GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:2141907   **Date:04-07-2022**

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.**

Q.1	**(a)**	List the important factors that influence the magnitude of factor of safety.	**03**
	(b)	Differentiate bearing stresses and bearing pressure with suitable examples.	**04**
	(c)	A mild steel rod of 12 mm diameter was tested for tensile strength with the gauge length of 60 mm. Following observations were recorded : Final length = 80 mm; Final diameter = 7 mm; Yield load = 3.4 kN and Ultimate load = 6.1 kN. Calculate : 1. Yield stress, 2. ultimate tensile stress, 3. Percentage reduction in area, and 4. percentage elongation.	**07**
Q.2	**(a)**	What is the importance of determining principal stresses at the critical section of a member subjected to external loads?	**03**
	(b)	Explain eccentric loading and eccentricity in a machine?	**04**
	(c)	Explain the design procedure of a knuckle joint.	**07**
		OR	
	(c)	A cranked lever has the following dimensions : Length of the handle = 300 mm Length of the lever arm = 400 mm Overhang of the journal = 100 mm If the lever is operated by a single person exerting a maximum force of 400 N at a distance of 1/3rd length of the handle from its free end. Find: 1. Diameter of the handle, 2. Cross-section of the lever arm, and 3. Diameter of the journal. The permissible bending stress for the lever material may be taken as 50 MPa and shear stress for shaft material as 40 MPa.	**07**
Q.3	**(a)**	Which theory is commonly used for design of a shaft? Explain why?	**03**
	(b)	Explain the design of shaft based on strength and rigidity as per ASME Standards.	**04**
	(c)	A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and $\mu = 0.24$.	**07**

Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.

OR

Q.3 **(a)** What are different types of keys used to connect shaft to a pulley? Explain by drawing sketch. **03**

(b) Kennedy keys of 12 mm x 12 mm are used to connect a shaft of 50 mm diameter, transmitting 40 kW at 360 rpm. The keys are made of 40C8 steel with $\sigma_{yt} = \sigma_{yc} = 380$ N/mm^2. Taking a factor of safety of 3, determine the required length of the keys. **04**

(c) Explain the design procedure for a rigid flange coupling. **07**

Q.4 **(a)** Why is hexagonal head preferred for cap screw instead of square head? **03**
(b) Explain the bolt of uniform strength? **04**
(c) The nominal diameter of a triple threaded square screw is 50 mm, while the pitch is 8 mm. It is used with a collar having an outer diameter of 100 mm and inner diameter as 65 mm. The coefficient of friction at the thread surface as well as at the collar surface can be taken as 0.15. The screw is used to raise a load of 15 kN. **07**
Using the uniform wear theory for collar friction,
calculate:
(i) torque required to raise the load;
(ii) torque required to lower the load; and
(iii) the force required to raise the load, if applied at a radius of 500 mm.

OR

Q.4 **(a)** Explain the design procedure of valve push rods. **03**
(b) Derive the expression of Rankine's formula for buckling of column. **04**
(c) Derive expressions for slope and deflection at the free end of a cantilever beam of L carrying point W at its free end. **07**

Q.5 **(a)** What are the causes of residual stresses in welded joint? How are they relieved? **03**
(b) Explain basic welding symbols as per the Scheme of symbols for welding IS 813–1986. **04**
(c) Two steel plates, 200 mm wide × 16 mm thick, are to be joined by the diamond riveting arrangement using two cover plates. Allowable stress in shearing $\sigma_{ta} = 80$ MPa, allowable shear stress $\tau_a = 60$ MPa, and allowable bearing stress $\sigma_{ba} = 100$ MPa. **07**
Determine: (a) rivet diameter, (b) thickness of cover plates,
(c) Number of rivet, (d) rivet arrangement and
(e) tearing strength of plate in each row.

OR

Q.5 **(a)** With the help of a sketch, show how geometrical tolerances are indicated on a drawing. **03**
(b) What is meant by 'hole basis system' and 'shaft basis system'? Which one is preferred and why? **04**
(c) Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as 40H8/f7. **07**

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