Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Sixth Semester - Regular) Examinations, April 2026

23BMEPC36002 - Design of Machine Members
(Mechanical Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Classify journal bearings based on lubrication conditions.	CO3	K1
b. Differentiate between thin and thick pressure vessels based on design criteria.	CO2	K2
c. Classify helical springs based on loading conditions.	CO4	K1
d. Compare flat belts and V-belts in power transmission.	CO5	K2
e. Interpret the function of a flywheel in energy regulation.	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. Design a journal bearing for a centrifugal pump from the following data: Load on the journal = 20 000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N / mm2.Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m2/°C.	10	CO3	K6
(OR)			
c. A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20 × 106 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing.	5	CO3	K3
d. Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 million of revolutions at 300 r.p.m. Assume uniform and steady load.	5	CO3	K6
3.a. A thin cylindrical pressure vessel of 1.2 m diameter generates steam at a pressure of 1.75 N/mm2. Find the minimum wall thickness, if (a) the longitudinal stress does not exceed 28 MPa; and (b) the circumferential stress does not exceed 42 MPa.	5	CO2	K2
b. Explain the various types of ends used for pressure vessel giving practical applications of each.	5	CO1	K2
(OR)			
c. Find the thickness for a tube of internal diameter 100 mm subjected to an internal pressure which is 5/8 of the value of the maximum permissible	5	CO2	K2

	circumferential stress. Also find the increase in internal diameter of such a tube when the internal pressure is 90 N/mm2. Take E = 205 kN/mm2 and μ = 0.29. Neglect longitudinal strain.			
d.	Discuss the influence of lubrication methods on bearing configuration.	5	CO1	K2
4.a.	A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm2, find the axial load which the spring can carry and the deflection per active turn.	10	CO4	K3
	(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/mm2 and allowable stress in spring material as 600 MPa.	10	CO4	K6
5.a.	An engine running at 150 r.p.m. drives a line shaft by means of a belt. The engine pulley is 750 mm diameter and the pulley on the line shaft is 450 mm. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Fine the speed of dynamo shaft, when 1. there is no slip, and 2. there is a slip of 2% at each drive.	5	CO5	K2
b.	Discuss the different types of belts and their material used for power transmission.	5	CO5	K2
	(OR)			
c.	Two pulleys, one 450 mm diameter and the other 200 mm diameter, on parallel shafts 1.95 m apart are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25?	10	CO5	K3
6.a.	A four stroke diesel engine has the following specifications: Brake power = 5 kW ; Speed = 1200 r.p.m. ; Indicated mean effective pressure = 0.35 N / mm 2 ; Mechanical efficiency = 80 %. Determine : 1. bore and length of the cylinder ; 2. thickness of the cylinder head ; and 3. size of studs for the cylinder head.	10	CO6	K3
	(OR)			
b.	Design a plain carbon steel centre crankshaft for a single acting four stroke single cylinder engine for the following data: Bore = 400 mm ; Stroke = 600 mm ; Engine speed = 200 r.p.m. ; Mean effective pressure = 0.5 N/mm2; Maximum combustion pressure = 2.5 N/mm2; Weight of flywheel used as a pulley = 50 kN; Total belt pull = 6.5 kN. When the crank has turned through 35° from the top dead centre, the pressure on the piston is 1N/mm2 and the torque on the crank is maximum. The ratio of the connecting rod length to the crank radius is 5. Assume any other data required for the design.	10	CO6	K6

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