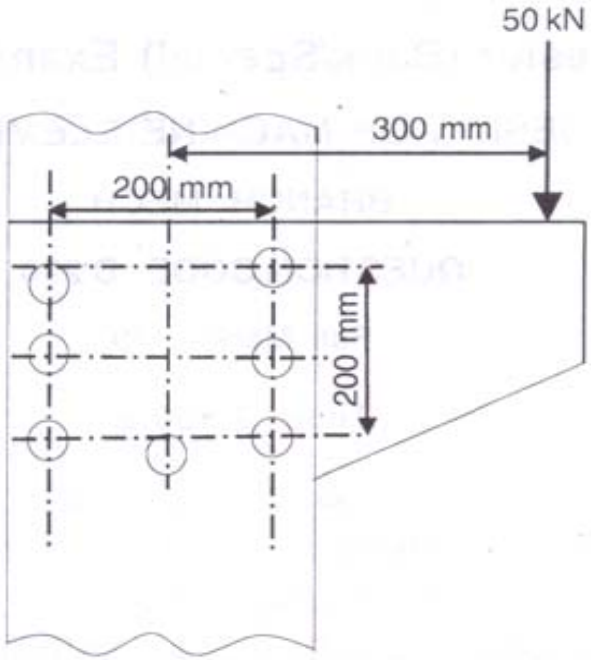
(h) What do you mean by buckling of a spring ? How it can be prevented ?

(i) Why is the nut of a power screw made of a soft material ?

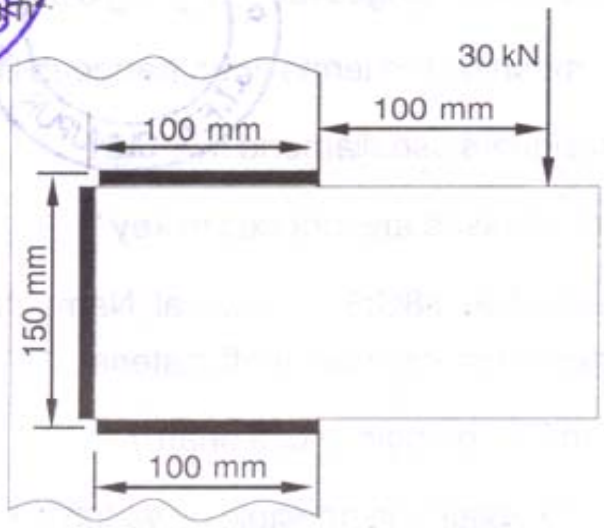
(j) Enlist the merits and demerits of V-belt over flat belt.

P.T.O.

2. (a) Design an eccentrically loaded lap joint riveted joint as shown in the side figure. The bracket plate is 35 mm thick. All rivets are to be same size. The load on the bracket is 50 kN. The rivet spacing is 100 mm and eccentricity is 300 mm. 6.5

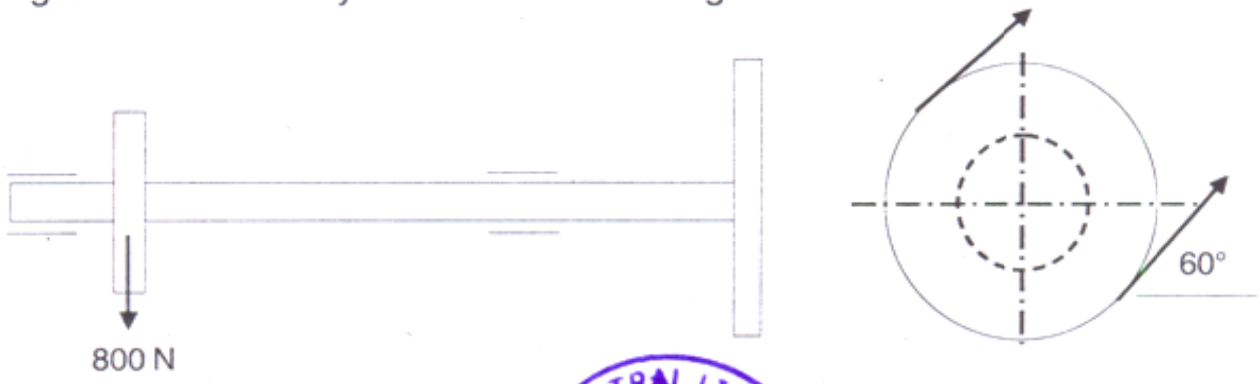


(b) A bracket carrying a load of 30 kN is to be welded as shown in the side figure. Calculate the size of the weld if the permissible shear stress is not to exceed 55 N/mm^2. 6



