36+2 (38)

SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | | **Total number of pages:[3]**

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B. Tech. || ME || 5th Semester
Design of Machine Elements
Subject Code: BTME 502A/501
Paper ID:

Time allowed: 3 Hrs **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (10×2marks)

1. (a) What do you understand by tearing strength?
   (b) Classify different types of keys.
   (c) What do you mean by Cotter? What is its purpose?
   (d) Sketch and Label the Spigot and Socket Cotter joint?
   (e) What are the different types of Levers? Draw neat sketch of these.
   (f) Differentiate Axle from Shaft.
   (g) How are the keys classified?
   (h) What are the different types of welded joints?
   (i) Explain Leverage and Mechanical advantage?
   (j) What is the function of coupling between two shafts?

Section B (5×8 marks)

Q2. Enumerate the most commonly used engineering materials and state at least one important property and one application of each.

OR

What do you mean by stress concentration? Briefly elaborate the methods of reducing the stress concentrations in engineering components.

(CO1)

Q3. Design a knuckle joint for a tie rod of a circular section to sustain a, maximum pull of 70kN. The ultimate strength of the material of the rod against tearing is 420MPa. The ultimate tensile and shearing strength of the pin material are 510MPa and 396MPa respectively. Determine the tie rod section and pin section. Take FOS = 6.

OR

Design a lap joint for a mild steel flat tie-bar 200mm×10mm thick, using 24 mm diameter rivets. Assume allowable stresses in tension and compression of the plate material as 112MPa and 200MPa respectively and shear stress of the rivets as 84MPa. Show the disposition of the rivets for maximum joint efficiency and determine the joint efficiency. Take diameter of rivet hole as 25.5mm for a 24mm diameter rivet. CO2)

Q4. A shaft is supported by two bearings placed 1m apart. A 600mm diameter pulley is mounted at a distance of 300mm to the right of left hand bearing & this drives a pulley directly below it with the help of a belt having maximum tension of 2.25kN. Another pulley 400mm diameter is placed 200mm 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 of both the pulleys is 180° and μ= 0.24. Determine the suitable diameter for a solid shaft, allowing working stress of 63MPa in tension and 42MPa in shear for the material of the shaft. Assume that the torque on pulley is equal to that on the other pulley.

OR

A line shaft is driven by means of a motor placed vertically below it. The pulley on the line shaft is 1.5m in diameter and has belt tensions 5.4kN and 1.8kN on the tight side and slack side of the belts respectively. Both these tensions may be assumed to be vertical. If the pulley be overhand from the shaft, the distance of the center line of the pulley from the center line of the bearing being 400mm, find the diameter of the shaft. Assume maximum allowable shear stress as 42MPa. (CO3)

Q5. Design a flange coupling to connect the shafts of a motor-pump set. The power to be transmitted is 20kW at 1440 rpm. Determine the diameter of shaft for motor and pump. The allowable shear stress in the shaft is 50MPa and the angle of twist is 1° in

a length of 20 diameters. The allowable shear stress in coupling bolts is $20MPa$. The maximum torque is 20% more than the mean torque.

OR

Design a square flanged pipe joint of internal diameter 60mm subjected to an internal fluid pressure of $7N/mm^2$. The maximum tensile stress in the pipe material is not to exceed $25MPa$ and in the bolts $30MPa$.

(CO4)

Q6. Design a cranked lever for the following dimensions:

Length of Handle	=	$320mm$
Length of lever arm	=	$450mm$
Overhang of the journal	=	$120mm$

The lever is operated by single person exerting a maximum force of $400N$ at a distance $1/3^{rd}$ length of the handle from its free end. The permissible stresses may be taken as $50MPa$ for lever material and $40MPa$ for shaft material.

OR

A foot lever is $1000mm$ from center of shaft to point of application of load of $900N$. Calculate the diameter of the shaft. If the permissible shear stress for shaft material is $75N/mm^2$, determine the dimensions of the key to secure lever to shaft, safe stress in shear for key material is $70N/mm^2$. Find the dimensions of rectangular arm of the foot lever at $100mm$ from center of shaft. Assume height of lever near bars as 3times the thickness. Allowable stress is $70N/mm^2$.

(CO5)

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