

USN

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

15AU63

Sixth Semester B.E. Degree Examination, July/August 2022
Design of Machine Elements – II

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of data handbook may be permitted.*

Module-1

- 1 The frame of a punch press is shown in Fig.Q1. Find the stresses at the inner and outer surface at section X-X of the frame if $W = 5000 \text{ N}$.

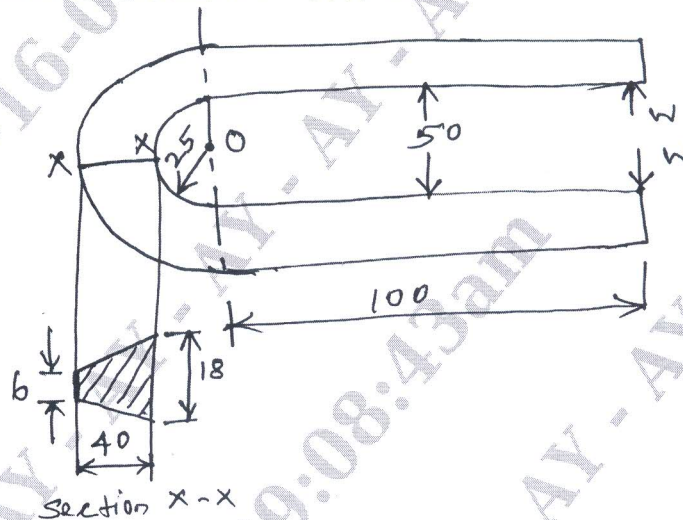


Fig.Q1

(16 Marks)

OR

- 2 Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity $G = 84 \text{ kN/mm}^2$.

Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring showing details of the finish of the end coils. (16 Marks)

Module-2

- 3 A gear drive is required to transmit a maximum power of 22.5 KW. The velocity ratio is 1:2 and rpm of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth has 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear.

Check the design for dynamic and wear loads. The deformation and dynamic factor in the Buckingham equation may be taken as 80 and the materials combination factor for the wear as 1.4. (16 Marks)

OR

- 4 A helical cast steel gear with 30° helix angle has to transmit 35 KW at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? The tooth factor for 20° full depth involute gear may be taken as $0.154 - \frac{0.912}{T_E}$ where T_E represents the equivalent number of teeth. (16 Marks)

Module-3

- 5 A worm drive transmits 15 KW at 2000 rpm to a machine carriage at 75 rpm. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.1. Calculate:
- Tangential force acting on the worm.
 - Axial thrust and separating force on worm.
 - Efficiency of the worm drive.
- (16 Marks)

OR

- 6 a. Write the classification of bevel gears. (08 Marks)
 b. Write the definitions of the following terms:
 (i) Addendum angle
 (ii) Face angle
 (iii) Module
 (iv) Backing (08 Marks)

Module-4

- 7 a. Determine the maximum, minimum and average pressure in a plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear. (08 Marks)
 b. What are the design considerations required for designing a friction clutch? (08 Marks)

OR

- 8 a. With neat sketch, explain the single block brake force system. (08 Marks)
 b. Write the required characteristics of materials for brake lining. (08 Marks)

Module-5

- 9 a. With simple sketches, explain the types of sliding contact bearings. (08 Marks)
 b. What are the assumptions used in theory of hydrodynamic bearings? (08 Marks)

OR

- 10 Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 rpm for an average life of 5 years at 10 hours per day. Assume uniform and steady load. (16 Marks)
