Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(New) • EXAMINATION – WINTER 2016

Subject Code:2142506 **Date:23/11/2016**

Subject Name:Fundamentals of Machine Design

Time:02:30 PM to 05:00 PM **Total Marks: 70**

Instructions:

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

MARKS

Q.1 **Select correct answer(s).** **14**

1 The ratio of linear stress to linear strain is called
(a) Modulus of elasticity (b) Modulus of rigidity
(c) Bulk modulus (d) Poison's ratio

2 At the neutral axis of a beam, the shear stress is
(a) zero (b) maximum (c) minimum

3 Failure of a material is called fatigue when it fails
(a) at the elastic limit (b) below the elastic limit
(c) at the yield point (d) below the yield point

4 The diameter of the rivet hole is usually _____ the nominal diameter of the rivet.
(a) equal to (b) less than (c) more than

5 The parallel fillet welded joint is designed for
(a) tensile strength (b) compressive strength
(c) bending strength (d) shear strength

6 The railway carriage coupling have
(a) square threads (b) acme threads
(c) knuckle threads (d) buttress threads

7 In a gib and cotter joint, the thickness of gib is _____ thickness of cotter.
(a)) more than (b) less than (c)equal to

8 Two shafts A and B are made of the same material. The diameter of the shaft A is twice as that of shaft B. The power transmitted by the shaft A will be _____of shaft B.
(a) twice (b) four times
(c) eight times (d) sixteen times

9 The type of stresses developed in the key is/are
(a) shear stress alone (b) bearing stress alone
(c) both shear and bearing stresses (d) shearing, bearing and bending stresses

10 The muff coupling is designed as a
(a) thin cylinder (b) thick cylinder
(c) solid shaft (d) hollow shaft

11 The cross section of the arm of a bell crank lever is
(a) Rectangular (b) elliptical
(c) I-section (d) any of these

12 Which of the following formula is used in designing a connecting rod?
(a) Euler's formula (b) Rankine's formula
(c) Johnson's straight line formula (d) Johnson's parabolic formula

13 The yield point in static loading is _____ as compared to fatigue loading.
(a) higher (b) lower (c) same

14 If the tearing efficiency of a riveted joint is 50%, then ratio of diameter of rivet hole to the pitch of rivets is
(a) 0.20 (b) 0.30
(c) 0.50 (d) 0.60

Q.2 **(a)** What is factor of safety? What are the factors to be considered while selecting the same? **03**

(b) Define the following: **04**
(1) Principal stress (2) Bearing pressure (3) Preferred number (4) Tensile stress

(c) A mild steel link as shown in Figure-1 by full lines, transmits a pull of 80 kN. Find the dimensions b and t if b = 3t. Assume the permissible tensile stress as 70 MPa. If the original link is replaced by an unsymmetrical one as shown by dotted lines in Figure-1, having the same thickness t, find the depth b_1 using the same permissible stress as before. **07**

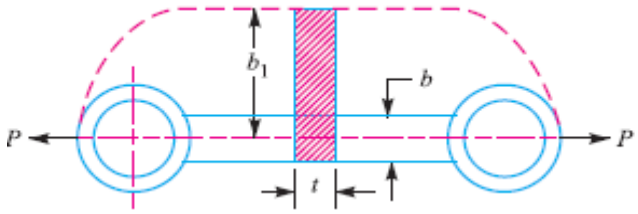

Figure-1

OR

(c) A bracket as shown in Figure-2 carries a load of 40 kN. Calculate the size of the weld, if the allowable shear stress is not to exceed 80 MPa. **07**

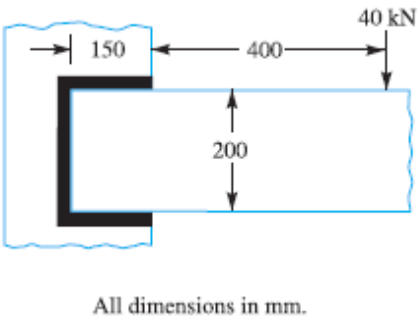

Figure-2

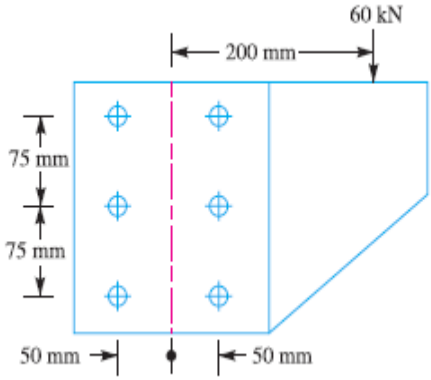

Figure-3

Q.3 **(a)** Explain caulking and fullering in terms of riveted joint. **03**

(b) Discuss on bolts of uniform strength giving examples of practical applications of such bolts. **04**

(c) A bracket is riveted to a column by 6 rivets of equal size as shown in Figure-3. It carries a load of 60 kN at a distance of 200 mm from the centre of the column. If the maximum shear stress in the rivet is limited to 150 MPa, determine the diameter of the rivet. **07**

OR

Q.3 **(a)** Explain the important terminology of riveted joint. **03**

(b) How are the keys classified? Draw neat sketches of different types of keys. **04**

	(c)	The pull in the cast iron turn buckle of the stay rope of an electric pole is 13 kN. Design the turn buckle assuming safe tensile stress of σt = 30 MPa and τ = 30 MPa for cast iron.	**07**
Q.4	**(a)**	What is shaft coupling? Enlist different couplings stating its applications.	**03**
	(b)	State and Explain the various criteria on which shaft are designed?	**04**
	(c)	A shaft made of mild steel is required to transmit 100 kW at 300 rpm. The supported length of the shaft is 3 meters. It carries two pulleys each weighing 1500 N supported at a distance of 1 meter from the ends respectively. Find the diameter of the shaft, take τ = 60 N /mm^2.	**07**

OR

Q.4	**(a)**	What are the advantages and disadvantages of Welded Joints over Riveted Joints?	**03**
	(b)	Define cotter. Why taper is provided in a cotter? What is the purpose of clearance in Cotter Joints?	**04**
	(c)	Design a muff coupling to connect two shafts transmitting 40 kW at 120 rpm. The permissible shear and crushing stresses for shaft and key made of plain carbon steel 30C8 are 40 MPa and 80 MPa respectively. The muff is made of grey cast iron with a permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is 25 % greater than the mean torque.	**07**
Q.5	**(a)**	State and explain the different functions of levers.	**03**
	(b)	Briefly describe all elements of production drawing.	**04**
	(c)	Design a rocker arm for operating an exhaust valve of a gas engine. The maximum force on the roller is limited to 2.5 kN. The effective length of each arm is 150 mm and the included angle is 135˚. The load and effort are applied at right angles to the lever arms. The opening of the valve is adjusted by a 10 mm stud and check nut. The rocker arm is made of forged steel, having permissible stresses, σt = 70 MPa and τ =56 MPa. The allowable bearing pressure for pin is limited to 6 MPa. The pin has same stresses as lever. The width of roller may be taken as 25 mm.	**07**

OR

Q.5	**(a)**	What do you understand by a column or strut? Explain the various end conditions of a column or strut.	**03**
	(b)	Explain the surface roughness symbols with their meanings.	**04**
	(c)	An I-section 400mm×200 mm×10 mm and 6 m long is used as a strut with both ends fixed. Find Euler's crippling load. Take Young's modulus for the material of the section as 200 kN/mm^2.	**07**

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