

B.Tech. SEM -V Mechanical 2014 Course (CBCS) : WINTER - 2018

SUBJECT : MACHINE DESIGN – I *

Day : Thursday
Date : 22/11/2018

W-2018-2420

Time : 02.30 PM TO 06.30 PM
Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data if necessary.

Q.1 A manufacturer is interested to start his business with six different models of trucks from 7.5 to 75 kW capacities specify power capacities of model. There is an expansion plan to further increase the number of models from six to nine to fulfill the requirement. Specify the power capacities of additional models. **(10)**

OR

- a) What are the steps include in design of machine element? **(05)**
- b) What are the various design consideration used in machine design? **(05)**

Q2 What are the various steps that are include in design of shaft on the basis of strength, rigidity and deflection. **(10)**

OR

- a) How are the keys classified, draw neat sketches of different type of key and state their application? **(05)**
- b) Design a clamp coupling to transmit 20 kW at 80 r.p.m. The allowable shear stress for the shaft and key is 40 MPa and number of bolts are six. The permissible tensile stress for the bolts is 80 MPa and coefficient of friction between muff and shaft surface is 0.3. **(05)**

Q.3 How will you calculate 'Torque' required to raise the load against thread friction for square thread and for trapezoidal thread? **(10)**

OR

A 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 150 MPa and in shear 100 MPa. The material for nut is FG 200 for which elastic limit is 80 MPa in tension, 90 MPa in compression and 70 MPa in shear. The bearing pressure between nut and screw is not to exceed 18 N/mm². Design and draw the screw jack. (screw, nut, handle, cup, body etc) **(10)**

Q.4 a) What do you understand by 'Wahl's factor' what is its importance in the design of helical spring? **(05)**

- b) A helical spring is made from a wire of 5 mm diameter and has outside diameter of 70 mm. If the permissible shear stress is 350 MPa and the modulus of rigidity 90 kN/mm². Find the axial load which the spring can carry and the deflection per active turn. **(05)**

OR

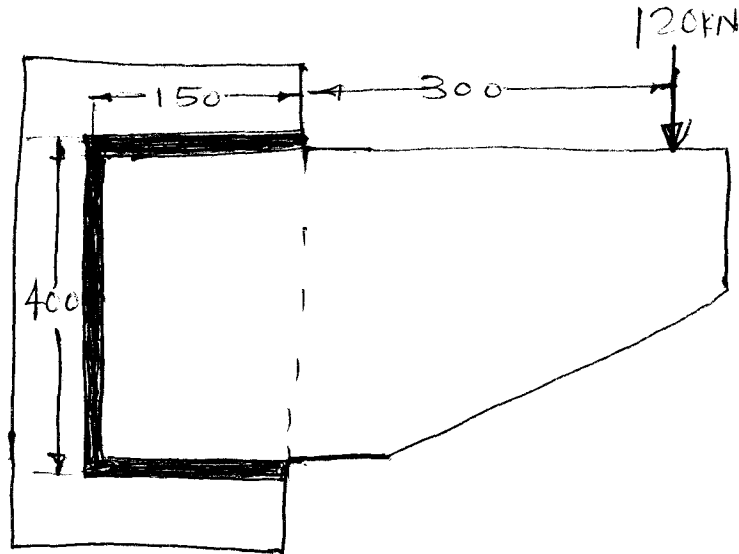
A composite spring has two closed coil spring. The outer spring is 15 mm larger than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter 5 mm. The inner spring has 8 coil of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axis load of 400 N. Find compression each spring, load shared by each spring shear stress induced in each spring. The modulus of rigidity may be taken as 8 kN/mm². **(10)**

P.T.O.

Q.5 What procedure you will follow for design of welds with in plane eccentric loads. (10)

OR

A bracket plate carrying a load of 120 kN is to be welded to a column as shown in figure find the size of the weld if the allowable shear stress in the weld is 110 MPa. (10)



Q6 How will you find out fatigue strength by means of rotating beam fatigue testing machine. Show S-N diagram for ferrous materials. (10)

OR

a) The mechanical component is subjected to the following bending stress cycles. (05)

i) $\pm 350 \text{ N/mm}^2$ for 70% of time.

ii) $\pm 500 \text{ N/mm}^2$ for 5% of time.

iv) $\pm 300 \text{ N/mm}^2$ for remaining time.

The component is made of plain carbon steel 50C 4 ($S_{ut} = 660 \text{ N/mm}^2$). If the endurance limit of the component is 280 N/mm^2 determine its life.

b) What are the various methods of reducing stress concentration? (05)

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