



Paper id: 250814

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Subject Code: KME603

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BTECH
(SEM VI) THEORY EXAMINATION 2024-25
THEORY OF MACHINE

TIME: 3 HRS**M.MARKS: 100****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 10 = 20**

Q No.	Question	CO	Level
a.	What is meant by inversion of a mechanism? Describe with the help of suitable sketches the inversion of a slider-crank chain.	1	K2
b.	Explain the concept of relative velocity method and write the procedure to draw velocity polygon of a slider-crank mechanism.	2	K2
c.	What are the different types of motion with which a follower can move?	3	K2
d.	What do you understand by the term 'interference' as applied to gears?	4	K2
e.	What is the difference between piston effort, crank effort and crank-pin effort?	5	K2
f.	Explain the effect of the gyroscopic couple on the reaction of the four wheels of a vehicle negotiating a curve.	6	K2
g.	What do you mean by fixed, permanent and moving instantaneous centres? Explain the procedure to locate the instantaneous centre of a mechanism with suitable example.	2	K2
h.	Explain with sketches the different types of cams and followers.	3	K2
i.	What are the various types of the torques in an epicyclic gear train?	4	K2
j.	Given acceleration image of a link. Explain how dynamical equivalent system can be used to determine the direction of inertia force on it.	5	K2

SECTION B**2. Attempt any three of the following:****10 x 3 = 30**

a.	What do you understand by terms machine and mechanism? Describe elliptical trammel. How does it enable us to describe a true ellipse?	1	K2
b.	Derive an expression for the magnitude and direction of coriolis component of acceleration. Explain how the coriolis component of acceleration arises when a point is rotating about some other fixed point and at the same time its distance from the fixed point varies.	2	K2
c.	Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower.	3	K2
d.	Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains? How the velocity ratio of epicyclic gear train is obtained by tabular method?	4	K2
e.	Discuss the method of finding the crank effort in a reciprocating single acting, single cylinder petrol engine.	5	K2

SECTION C**3. Attempt any one part of the following:****10 x 1 = 10**

a.	Determine the number of degree of freedom for the mechanisms shown in Fig. 3(A).	1	K3
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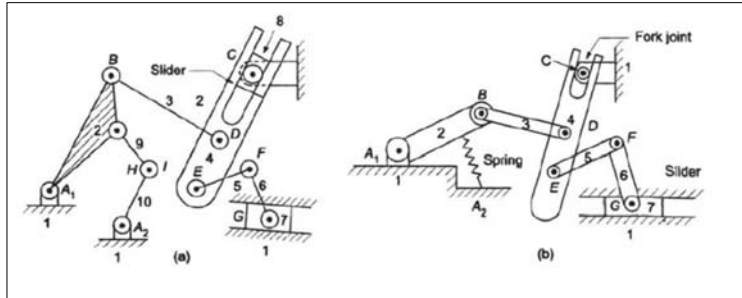


Fig. 3(A)

b. The crank AB of a four-bar mechanism shown in Fig. 3(B) rotates at 60 rpm clockwise. Determine the relative angular velocities of the coupler to the crank and the lever to the coupler. Find also the rubbing velocities at the surface of pins 25 mm radius at the joints B and C.

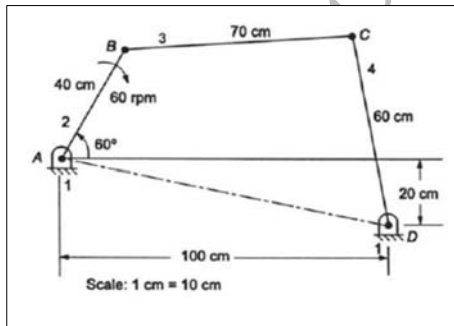


Fig. 3(B)

4. Attempt any one part of the following: 10 x 1 = 10

a.	A cam is to operate a flat faced follower having uniform acceleration and deceleration during ascent and descent. The least radius of the cam is 50 mm. During descent, the deceleration period is half of the acceleration period. The ascent lift is 37.5 mm. The ascent is for 1/4th period, dwell for 1/4th, descent for 1/3rd, and dwell for the remaining 1/6th period. The cam rotates at 600 rpm. Find the maximum velocity and acceleration during ascent and descent. Draw the cam profile.	3	K3
b.	A flat-faced reciprocating follower has the following motion with uniform acceleration and retardation: Ascent for 80°, dwell for 80°, and return for 120°. The base circle diameter of the cam is 60 mm and the stroke of the follower is 20 mm. The line of motion of the follower passes through the axis of the cam. Draw the cam profile.	3	K3

5. Attempt any one part of the following: 10 x 1 = 10

a.	Two parallel shafts are to be connected by spur gearing. The approximate distance between the shafts is 600 mm. If one shaft runs at 120 r.p.m. and the other at 360 r.p.m., find the number of teeth on each wheel, if the module is 8 mm. Also determine the exact distance apart of the shafts.	4	K3
b.	Two spur gears of 24 teeth and 36 teeth of 8 mm module and 20° pressure angle are in mesh. Addendum of each gear is 7.5 mm. The teeth are of involute form.	4	K3



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	Determine: (1) the angle through which the pinion turns while any pair of teeth are in contact, and (2) the velocity of sliding between the teeth when the contact on the pinion is at a radius of 102 mm. The speed of the pinion is 450 r.p.m.		
6.	Attempt any one part of the following:	10 x 1 = 10	
a.	The connecting rod of a horizontal reciprocating engine is 400 mm and length of the stroke is 200 mm. The mass of the reciprocating parts is 125 kg and that the connecting rod is 100 kg. The radius of gyration of the connecting rod about an axis through the centre of gravity is 120 mm and the distance of centre of gravity of the connecting rod from big end centre is 160 mm. The engine runs at 750 r.p.m. Determine the torque exerted on the crankshaft when the crank has turned 30° from the inner dead centre.	5	K3
b.	Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.	5	K3
7.	Attempt any one part of the following:	10 x 1 = 10	
a.	The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 r.p.m. clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steer to the left in a curve of 75 m radius.	6	K3
b.	A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor.	6	K3