Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) EXAMINATION – SUMMER 2016

Subject Code:2141907 Date:06/06/2016

Subject Name:Machine Design & Industrial Drafting

Time:10:30 AM to 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 **Answer the following questions in short.** **14**

1 What is impact load?
2 What is factor of safety?
3 How is the leverage of compound lever calculated?
4 If the ratio of torque to bending moment on a shaft is 0.33, what would be the ratio of equivalent bending moment to equivalent torque?
5 Which stress is considered to design bolt in a flange coupling?
6 What is circumferential riveted joint?
7 What is self locking screw?
8 What would be the throat area of a fillet weld with equal legs of 6 mm and length of 1 cm?
9 What is caulking process as used in riveted joint?
10 What is equivalent length of a column?
11 Define 'slenderness ratio'.
12 What is unilateral and bilateral tolerance?
13 What is deviation as used in fits?
14 How the surface finish is represented symbolically?

Q.2 **(a)** What is fit? Explain various types of fit with neat sketches. **03**

(b) A journal of nominal diameter 79 mm rotates in a bearing. The upper and lower deviations in hole diameter are respectively +0.05 mm and 0.00 mm, while those for shaft are respectively -0.03 mm and -0.07 mm. Calculate: (i) Extreme diameters for hole and shaft, (ii) Tolerances for hole and shaft and (iii) maximum and minimum clearance. **04**

(c) Calculate the diameter of a piston rod for a cylinder of 1.5 m diameter in which the greatest difference of steam pressure on two sides of piston may be assumed to be 0.2 N/mm^2. The rod is made of mild steel and is secured to piston by a tapered rod and nut and to the crosshead by a cotter. Assume modulus of elasticity as 200 kN/mm^2 and factor of safety as 8. The length of rod may be assumed as 3 m. **07**

OR

(c) Explain Rankine's and Johnson's formula for designing columns. **07**

Q.3 **(a)** Explain maximum principal stress theory. **03**

(b) The dimensions of an overhang crank are shown in figure 1. The force P acting at crankpin is 1 kN. The crank is made of steel 30C8 with allowable shear stress 100 MPa. Using maximum shear stress theory of failure, determine the diameter at section XX. **04**

(c) Design a knuckle joint to transmit 50 kN. The design stresses may be taken as 80 MPa in tension, 40 MPa in shear and 80 MPa in compression. **07**

OR

Q.3	**(a)**	How will you select among different theories of failure?	**03**
	(b)	What is lever? Why they are usually made tapered?	**04**
	(c)	A lever loaded safety valve is 70 mm in diameter and is to be designed for a boiler to blow-off at pressure of 1 N/mm^2 gauge. Design a suitable mild steel lever of rectangular cross-section. The permissible stresses are: Tensile stress = 70 MPa; Shear stress = 50 MPa; Bearing pressure intensity = 25 MPa. The pin is also made of mild steel. The distance from fulcrum to weight of lever is 880 mm and distance between fulcrum and pin connecting valve spindle links to lever is 80 mm.	**07**
Q.4	**(a)**	Explain ASME design code for shaft.	**03**
	(b)	Deduce the design equation for shaft subjected to twisting moment only.	**04**
	(c)	Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of belt drive. The pulley weighs 200 N and is located at 300 mm from centre of bearing. The diameter of pulley is 200 mm and maximum power transmitted is 1 kW at 120 rpm. The angle of lap of belt is 180° and coefficient of friction between belt and pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress for shaft is 35 MPa.	**07**

OR

Q.4	**(a)**	What is keyway? How is its effect considered in shaft design?	**03**
	(b)	Explain different types of keys used in shaft coupling.	**04**
	(c)	Design muff coupling to connect two steel shafts transmitting 40 kW at 350 rpm. The material for shafts and key is plain carbon steel for which allowable shear and crushing stresses are 40 MPa and 80 MPa respectively. The material for muff is cast iron for which allowable shear stress is 15 MPa.	**07**
Q.5	**(a)**	Explain terminology of power screw with neat sketch.	**03**
	(b)	Deduce the equation for strength of transverse fillet weld.	**04**
	(c)	A double threaded power screw with ISO metric trapezoidal threads with 15° semi-angle of thread is used to raise a load of 300 kN. The nominal diameter is 100 mm and pitch is 12 mm. the coefficient of friction at screw threads is 0.15. Neglecting collar friction, calculate; (i) torque required to raise the load, (ii) torque required to lower the load and (iii) efficiency of the screw.	**07**

OR

Q.5	**(a)**	Draw neat sketch of Double riveted zigzag lap joint with all terminology	**03**
	(b)	Deduce the design equation for circular fillet weld subjected to torsion.	**04**
	(c)	Design a double riveted zigzag lap joint for 13 mm thick plates. The allowable stresses are: σ_t = 80 MPa, τ = 60 MPa and σ_c = 120 MPa. State how the joint will fail and find efficiency of joint.	**07**

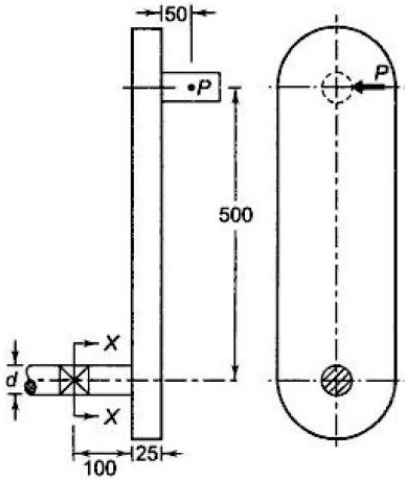

Figure 1(All dimensions are in mm.)

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