

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2142506

Date: 14/12/2019

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.

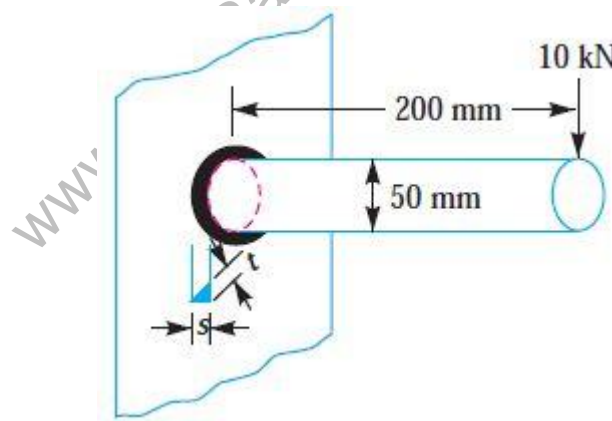
- Q.1**
- | | | |
|-----|---|-----------|
| (a) | Define Principle Stress, Shear Stress and Residual Stress. | 03 |
| (b) | What is factor of safety? What are the factors to be considered while selecting the same? | 04 |
| (c) | Explain the General Procedure in machine design. | 07 |

- Q.2**
- | | | |
|-----|---|-----------|
| (a) | Explain the types of riveted joints. | 03 |
| (b) | Explain the terminology used in riveted joints. | 04 |
| (c) | Explain the failures of riveted joints. | 07 |

OR

- (c) A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint.
If the above joint is subjected to a load such that factor of safety is 4. Find out the actual stresses developed in the plates and the rivets.

- Q.3**
- | | | |
|-----|---|-----------|
| (a) | Describe the types of welded joints with neat sketch. | 03 |
| (b) | Explain the advantages and disadvantages of welded joints over riveted joints. | 04 |
| (c) | A 50 mm diameter solid shaft is welded to a flat plate as shown in Fig. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. | 07 |



OR

- Q.3**
- | | | |
|-----|--|-----------|
| (a) | Explain the terminology used in screw threads. | 03 |
| (b) | Explain Gib and cotter joint with neat sketch. | 04 |
| (c) | Explain the Design procedure of Knuckle joint. | 07 |
- Q.4**
- | | | |
|-----|--|-----------|
| (a) | Explain various types of sunk keys. | 03 |
| (b) | Discuss the design procedure of shafts on the basis of rigidity. | 04 |
| (c) | Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : | 07 |

Shear stress for shaft, bolt and key material = 40 MPa

Crushing stress for bolt and key = 80 MPa

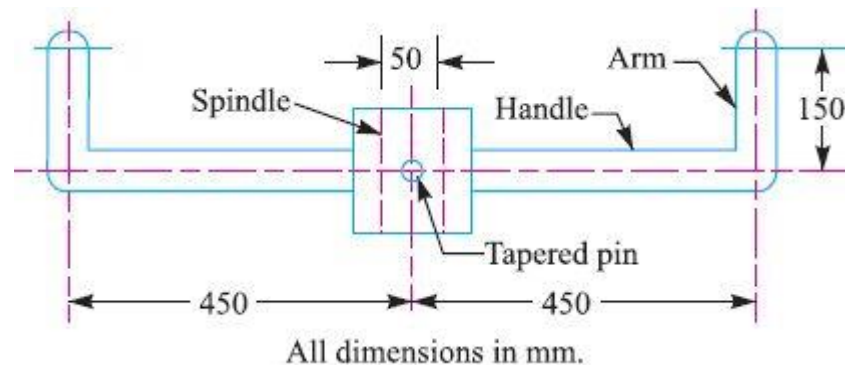
Shear stress for cast iron = 8 MPa

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OR

- Q.4** (a) Describes the types of levers with neat diagram. **03**
 (b) Discuss the design procedure of Lever. **04**
 (c) A handle for turning the spindle of a large valve as shown in Fig. The length of the handle from the centre of the spindle is 450 mm. The handle is attached to the spindle by means of a round tapered pin. If an effort of 400 N is applied at the end of the handle. **07**
 Find: 1. Mean diameter of the tapered pin.
 2. Diameter of handle.
 The allowable stresses for the handle and pin are 100 MPa in tension and 55 MPa in shear.



- Q.5** (a) Differentiate struts and columns **03**
 (b) Explain Rankine's formula for columns **04**
 (c) A T-section 150 mm × 120 mm × 20 mm is used as a strut of 4 m long hinged at both ends. Calculate the crippling load, if Young's modulus for the material of the section is 200 kN/mm². **07**

OR

- Q.5** (a) Explain machining symbols with all parameters. **03**
 (b) Describe Johnson's Formulae for Columns. **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 the two sides of the piston may be assumed to be 0.2 N/mm². The rod is made of mild steel and is secured to the piston by a tapered rod and nut and to the crosshead by a cotter. Assume modulus of elasticity as 200 kN/mm² and factor of safety as 8. The length of rod may be assumed as 3 meters. **07**
