Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:2142506 **Date:06/06/2016**

Subject Name:Fundamentals of Machine Design

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.**

MARKS

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

1 The torsional shear stress on any cross section normal to the axis is _____ the distance from the centre of the axis.
(a) Directly proportional to (b) inversely proportional to

2 The bending stress in a curved beam is
(a) zero at the centroidal axis (b) zero at the point other than centroidal axis
(c) maximum at the neutral axis (d) none of the above

3 In cyclic loading, stress concentration is more serious in
(a) brittle materials (b) ductile materials
(c) brittle as well as ductile materials (d) elastic materials

4 The objective of caulking in a riveted joint is to make the joint
(a) free from corrosion (b) stronger in tension
(c) free from stresses (d) leak-proof

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

6 When a nut is tightened by placing a washer below it, the bolt will be subjected to
(a) tensile stress (b) compressive stress
(c) shear stress (d) none of these

7 In a turn buckle, if one of the rods has left hand threads, then the other rod will have
(a) right hand threads (b) left hand threads
(c) pointed threads (d) multiple threads

8 The taper on a rectangular sunk key is
(a) 1 in 16 (b) 1 in 32
(c) 1 in 48 (d) 1 in 100

9 Which of the following loading is considered for design of axles?
(a) Bending moment only (b) Twisting moment only
(c) Combined bending moment and torsion
(d) Combined action of bending moment, twisting moment and thrust

10 All the types of levers are subjected to
(a) twisting moment (b) bending moment
(c) direct axial load (d) combined twisting and bending moment

11 A connecting rod is designed as a
(a) long column (b) short column
(c) strut (d) any of these

12 In a steam engine, the piston rod is usually connected to the crosshead by means of
(a) knuckle joint (b) universal joint
(c) flange coupling (d) cotter joint

13 The maximum shear stress theory is used for
(a) brittle materials (b) ductile materials
(c) plastic materials (d) non-ferrous materials

14 The stress which vary from minimum value to a maximum value of the same nature(i.e. tensile or compressive) is called
(a) repeated stress (b) yield stress
(c) fluctuating stress (d) alternative stress

Q.2 **(a)** Explain bending stress and shear stress with simple sketches. **03**
(b) What are the various steps involved in machine design process, explain it. **04**
(c) A wall bracket as shown in Figure-1 is subjected to a pull of P = 5 KN at 60 ° to the vertical. The cross-section of bracket is rectangular having b= 3t.Determine the dimensions b and t if the stress in the material of the bracket is limited to 28 MPa. **07**

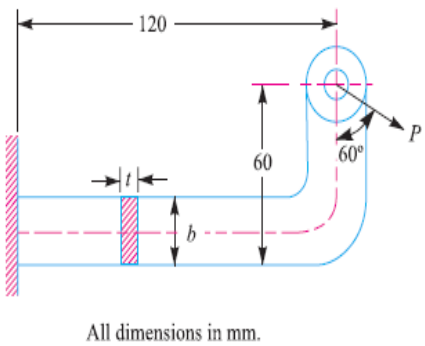

Figure-1

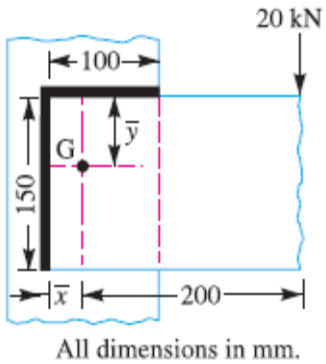

Figure-2

OR

(c) A triple riveted unequal cover butt joint is used to connect two plates 20 mm thick. If σ_t = 75 MPa, τ = 60 MPa,σ_{cr} = 140 MPa, design the joint completely using chain riveting. **07**

Q.3 **(a)** Define shaft, axle and spindle. **03**
(b) Distinguish between cotter joint and knuckle joint. **04**
(c) Figure-2 shows a welded joint subjected to an eccentric load of 20 KN. The welding is only on one side. Determine the uniform size of the weld on the entire length of two legs. Take permissible shear stress for the weld material as 80 MPa. **07**

OR

Q.3 **(a)** What is an eccentric loaded welded joint? Explain it. **03**
(b) Explain the different failures of riveted joint. **04**
(c) Design a socket and spigot type cotter joint to connect two rods of mild steel for an axial tensile load of 40 kN. The allowable stresses are :σ_t= 60MPa,τ = 48MPa and σ_{cr} = 80 MPa. **07**

Q.4 **(a)** What is a lever? Explain the principles on which it works. **03**
(b) An universal coupling is used to connect two mild steel shafts transmitting a torque of 5000N-m. Assuming that the shafts are subjected to torsion only, find the diameter of the shafts and pins. The allowable shear stresses for the shaft and pin may be taken as 60 MPa and 28 MPa respectively. **04**

(c) A shaft is required to transmit 7.5 kW at 1200 rpm. The shaft carries an overhung pulley situated at a distance of 0.25 m from the nearest bearing. The belt tensions are 2100 N and 1000 N on tight and slack side of the vertical belt drive. The mass of pulley is 40 kg. If the allowable stresses in tension and shear are 70 MPa and 42 MPa respectively find the size of the shaft. Neglect shock and fatigue effect. **07**

OR

Q.4 **(a)** How are the keys classified? Explain it in brief. **03**

(b) Explain Johnson's formula for columns. **04**

(c) Figure-3 shows a lever of a lever loaded safety valve. The valve diameter d_v is 100 mm. It is required to blow off at a pressure of 1.25 bar. Design the cross-section of the lever and fulcrum pin diameter if the allowable stresses are: σ_t= 75 MPa, τ =60 MPa for pin and lever and bearing pressure for pin is 20 MPa. **07**

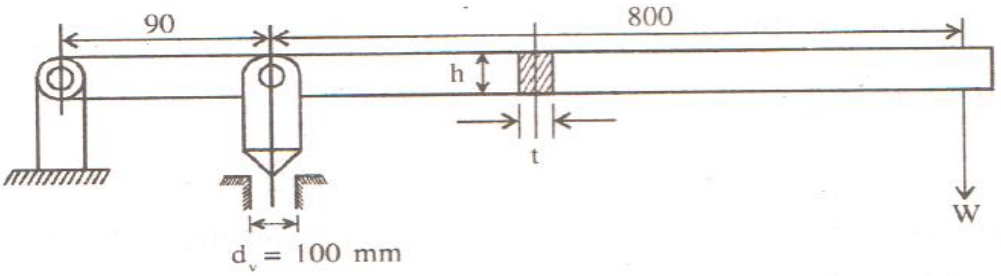

Figure-3

Q.5 **(a)** Differentiate between rigid and flexible coupling. **03**

(b) Explain stress concentration & methods of reducing it by sketches. **04**

(c) Determine the diameter of a piston rod of a steam engine from the following data: Cylinder bore= 450 mm, Maximum net pressure on piston side = 0.56 N/mm^2, distance between piston to the cross-head = 1500 mm, Elastic limit stress = 280 N/mm^2, Factor of safety = 4, End fixity Co—efficient for piston rod = 3.5, Rankine constant, a = 1/7500. **07**

OR

Q.5 **(a)** Explain the machining symbols with all parameter. **03**

(b) Explain in brief about the Nut locking devices. **04**

(c) Design a compression coupling for a shaft to transmit 30 kW at 2200 rpm. The allowable shear stress for shaft and key is 40 MPa. Four bolts are used to connect two halves of the coupling. The allowable tensile stress for bolt is 70 MPs. Take f= 0.3 **07**

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