Reg. No.												

Question Paper Code	12867

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Fifth Semester

Mechanical Engineering

20MEPC503 - THEORY OF MACHINES

A3 sheet is permitted

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

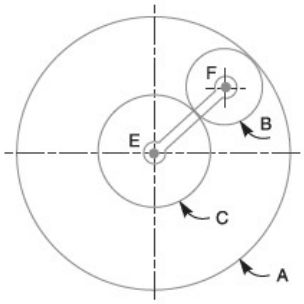
		Marks	K – Level	CO
1.	What is a kinematic pair?	2	K1	CO1
2.	Write the equation of kutzbach criterion.	2	K1	CO1
3.	Define the term Module used in gears.	2	K2	CO2
4.	What are the applications of reverted gear train?	2	K2	CO2
5.	Define crank pin effort.	2	K1	CO4
6.	State the concept involved in balancing of Rotating masses.	2	K1	CO4
7.	What 'Logarithmic decrement' is as applied to damped vibrations?	2	K1	CO5
8.	Differentiate between longitudinal vibration and transverse vibration.	2	K2	CO5
9.	Write the expression to find Length of Open belt drive.	2	K2	CO6
10.	Define the motions of a Ship-steering, pitching and rolling.	2	K2	CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ= 62.5 mm; QR = 175 mm; RS = 112.5 mm; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity of links QR and RS.	13	K2	CO1
		OR			
	b)	Explain the Inversions of Four bar chain Mechanism with neat sketches.	13	K2	CO1
12.	a)	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and Contact ratio.	13	K3	CO2
		OR			

b) An epicyclic gear consists of three gears A, B and C as shown in Fig. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C. *13 K2 CO2*



13. a) A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg,400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. *13 K3 CO4*

OR

b) The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2. The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate: 1. pressure on slide bars, 2. thrust in the connecting rod, 3. tangential force on the crank-pin, and 4. turning moment on the crank shaft. *13 K3 CO4*

14. a) An instrument vibrates with a frequency of 1 Hz when there is no damping. When the damping is provided, the frequency of damped vibrations was observed to be 0.9 Hz. Find 1. The damping factor and 2. Logarithmic decrement. *13 K4 CO5*

OR

b) A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2. Find the lowest whirling speed of the shaft, taking into account the mass of the shaft. *13 K4 CO5*

15. a) In an engine governor of the Porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40°, find, taking friction into account, range of speed of the governor. *13 K4 CO6*

OR

b) A thrust shaft of a ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 kN. If the coefficient of friction is 0.12 and speed of the engine 90 r.p.m., find the power absorbed in friction at the thrust block, assuming l. Uniform pressure; and 2. Uniform wear. *13 K4 CO6*

PART - C (1× 15 = 15 Marks)

16. a) A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed is required to give a knife edge follower, the, motion described below : *15 K3 CO3*

1. To move outwards through 40 mm during 100° rotation of the cam 2. To dwell for the next 80°
3. To return to its starting position during next 90° and
4. To dwell during rest of the revolution i.e. 90°

Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft. The displacement of the follower is to take place with Uniform acceleration and uniform retardation.

OR

b) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam. *15 K3 CO3*