Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:2141907 Date:19/02/2021

Subject Name:Machine Design & Industrial Drafting

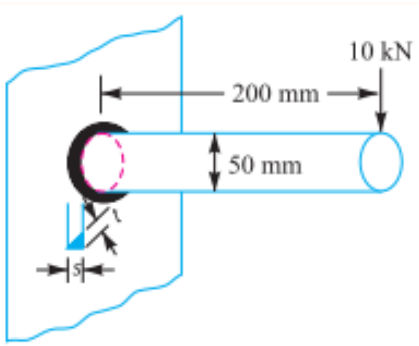
Time:02:30 PM TO 04:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain the maximum shear stress theory in detail.	**03**
	(b)	Explain the contact stresses and bearing stress.	**04**
	(c)	Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6.	**07**
Q.2	**(a)**	Explain the buckling of columns in detail.	**03**
	(b)	Define factor of safety. Explain its importance in design. Discuss the factors affecting selection of it.	**04**
	(c)	Design a bell crank lever to raise a load of 7.5 kN at short arm end. The arm lengths are 100 mm and 500 mm. The permissible stresses for lever and pin material in shear and tension are 30 MPa and 60 MPa respectively. The bearing pressure on pin is to be limited to 10 MPa. Assume lever cross section as t x 4t and fulcrum pin length as 1.5 times pin diameter.	**07**
Q.3	**(a)**	State and explain the different shaft materials.	**03**
	(b)	State the requirements of a good coupling. Compare solid Muff coupling and split Muff coupling.	**04**
	(c)	Design a transmission shaft supported two bearings that are 750 mm apart. Power is supplied to the shaft through a coupling, that is located to the left of left hand bearing. Power is supplied to the shaft by means of a belt pulley 450 mm diameter, which is located at a distance of 200 mm to the right of left hand bearing. The weight of the pulley is 300 N and the ratio of the belt tension of the tight side and slack sides is 2:1. The belt tensions acts vertically downward. The shaft is made from FeE 300 have permissible torsional shear stress 50 MPa. Find the shaft diameter, if it transmits 12.5 kW power at 300 rpm from the coupling to the pulley.	**07**
Q.4	**(a)**	Explain the design of shaft according to ASME code in detail.	**03**
	(b)	Write short notes on: Different types of keys.	**04**
	(c)	Design the protected type bushed pin flexible coupling to transmit 60 kW power at 720 rpm. The keys have square cross- section. The permissible stresses are: For shaft and key material : $\tau = 40$ N/mm^2, $\sigma_c = 80$ N/mm^2 For pin material : $\tau = 35$ N/mm^2, $\sigma_t = 80$ 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 numbers of bolts are 4.	**07**
Q.5	**(a)**	Explain the different failures of riveted joint with neat sketch.	**03**
	(b)	Explain the different types of screw threads used in power screws with neat sketches in detail.	**04**

(c) A 50 mm diameter solid shaft is welded to a flat plate as shown in below. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. **07**



Q.6 **(a)** Explain the Classification of Welded joints. **03**

(b) Explain the design of eccentrically loaded riveted joints. **04**

(c) The lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine (a) the power required to drive the screw; and (b) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar. **07**

Q.7 **(a)** Write a note on: Relation of surface roughness and various manufacturing processes **03**

(b) Explain hole base and shaft base limit system with neat sketch. **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 is 0.2 N/mm^2. The piston rod is made of mild steel (E = 200 kN/mm^2) and is secured to the piston by a tapered rod and nut. The outer end piston rod is connected to cross-head by cotter. The length of rod is 3 m, while the required factor of safety is 8.Assume both ends fixed condition. **07**

Q.8 **(a)** Write a note on: Surface roughness and its symbols **03**

(b) Explain the different types of fits with neat sketch. **04**

(c) Derive Euler's equation for buckling failure of long column with both ends hinged conditions with assumptions. **07**

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