Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code: 2141907 **Date: 03/06/2015**

Subject Name: Machine Design and Industrial Drafting

Time: 10:30am-1.00pm **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)**	1. Explain Mohr's circle diagram for principal stresses.	**04**
		2. Define Basic size, Tolerance and Deviation.	**03**
	(b)	1. What are the parameters used for surface roughness measurement? Explain any two.	**04**
		2. In bush and pin assembly, pin of 30 mm diameter rotates in a bush. The tolerance for pin is 0.025 mm while for bush is 0.04 mm. If allowance is 0.1 mm, determine dimensions of pin and bush considering hole-basis system.	**03**
Q.2	**(a)**	1. Explain with neat sketch three basic types of lever stating their practical examples.	**04**
		2. Why taper is provided on cotter? What is its normal value? State its applications.	**03**
	(b)	Design a knuckle joint to transmit 75 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.	**07**
		OR	
	(b)	A bell crank lever is to be designed to raise a load of 6 kN at short arm end. The arm lengths are 160 mm and 550 mm. The permissible stresses for lever and pin materials in shear and tension are 60 MPa and 90 MPa respectively. The bearing pressure on pin is to be limited to 13 MPa. Assume lever cross section as t×4t and fulcrum pin length as 1.25 times pin diameter.	**07**
Q.3	**(a)**	1. Draw neat sketches of double V-Butt weld, single transverse fillet weld, single V-Butt weld and T-weld.	**04**
		2. Differentiate between beam and column. Enlist different types of beams.	**03**
	(b)	A connecting rod of uniform rectangular cross-section having b/d ratio of 1.5 and length 100 mm is used for supporting an axial compressive load of 20 kN. It is hinged at both ends and made of alloy steel with ultimate compressive strength of 700 MPa and modulus of elasticity of 210 GPa. Considering factor of safety 4, determine cross-sectional dimensions using appropriate of Euler's and Johnson's formulae.	**07**
		OR	
Q.3	**(a)**	1. Differentiate between power screw and threaded joint.	**04**
		2. Explain Euler's formula along with its applicability and limitations.	**03**
	(b)	A 300 mm long alloy steel rod is used to support an axial compressive load of 65 kN. One end of rod is fixed and the other end is free to support load. Assuming compressive yield strength 550 N/mm^2 and modulus of elasticity 210 GPa, determine diameter of rod by buckling consideration. Use Rankine's formula with Rankine constant $\alpha = 1/7500$. Take factor of safety 3.5.	**07**
Q.4	**(a)**	1. Explain Axle, Spindle, Counter shaft and line-shaft with their examples.	**04**
		2. What is ASME code for shaft design?	**03**

(b) A hoisting drum 0.5 m in diameter is keyed to shaft which is supported in two bearings and driven through 12:1 reduction ratio by an electric motor. Determine power of driving motor, if maximum load of 8 kN is hoisted at speed of 50 m/min with 80% efficiency. Also determine torque on drum shaft and speed of motor in rpm. Determine also diameter of shaft for which working stresses are 115 MPa in tension and 50 MPa in shear. The drive gear whose diameter is 450 mm is mounted at end of shaft such that it overhangs nearest bearing by 150 mm. The combined shock and fatigue factors for bending and torsion may be taken as 2 and 1.5 respectively. **07**

OR

Q.4 **(a)** 1. Derive strength equations of sunk key based on shear and compression failures. **04**

2. Discuss factors to be considered while selecting type of key. **03**

(b) A bushed pin type flexible coupling is used to transmit 10 kW power at 720 rpm. The design torque is 150% of rated torque. The keys have square cross-section. The permissible stresses are: For shaft and key material, $\tau = 66.67$ N/mm^2, $\sigma_c = 200$ N/mm^2; For pin material, $\tau = 35$ N/mm^2, $\sigma_t = 133$ N/mm^2; For flange material $\tau = 16.67$ N/mm^2. The permissible bearing pressure for rubber bushes is 1 N/mm^2. The number of bushes is 4. **07**

Design the bushed pin flexible coupling.

Q.5 **(a)** 1. Draw neat sketch of Double riveted zig-zag butt joint with all terminology. **04**

2. Two steel plates, 120 mm wide and 12.5 mm thick, are joined together by means of double transverse fillet welds. The maximum tensile stress for plates and welding materials should not exceed 110 N/mm^2. Find required length of weld, if strength of weld is equal to strength of plates. **03**

(b) Find the value of P for joint shown in Figure 1, based on a working shear stress of 100 MPa for rivets. Each of four rivets is of 20 mm diameter. **07**

OR

Q.5 **(a)** 1. Define Pitch, Lead, Nominal diameter and Core diameter for power screw. **04**

2. What do you mean by bolt of uniform strength? Explain with neat sketch. **03**

(b) The nominal diameter of a triple threaded square screw is 50 mm, while pitch is 8 mm. It is used with a collar having outer diameter of 100 mm and inner diameter of 65 mm. The coefficient of friction at thread surface as well as at collar surface can be taken as 0.15. The screw is used to raise a load of 15 kN. Using uniform wear theory for collar friction, calculate: (i) Torque required to raise load, (ii) Torque required to lower load and (iii) Force required to raise load, if applied at a radius of 500 mm. **07**

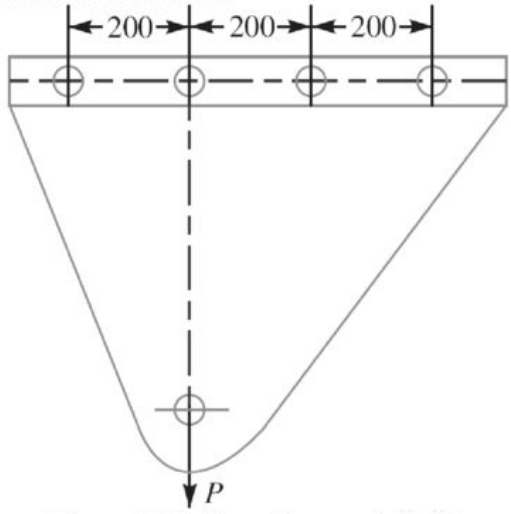

Figure 1(All dimensions are in mm.)

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