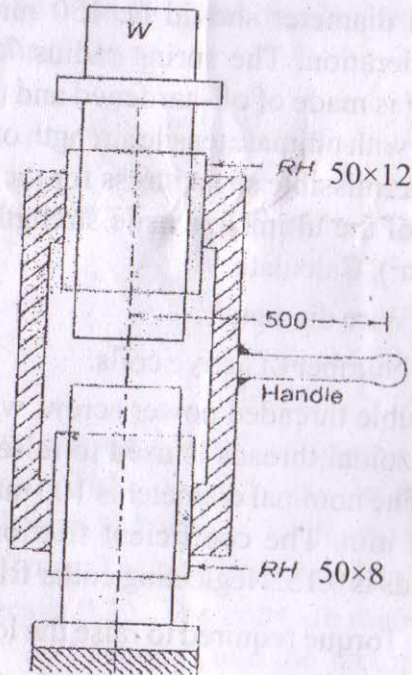


OR

The differential type screw jack is shown in fig. In this construction, the two screws do not rotate and the nut is rotated by the operator by applying a force of 100N at a mean radius of 500 mm. The coefficient of friction at the threads is 0.15. Calculate

- The load that can be raised.
- The efficiency of the screw jack.



(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2012304

Roll No.

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B.TECH.

Regular Theory Examination (Odd Sem-V), 2016-17

MACHINE DESIGN - I

Time : 3 Hours

Max. Marks : 100

Section - A

1. Attempt all parts of this questions. (10×2=20)

- List the factor that influences selection of material during design.
- State any one theory of failure.
- What are Soderberg & Goodman line?
- List types of rivet heads.
- Comment on factor of safety.
- Define : Flat key, Woodruff key.
- Why Wahl correction factor is used in design?
- List the main terminology in Power Screw?
- List different types of Springs.
- What is notch Sensitivity?

## Section - B

2. Attempt any Five parts (5×10=50)
- a) A bolt is subjected to a tensile load of 25 kN and a shear load of 10 kN. Determine the diameter of the bolt according to
- Maximum principal stress theory.
  - Maximum principal strain theory.
  - Maximum stress theory. Assume factor of safety as 2.5, yield point stress in simple tension =  $300 \text{ N/mm}^2$ , poisson ratio 0.25.
- b) A railway wagon moving at a velocity of 1.5 m/s is brought to rest by a bumper consisting of two helical springs arranged in parallel. The mass of the wagon is 1500 kg. The springs are compressed by 150 mm in bringing the wagon to rest. The spring index can be taken as 6. The springs are made of oil-hardened and tempered steel wire with ultimate tensile strength of  $1250 \text{ N/mm}^2$  and modulus of rigidity of  $81370 \text{ N/mm}^2$ . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. The design the spring and calculate
- Wire Diameter
  - Mean coil diameter
  - Number of active coils
  - Total number of coils
  - Solid length
  - Free length
  - Pitch of the coil.

- Required spring rate
  - Actual spring rate.
- c) The layout of a transmission shaft carrying two pulleys B and C and supported on bearings A and D is shown in fig. 1. Power is supplied to the shaft by means of a vertical belt on the pulley B, which is then transmitted to the pulley C carrying a horizontal belt. The maximum tension in the belt on the pulley B is 2.5 kN. The angle of wrap for both the pulleys is  $180^\circ$  and the coefficient of friction is 0.24. The shaft is made of plain carbon steel 30C8 ( $S_{yt} = 400 \text{ N/mm}^2$ ) and the factor of safety is 3. Determine the shaft diameter on strength basis.

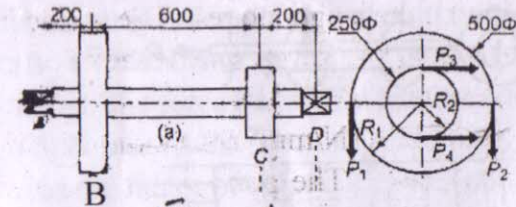


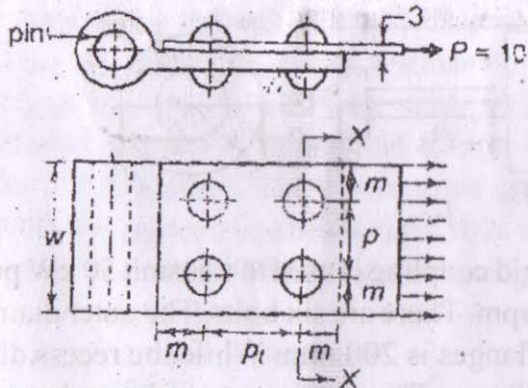
Fig. 1

- d) A rigid coupling is used to transmit 50 kW power at 300 rpm. There are six bolts. The outer diameter of the flanges is 200 mm. While the recess diameter is 150 mm. The coefficient of friction between the flanges is 0.15. The bolts are made of steel 45C8 ( $S_{yt} = 380 \text{ N/mm}^2$ ) and the factor of safety is 3. Determine the diameter of the bolts. Assume that the bolts are fitted in large clearance holes.

- e) Describe in detail with neat sketches the design procedure of a screw jack.
- f) Describe the standard design procedure in detail. What are the different standards in design. Discuss in detail.

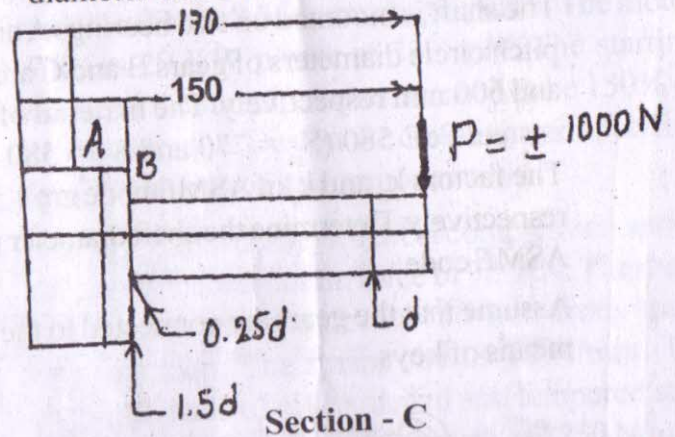
OR

- g) A brake band attached to the hinge by means of a riveted joint is shown in fig. Determine the size of the rivets needed for the load of 10 kN. Also, determine the width of the band. This permissible stresses for the band and rivets in tension, shear and compression are 80, 60 and 120 N/mm<sup>2</sup> respectively. Assume, margin (m) = 1.5d, transverse pitch (p<sub>t</sub>) = p, find the pitch of the rivets.



- h) A cantilever beam made of cold drawn steel 20C8 ( $S_{ut} = 540 \text{ N/mm}^2$ ) is subjected to a completely reversed load of 1000N as shown in fig. The notch sensitivity factor q at the fillet can be taken as 0.85

and the expected reliability is 90%. Determine the diameter d of the beam for a life of 10000 cycles.



Attempt any two parts of this questions. (2×15=30)

- 3. a) A cantilever beam made of cold drawn steel 40C8 ( $S_{ut} = 600 \text{ N/mm}^2$  and  $S_{yt} = 380 \text{ N/mm}^2$ ) is shown in fig. The force P acting at the free end varies from -50N to +150N. The expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter 'd' of the beam at the fillet cross-section.

