Total No. of Questions : 10]

SEAT No. :

P3341

[Total No. of Pages : 4

[5353]-511

T.E. (Mechanical Engineering) (End Semester)

DESIGN OF MACHINE ELEMENTS - I

(2015 Pattern)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer five questions from the following***
2) ***Draw neat labeled diagrams wherever necessary***
3) ***Figures to right indicate full marks***
4) ***Use of electronic calculator is permitted***
5) ***Use of Programmable calculator is not allowed***
6) ***Assume suitable/standard data if necessary.***

Q1) a) A manufacturer is interested in starting a business with five different models of tractors ranging from 7.5kW to 75kW capacities. Specify power capacities of models. **[6]**

b) What are Renard numbers? Enlist basic five preferred series and explain any one with suitable example. **[4]**

OR

Q2) a) Draw neat labeled sketch of Bush-pin type coupling. **[4]**

b) A flexible coupling is used to transmit 15kW power at 100 rpm. There are six pins and their pitch circle diameter is 200 mm. The effective length of the bush, the gap between two flanges and the length of the pin in contact with the right hand flange are 35, 5 and 23 mm respectively. The permissible shear and bending stresses for the pin are 35 MPa and 152MPa respectively. Calculate a) Pin diameter by shear consideration and b) Pin diameter by bending consideration. **[6]**

Q3) a) Explain equivalent torsional and bending moment. **[4]**

b) A propeller shaft is required to transmit 45kW power at 500 rpm. It is a hollow shaft having inside diameter 0.8 times of outside diameter. It is made of plain carbon steel and the permissible shear stress is 84 N/mm^2. Evaluate the inside and outside diameters of shaft. **[6]**

P.T.O.

OR

Q4) a) Explain with neat sketches any four methods for reduction of stress concentration. **[4]**

b) Explain modified Goodman diagram. Draw neat labeled sketches of Modified Goodman diagram for Axial & Bending stresses and Modified Goodman diagram for Torsional shear stresses. **[6]**

Q5) a) A square threaded screw having 50 mm nominal diameter and 10 mm pitch is used for lifting a load of 20 kN. through a distance of 170 mm. Find the work done in lifting the load and efficiency of screw when: **[12]**

i) The load rotates with the screw and

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

iii) Stresses in screw.

The external and internal diameter of bearing surface of loose head are 60 mm and 10 mm respectively, while the coefficient of friction of friction bearing surface is 0.08 and for thread friction is 0.12.

b) Explain various thread forms suitable for power transmission. **[4]**

OR

Q6) a) Describe the term 'Virtual coefficient of friction'. **[3]**

b) A single start square threaded screw of a screw press is required to transmit a maximum load of 150 kN at 50rpm. The coefficient of friction for the threads is 0.12. The torque required for collar friction and journal bearing is about 10% of the torque required to drive the load. The maximum permissible compressive stress for the screw is 108.27 MPa. Determine: **[13]**

i) Safe diameter of the screw if allowable shear stress for the screw material is 55 MPa.

ii) Efficiency.

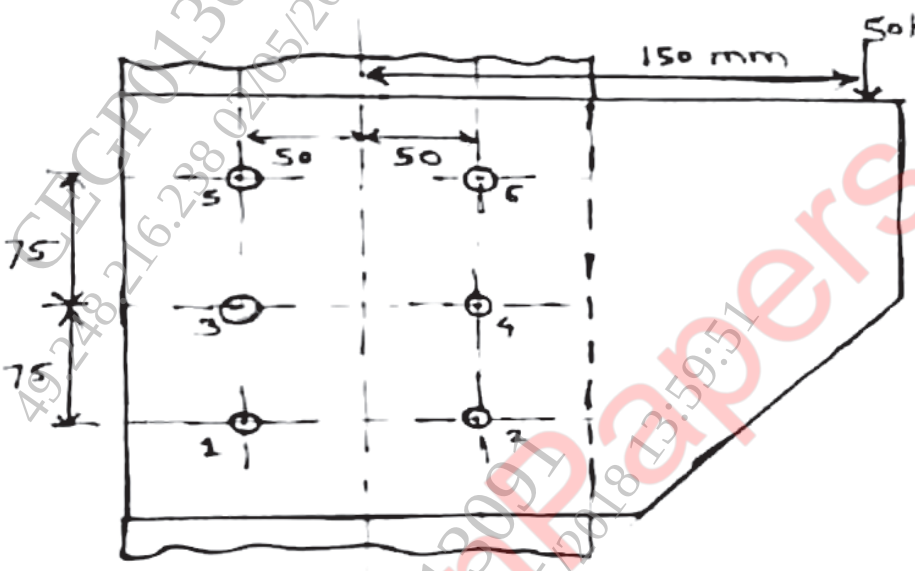
iii) Motor power required to drive the screw.