3. Design a knuckle joint to connect two rods of equal diameter. Each rod is subjected to an axial tensile force of 25 kN. The rods are made of mild steel having allowable limits of tensile, shear and crushing strengths are 65 N/mm^2, 40 N/mm^2 and 100 N/mm^2. 12.5

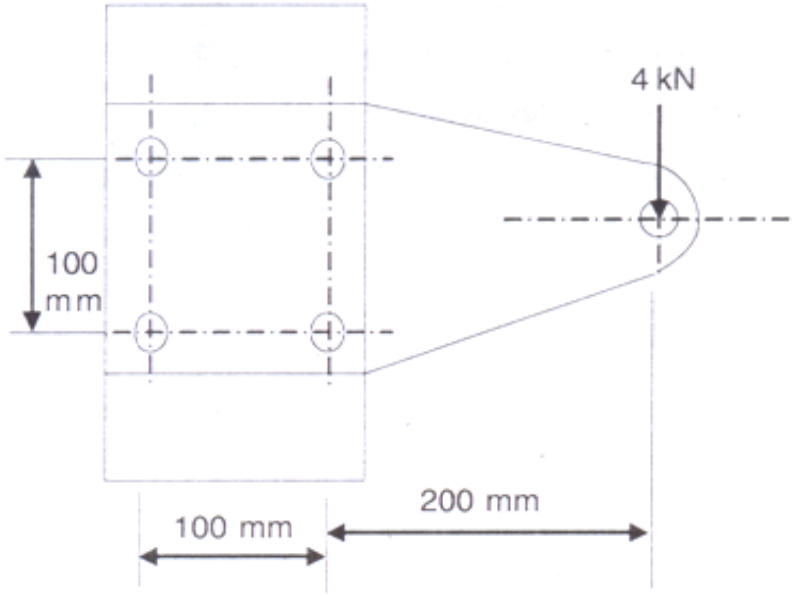
4 A machine turning at 600 rpm is supported on bearings 750 mm apart. 15 kW is supplied to the shaft through a 450mm pulley located 250 mm to the right of the right bearing. The power is transmitted from the shaft through a 200mm spur gear located 250 mm to the right of the left bearing. The belt drive is at an angle of 60° above horizontal. The pulley weighs 800N to provide some flywheel effect. The ratio of belt tension is 2 : 1. The gear has a 20° tooth form and mates with another gear located directly above the shaft. Design the shaft. 12.5



5 A rigid protected type flange coupling is used to connect the output shaft of an electric motor to the shaft of a compressor. The electric motor delivers transmitting 22 kW power at 450 rpm. The overload capacity is 1.5 times the average torque. Design rigid protected type flange coupling. The shaft, keys and pins are made of plain carbon steel C 40 having yield tensile strength 350 N/mm^2. The flange is made of Grey cast iron FG200 (Ultimate tensile strength is 200 N/mm^2). 12.5

6 A screw jack is used for lifting a load of 20 kN through a distance of 200 mm. The power screw of the screw jack is made of plain carbon steel C45 having yield strength of 340 N/mm^2 and the nut is made of phosphor bronze having allowable tensile strength of 40 N/mm^2. Coefficient of friction between steel screw and bronze nut is 0.15. Coefficient of friction between cup and screw head is 0.12. The lever is made of C20 having allowable strength of 120 N/mm^2. Limiting pressure between the mating threads of the screw and the nut is 10 N/mm^2. Consider the material for screw jack frame and cup as Grey cast iron of grade FG200 having ultimate tensile stress as 200 N/ mm^2 and E = 205, 000 N/mm^2. Design the screw jack. 12.5

7 (a) A steel plate is subjected to a force of 4 kN and fixed to a vertical channel by means of four identical bolts. Determine the diameter of the shank. 6.5



(b) Design a simple lever of a safety valve for a boiler having a gauge pressure of 18 bar. The valve diameter is 90 mm. The lever is 1.2 meter long and the distance between the fulcrum and the valve point is 200 mm. The cross section of the lever is rectangular having width to height ratio is 4 : 1. The lever is made of C20 steel having allowable strength of 100 N/mm^2. The bearing pressure at the pin is 20 N/mm^2. 6

8. Answer the following :

(a) What do you understand by surge in a spring ? How can it be prevented ? 3

(b) What is nipping in leaf spring ? Discuss its role in spring design. 3.5

(c) What types of stresses are produced in a belt used for power transmission ? 3

(d) What are the basic elements of chain drive ? What are the advantages and disadvantages of chain drive over other drive ? 3