Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III • EXAMINATION – SUMMER 2015

Subject Code: 131902 **Date: 06/06/2015**

Subject Name: Machine Design and Industrial Drafting

Time: 02.30pm-05.30pm **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)** Attempt the following **07**

(i) Define and state factors that influence magnitude of factor of safety.

(ii) What are the various steps involved in machine design process, explain it.

(b) The load on a bolt consists of an axial pull of 10 KN together with a transverse shear force of 5 KN. Find the diameter of bolt required according to 1.Maximum principal stress theory; 2.Maximum shear stress theory; 3.Maximum distortion energy theory Take permissible tensile stress at elastic limit = 100 MPa and Poisson's ratio = 0.3 **07**

Q.2 **(a)** Attempt the following **07**

(i) Show by neat sketches the various ways in which a riveted joint may fail.

(ii) State the difference between caulking and fullering with neat sketches.

(b) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are : **07**

σ_t = 120 MPa; τ = 100 MPa; σ_c = 150 MPa

Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear.

OR

(b) A rectangular cross-section bar is welded to a support by means of fillet welds as shown in figure-1.Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 MPa. **07**

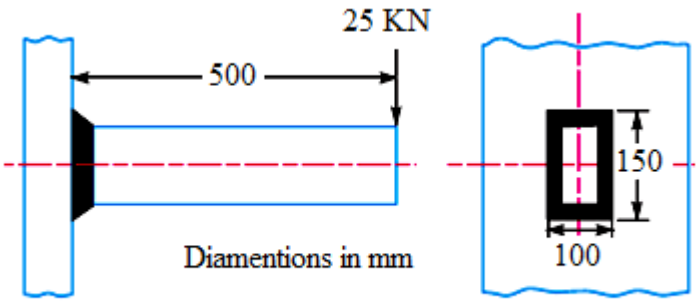

Figure-1

Q.3 **(a)** A knuckle used to connect two circular rods subjected to an axial load of 150KN Design the joint and specify the dimensions of its component. The allowable stresses of the joint material may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. **10**

(b) Explain hole-based and shaft based limit system with neat sketch. **04**

OR

Q.3 **(a)** Design a cotter joint to connect piston rod to the crosshead of a double acting steam engine. The diameter of the cylinder is 300 mm and the steam pressure is 1 N/mm^2. The allowable stresses for the material of cotter and piston rod are as follows : σ_t = 50 MPa ; τ = 40 MPa ; and σ_c = 84 MPa **10**

(b) Discuss the Indian standard system of fits. **04**

Q.4 **(a)** Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 KW at 120 R.P.M. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. Allowable shear stress in the shaft may be taken as 35 MPa. **07**

(b) Attempt the following **07**

(i) A hollow shaft has greater strength and stiffness than solid shaft of equal weight. Explain.

(ii) What is the effect of keyway cut into the shaft?

OR

Q.4 **(a)** Two 35 mm shafts are connected by a flanged coupling. The flanges are fitted with 6 bolts on 125 mm bolt circle. The shafts transmit a torque of 800 N-m at 350 R.P.M. Calculate 1. Diameter of bolts; 2. Thickness of flanges; 3. Key dimensions; 4. Hub length; and 5. Power transmitted. Material stresses are: **07**

Allowable shear stress for shaft material = 63 MPa
Allowable stress for bolt material = 56 MPa
Allowable stress for cast iron coupling = 10 MPa
Allowable stress for key material = 46 MPa

Shaft diameter (mm) up to and including	Key cross-section (mm^2) (w x t)
30	10 X 8
38	12 X 8

(b) How are the keys classified? Draw neat sketches of different types of keys and state their applications. **07**

Q.5 **(a)** A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 KN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 R.P.M. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm^2, Find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw. **07**

(b) Attempt the following **07**

(i) What do you understand by self-locking and overhauling of screw?

(ii) Show that the efficiency of self-locking screws is less than 50 %

OR

Q.5 **(a)** Attempt the following **07**

(i)What is surface roughness? How it is indicated on drawing?

(i)Explain circle, arc, rectangle and polygon commands for Auto CAD drawing.

(b) Explain the general procedure usually adopted in the design of a lever. **07**

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