For the square threads use following standard data.

Sr.No.	Nominal diameter mm	Pitch mm
1	30, 32, 34, 36	6
2	38, 40, 42, 44	7
3	46, 48, 50, 52	8
4	55, 58, 60, 62	9
5	65, 70, 75, 80	10

Q7) a) Determine the method to determine the size of bolt when the bracket carries an eccentric load perpendicular to the axis of bolts. **[6]**

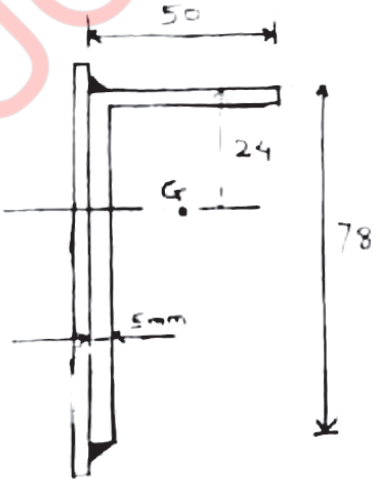
b) A bracket bolted to a column by 6 bolts of equal size as shown in figure. It carries a load of 50KN at a distance of 150mm from the centre of column. If the maximum stress in bolt is to be limited to 150 N/mm^2. Determine Size of bolts. **[12]**

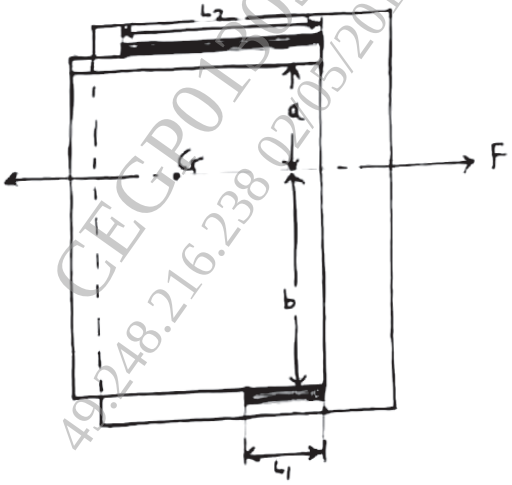


OR

Q8) a) Derive the strength equation for single transverse fillet weld. **[6]**

b) An angle is welded to a steel plate as shown in figure the angle is subjected to an axial load of 50 KN and permissible shear strength of weld is 75Mpa. Determine the weld length L2 and LI at the top and bottom. **[12]**





Q9) a) Explain A M Wahl's factor & state its importance. **[4]**

b) A concentric spring consists of two helical compression springs having the same free length. The composite spring is subjected to a maximum force of 2000 N.The wire diameter and mean coil diameter of inner spring are 8 and 64 mm respectively. Also the wire diameter and mean coil diameter of outer springs are 10 and 80 mm respectively. Assume the same material for two springs and the modulus of rigidity of spring material is 81370 N/mm^2. Calculate: **[12]**

i) The maximum force transmitted by each spring

ii) The maximum deflection of spring

iii) The maximum torsional shear stress induced in each spring

OR

Q10)a) Derive the expression for shear stress induced in helical compression spring. **[6]**

b) It is required to design a helical compression spring subjected to a maximum force of 7.5 KN. the mean coil diameter should be 150 mm from space consideration. The spring rate is 75 N/mm. the spring made of Oil- hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm^2. The permissible shear stress for the spring wire is 30% of ultimate tensile strength(G = 81370 N/mm^2) calculate, **[10]**

i) Wire diameter

ii) Number of active coils