GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:2141907   **Date:19-07-2023**

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS

Q.1	**(a)**	Define the following terms
		  i. Shear stress
		  ii. Bending stress
		  iii. principal stress
			03

	(b)	Differentiate between hole basis system and shaft basis sys	**04**
	(c)	Explain the different types of fits with neat sketches.	**07**
Q.2	**(a)**	Define factor of safety and state the factors affecting the value of FOS.	**03**
	(b)	Explain the maximum Principal stress theory.	**04**

	(c)	Design a knuckle joint to transmit a load of 140 kN in tension or compression. All the components of the joint are made of the same material with following stresses
		     Allowable tensile stress--- 70 Mpa
		     Allowable Compressive stress-- 120 Mpa
		     Allowable shear stress--- 45 Mpa
			07

OR

	(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 1.1 Mpa gauge. Design a suitable mild steel lever of rectangular cross-section using the following allowable stresses :
		     Tensile stress = 70 MPa;
		     Shear stress = 50 MPa;
		     Bearing pressure intensity = 25 Mpa
		The pin is also made of mild steel. The distance from the fulcrum to the weight of the lever is 850 mm and the distance between the fulcrum and pin connecting the valve spindle links to the lever is 50 mm.
			07

Q.3	**(a)**	Differentiate between a beam and a columnn	**03**
	(b)	Explain the terms "Self- locking" and " Over- hauling" in connection to power screw.	**04**
	(c)	Derive Rankine's formula for buckling load on a column	**07**

OR

Q.3	**(a)**	State the assumption made in Euler's theory.	**03**

(b) Explain the different form of threads used in power screw. **04**

(c) An I- section 400mm x 200mm x 10mm and 5 meter long is used as strut with both ends pinned. Assume modulus of elasticity as 210 Gpa for the material of the section. **07**

Find Euler's buckling load

Q.4 **(a)** Define- shaft , axle and spindle. **03**

(b) " A hollow shaft has shaft has greater strength and stiffness than solid shaft of equal weight" justify the statement in detail **04**

(c) Design a cast iron protective type flange coupling to transmit 20 kW at 900 r.p.m. from an electric motor to a compressor. 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 = 15 MPa

OR

Q.4 **(a)** Define a coupling and classify the couplings. **03**

(b) " Square key is stronger against crushing than rectangular key" Justify the statement in detail. **04**

(c) A line shaft is driven by an electric motor placed vertically below it. The pulley on the line shaft is 160 mm in diameter and has belt tensions 5.5 kN and 1.5 kN on the tight and slack side of the belt respectively. Both these tensions may be assumed to be vertical. If the pulley is overhang from the shaft, the distance of the centre line of shaft from the cenre line of bearing is 350 mm. **07**

Calculate the diameter of the shaft assuming permissible shear stress for the shaft material as 45 Mpa

Q.5 **(a)** Define the following terms used in riveted joints **03**
1 Diagonal pitch
2 Margin
3 Efficiency of a riveted joint

(b) A circular shaft is welded to the support by means of circumferential fillet weld , the diameter of the shaft is 50mm and it is subjected to torque of 3 kN-m **04**

Calculate the size of the weld, allowable shear stress of the weld is 90 Mpa.

(c) Derive an expression for torque required to raise the load by square threaded screw. **07**

OR

Q.5 **(a)** Differentiate between a power screw and a threaded joint. **03**

(b) Explain the terms " Caulking" and " Fullering" in relation to riveted joints. **04**

(c) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.90 Mpa. Assume joint efficiency as 70 %, allowable tensile stress in the plate 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 55 MPa **07**