



School: School of Engineering and Technology
Program/s: BTech Mechanical
Year: 2nd **Semester:** 4th
Examination: End Semester Examination
Examination year: May 2023

Course Code: DES 403 **Course Name:** Machine Design I

Date: 16/05/2023

Time: 10:00 am to 12:00 pm

Total Marks: 40

Total Pages: 02

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted/not permitted.
- * COs=Course Outcome mapping. # BTL=Bloom's Taxonomy Level mapping

Q. No.	Attempt Any Five Questions (All carry Equal Marks)	Marks	COs*	BTL#
Q.1	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 $\mu = 0.24$. 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.	8	CO1	BT1, BT2
Q.2	Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : Shear stress for shaft, bolt and key material = 40 MPa Crushing stress for bolt and key = 80 MPa Shear stress for cast iron = 8 MPa Draw a neat sketch of the coupling.	8	CO1, CO2	BT1, BT3,
Q.3	a) Explain the strength of transverse fillet welded joint and parallel fillet welded joint with neat sketch.	8	CO2	BT3, BT4

	b) Explain various failure of riveted joint with neat sketch.			
Q.4	<p>The mean diameter of the square thread screw having pitch of 10 mm is 50 mm. A load of 20 KN is lifted through a distance of 170 mm. Find the workdone in lifting the load and the efficiency of the screw, when</p> <p>1. the load rotates with the screw and 2.. the load rests on the loose head which does not rotate with the screw.</p> <p>The external and internal diameter of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw and the bearing surface may be taken as 0.08.</p>	8	CO3, CO4	BT2, BT4
Q.5	Write down the step to design cotter Joint with neat sketch.	8	CO4	BT1, BT2
Q-6	<p>Design a right angled bell crank lever. The horizontal arm is 500 mm long and a load of 4.5KN acts vertically downward through a pin in the forked end of this arm. At the end of the 150mm long arm which is perpendicular to the 500 mm long arm, a force P act at right angles to the axis of 150 mm arm through a pin into a forked end. The lever consists of forged steel material and pin at the fulcrum. Take the following data for both the pins and lever materials.</p> <p>Safe stress in tension 75 MPa, Safe stress in shear 60 MPa, and the bearing pressure is 10 MPa.</p>	8	CO3, CO4	BT2, BT4
Q-7	<p>A screw press is to exert a force of 40 KN. The unsupported length of the screw is 400 m. Nominal diameter of screw is 50 mm. The screw has square threads with pitch equal to 10 mm. The material of the screw and nut are medium carbon steel and cast iron respectively. For the steel used take ultimate crushing stress as 320 MPa. Yield stress in tension or compression as 200 MPa and in shear is 120 MPa. Allowable shear stress for the Cast Iron is 20MPa. Bearing pressure is 12 MPa. And young modulus for the steel is 210KN/mm². Find the dimensions of the nut and the efficiency of power screw. Take co efficient of friction is 0.13.</p>	8	CO4	BT1, BT2

*****End of Question Paper*****