Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fifth Semester

Mechanical Engineering

ME3591 – Design of Machine Elements

Use of approved Design Data Book is permitted

Regulations - 2021

Duration: 3 Hrs. ***Maximum: 100 Marks***

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q. No.	*Questions*	*BLT*	*CO*	*Marks*
1.	Which theory of failure is suitable for the design of brittle materials?	L2	1	2
2.	Compare modulus of resilience and proof resilience.	L2	1	2
3.	Why a hollow shaft has greater strength and stiffness than solid shaft of equal weight?	L1	2	2
4.	Differentiate rigid and flexible couplings.	L1	2	2
5.	Name the possible modes of failure of riveted joint.	L1	3	2
6.	Why are welded joints preferred over riveted joints?	L1	3	2
7.	Distinguish between open coil and closed coil helical spring.	L1	4	2
8.	What is the purpose of the flywheel?	L2	4	2
9.	What is meant by hydrodynamic Lubrication?	L2	5	2
10.	Give an example for anti-friction bearing.	L1	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q. No.		*Questions*	*BLT*	*CO*	*Marks*
11.	a	The crane hook carries a load of 20 kN as shown in Fig.1. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibres at the given section.	L3	1	16

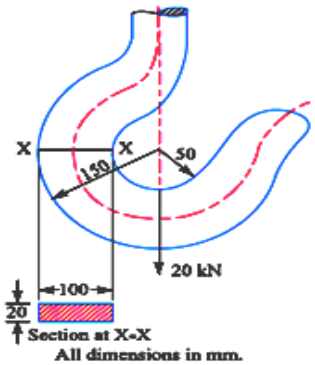

Fig. 1

Or

	b	A hollow shaft is required to transmit 500 KW at 100 rpm. The maximum torque being 20% greater than the mean torque. The shear stress is not to exceed 65 MPa and twist in a length of 2 m not to exceed 1.2 degrees. Find the external and internal diameter of the shaft, if the ratio of internal to external diameter is 3/8. Take modulus of rigidity as 84 GPa.	L3	1	16
12.	a	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 degree and μ = 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.	L3	2	16
		Or			
	b	Design and draw a protective type of cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25 % greater than the full load torque. The shear stress for cast iron is 14 MPa.	L3	2	16
13.	a	A knuckle joint is to transmit a force of 140 kN. Allowable stresses in tension, shear and compression are 75 N/mm^2, 65 N/mm^2 and 140 N/mm^2 respectively. Design the joint.	L3	3	16
		Or			
	b	A 50 mm diameter solid shaft is welded to a flat plate shown in Fig.2. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld.	L3	3	16

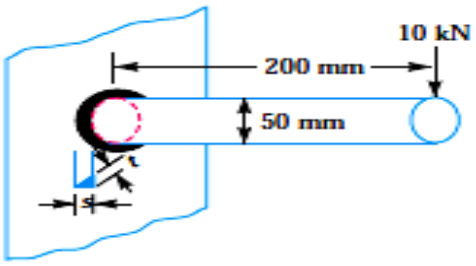

Fig. 2

14.	a	A safety valve, 50 mm in diameter, is to blow off at a pressure of 1.5 MPa. It is held on its seat by means of a helical compression spring, with an initial compression of 25 mm. The maximum lift of the valve is 10 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1500 N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire should be taken as 30% of the ultimate tensile strength. Design the spring and calculate: (i) wire diameter (ii) mean coil diameter (iii) number of active turns (iv) total no of turns (v) solid length of the spring (vi) free length of the spring (vii) pitch of the coil.	L3	4	16
		Or			
	b	Design a leaf spring for the following specifications: Total load = 140 kN Number of springs supporting the load = 4 Maximum number of leaves= 10 Span of the spring = 1000 mm Permissible deflection = 80 mm Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa.	L3	4	16
15.	a	Design a journal bearing for a centrifugal pump with the following data. Diameter of the journal = 150mm, Load on bearing = 40 kN, Speed of journal = 900 rpm.	L3	5	16
		Or			
	b	Select a single row deep groove ball bearing for a radial load of 4000 N and an axial load of 5000 N, operating at a speed of 1600 for an average life of 5 years at 10 hours per day. Assume uniform and safety load.	L3	5	16