Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III • EXAMINATION – WINTER • 2014

Subject Code: X 31903 Date: 31-12-2014

Subject Name: Machine Design and Industrial Drafting

Time: 10:30 am - 01:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the following with reference to AutoCAD: **07**

(i) any two drawing commands

(ii) any two modifying commands

(iii) ARRAY command with example

(b) What is 'engineering design'? Explain the general design procedure for design of any machine. **07**

Q.2 **(a)** Define factor of safety and state the important factors affecting the selection of factor of safety. **04**

(b) What is stress concentration? Explain any three methods to relieve stress concentration? **04**

(c) Explain: 'A hollow shaft has greater strength and stiffness than solid shaft of equal weight'. **06**

OR

(c) A cantilever beam of I-section supports an electric motor weighing 1000 N at a distance of 400 mm from the fixed end. If the allowable strength of the beam material is 100 N/mm^2, determine the size of I-section. The proportion of I-section are B = 4t and H = 6t, where t is the thickness of the flange as well as that of the web. **06**

Q.3 **(a)** Write the advantages of welded joint over riveted joint? Explain, with neat sketches, the possible mode of failures for a riveted joint. **07**

(b) Design a knuckle joint to connect two rods of equal diameter to sustain a maximum pull of 100 kN. The ultimate strength of the material of the rod against tearing is 480 N/mm^2. The ultimate tensile and shearing strength of the pin material are 540 N/mm^2 and 360 N/mm^2 respectively. Determine the rod, knuckle pin and single eye end dimensions. Take factor of safety = 6. **07**

OR

Q.3 **(a)** Explain the design of socket and spigot cotter joint. **07**

(b) Draw neat sketches of 'corner weld' and 'T weld' joints. A welded joint as shown in Fig. 1, is subjected to an eccentric load of 2 kN. Find the size of weld, if the maximum permissible shear stress in the weld is 25 N/mm^2. **07**

Q.4 **(a)** Explain torsional and lateral rigidity of shaft. Also, describe the ASME code for the shaft design. **07**

(b) Write the function of shaft coupling. List the different types of shaft couplings. **03**

(c) A 45 mm diameter shaft is made of steel with a yield strength of 400 N/mm^2. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 N/mm^2 is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Take factor of safety as 2. **04**

OR

Q.4 **(a)** A cylindrical shaft made of steel having ultimate tensile strength of 660 N/mm^2 and ultimate shear strength of 450 N/mm^2 is subjected to static loads consisting of a bending moment of 1 kN-m and a torsional moment of 30 kN-m. Determine the diameter of shaft using maximum shear stress theory and maximum normal stress theory. Assume factor of safety as 6. **07**

(b) With neat sketches explain different types of fits. **07**

Q.5 **(a)** Differentiate between self-locking and overhauling of power screw. Show that the efficiency of self-locking power screws is less than 50 %. **07**

(b) Explain with neat sketch design procedure of rocker arm for exhaust valve. **07**

OR

Q.5 **(a)** Write short note on 'lever' describing its function, types, applications and general design procedure. **07**

(b) The screw, as shown in Fig. 2 is operated by a torque applied to the lower end. The nut is loaded and prevented from turning by guides. Assume friction in the ball bearing to be negligible. The screw is a triple start trapezoidal thread (Take, $2\beta=30^\circ$). The outside diameter of the screw is 48 mm and pitch is 8 mm. The coefficient of friction of the threads is 0.15. Find : **07**

1. Load which can be raised by a torque of 40 N-m ;
2. Whether the screw is overhauling ; and
3. Average bearing pressure between the screw and nut thread surface.

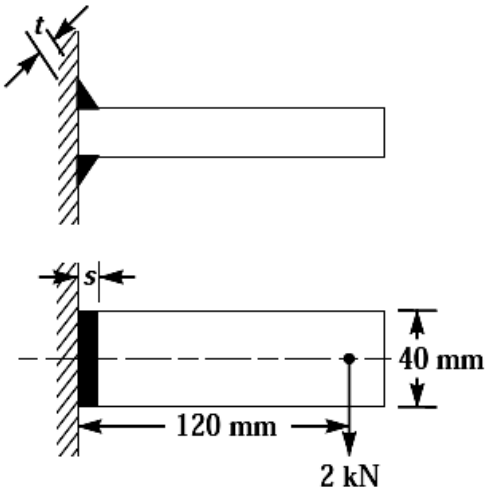

Fig. 1

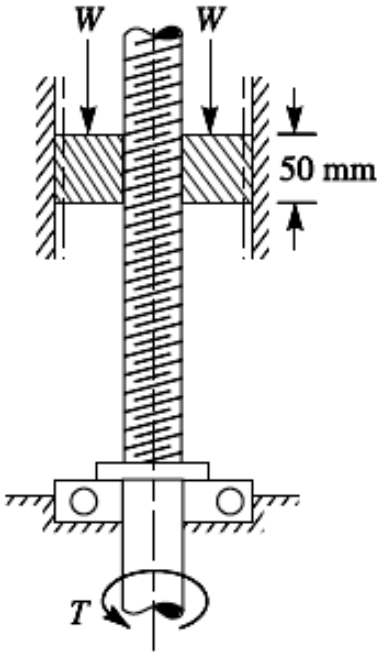

Fig. 2

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