



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGE Act - 1956)

SLOT: A1+TA1+TAA1

SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST (CAT) -II
FALL SEMESTER 2024-2025

REG.NO.: 22BME00488

Programme Name & Branch	: B. Tech (Mechanical Engineering)
Course Code	: BMEE301L
Course Name	: Design of Machine Elements
Faculty Name(s)	: Dr. A. Vinoth Jebaraj, Dr. Benedict Thomas, Dr. J. Naveen, Dr. Niranjana Behera, Dr. K. Venkatesan
Class Number(s)	: VL2024250103776, VL2024250103772, VL2024250103773, VL2024250103774, VL2024250103775
Exam Duration	: 90 minutes
	Maximum Marks: 50

Answer all

General instruction(s): PSG Data book is allowed

- M - Max mark; CO - Course Outcome; BL - Bloom's Taxonomy Level
- CO 3: Recommend suitable mechanical springs for various applications.
- CO 4: Design shafts, keys and couplings as per the international standards.
- CO 5: Investigate the design aspects of temporary and permanent joints.

Q. No	Question	M	CO	BL
1.	A helical spring is subjected to a load varying from 400 N to 1000N having spring index of 6 and the design factor of safety is 1.25. The compression of the spring at the maximum load is 30 mm. Determine the wire diameter, mean coil diameter and number of active coils of helical compression spring. Take yield stress in shear as 350 N/mm ² , endurance stress in shear as 110 N/mm ² and the modulus of rigidity for the spring material as 80 kN/mm ² .	10	CO 3	BL3
2.	A 600 mm diameter pulley driven by a horizontal belt transmits power through a solid shaft to a 340 mm diameter pinion which drives a mating gear. The arrangement of elements, the belt tensions and the components of the gear reactions on the pinion are as indicated in Figure 1. Determine the necessary shaft diameter using suitable value for commercial shafting and shock fatigue factors of $K_b=2$ and $K_t=1.5$. Assume shaft material is C45 and factor of safety is 3.5. 	10	CO4	BL5
3.	Design a protective type of cast iron flange coupling (hub, key and flange only) for a steel shafts transmitting 7.5 kW at 720 rpm. The following permissible stresses may be used: Permissible shear stress for the shaft and key material=33 MPa Permissible crushing stress for key material= 60 MPa Permissible shear stress for the cast iron= 15 MPa.	10	CO4	BL4





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4. A basketball 'goal' as shown in Figure 2 comprises of hoop, arm and flange plate portions. The 50 mm square arm is connected to the flange plate via a continuous fillet weld. Determine the minimum weld size for the square arm to flange plate connection assuming the vertical load of 1.2 kN if the allowable shear stress in the weld is 75 MPa.

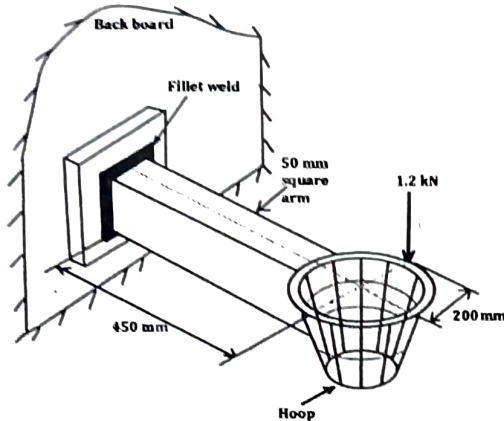
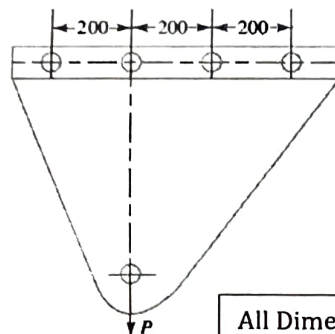


Figure 2

5. Find the value of P for the joint shown in Figure 3 based on a working shear stress of 75 MPa for the rivets. The four rivets are equal, each of 18 mm diameters.



All Dimensions are in mm

Figure 3

Bloom's Taxonomy Levels	Category
BL1	Remembering
BL2	Understanding
BL3	Applying
BL4	Analysing
BL5	Evaluating
BL6	Creating

