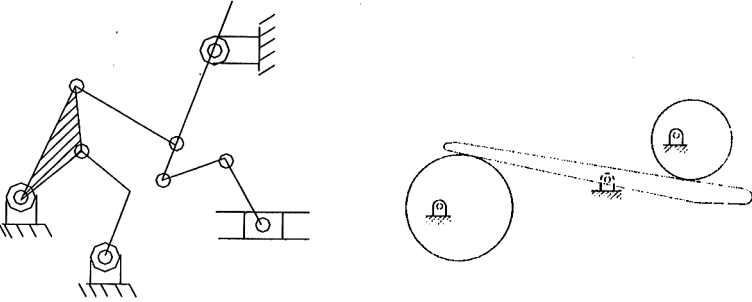


B.E. MECHANICAL ENGINEERING 2nd YEAR 2nd SEMESTER EXAM 2022**Kinematic Analysis & Synthesis**

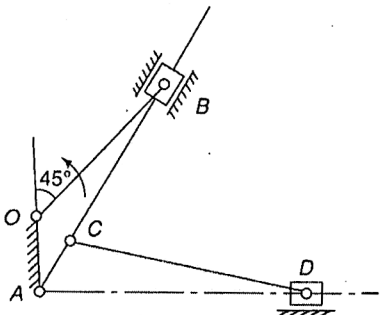
Time:3 hrs

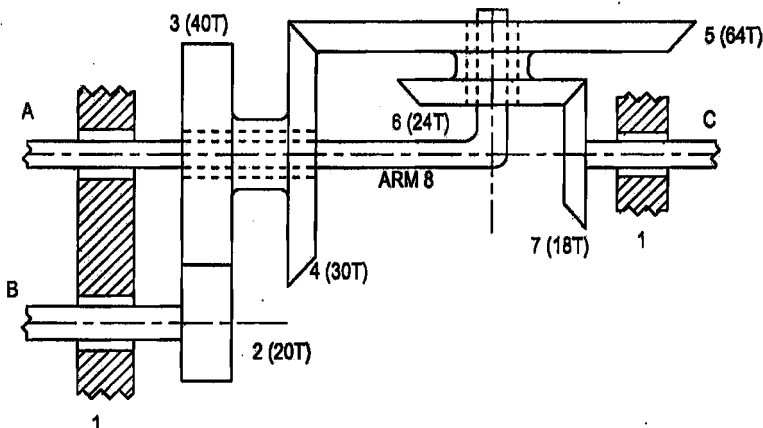
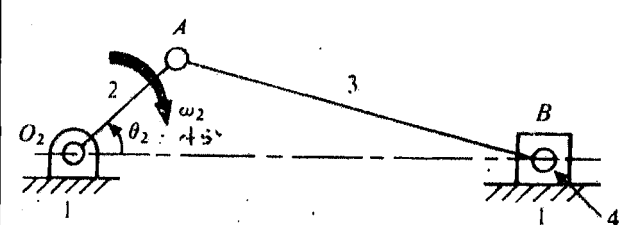
(Answer Group A and any four from Group B)
(Assume data if missing)

Full marks: 100

Group – A (Theory Type Questions) Answer any 10 (TEN) from following		5 x 10=50
1.	(i) Explain different types of kinematic pairs.	5
	(ii) What is Kinematic Inversion? Explain the different inversion of a slider crank chain with suitable sketches.	5
	(iii) State and prove Kennedy's theorem as applicable to instantaneous centres of rotation of three bodies. How is it helpful in locating various instantaneous centres of a mechanism?	5
	(iv) Find out the degree of freedom of the following mechanisms. 	5
	(v) What is the coriolis acceleration component? In which cases does it occur? How is it determined?	5
	(vi) Explain the function of differential gear box used in an automobile with a sketch.	5
	(vii) Find out maximum number of hinges possible on one link in a constrained mechanism with n-links.	5
	(viii) What do you mean by precision or accuracy points the design of mechanism? What is Chebychev spacing? What is its significance?	5
	(ix) What is a pantograph? Show that it can produce paths exactly similar to the ones traced out by a point on a link on an enlarged or a reduced scale.	5

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	(x) Define the term pitch point, trace point and pressure angle of cam.	5
	(xi) Why is a cycloidal motion of follower most suitable for high-speed cams?	5
	(xii) Find out the minimum number of teeth of a pinion meshing with a rack having a 20 degree pressure angle and an addendum equal to the module to avoid interference.	5
	(xiii) An assortment of five links of lengths 5 cm, 15 cm, 19 cm and 28 cm is available for constructing a crank-rocker mechanism. Sketch the mechanism, indicating the crank and showing all the lengths.	5
	Group – B (Numerical Type Questions) Answer any 5 (Five) from following	10 X 5=50
2	<p>Determine the velocity of the slider D for anti-clockwise rotation of OB at 80 rpm is shown Fig Q2. O and A are fixed points.</p>  <p style="text-align: center;">Fig. Q2</p> <p>CD=200mm, OA=60mm, AC=50mm and OB crank=150mm.</p>	10
3.	Synthesis a four-link mechanism if the motions of the input (θ) and output (ϕ) links governed by a function $y=x^{1.5}$ and x varies from 1 to 4. Assume θ to vary from 30° to 120° and ϕ from 60° to 130° . The length of the fixed link is 30mm.	10
4.	<p>Draw the profile of cam, the following data are given below:</p> <p>Maximum follower displacement = 35 mm;</p> <p>Least radius of cam = 25 mm;</p> <p>Offset from axis of the cam =10 mm;</p> <p>Ascending and descending of the cam = SHM;</p> <p>Angle of ascent, dwell, descent are 60°, 40°, 90° respectively and dwell during the rest of cam rotation.</p>	10

<p>5.</p>	<p>Assume the follower displacement y as a polynomial function of θ, that is</p> $y = C_0 + C_1 \theta + C_2 \theta^2 + C_3 \theta^3 + \dots + C_5 \theta^5 + \dots$ <p>Satisfying the following boundary conditions, namely, $y = 0, y' = 0$ at $\theta = 0$ and $y = L, y' = 0$ at $\theta = \beta$.</p> <p>Find out the expression for velocity and acceleration of the follower motion. Number of constants should be chosen considering the given boundary condition.</p>	<p>10</p>
<p>6.</p>	<p>Two gear wheels having involute teeth are in mesh have a velocity ratio of 4. The pressure angle is 20°. The arc of approach is not to exceed the circular pitch. Determine the minimum number of teeth on each wheel to avoid interference. Also find the addendum of the wheel in terms of circular pitch. Assume the smaller wheel to be the driver.</p>	<p>10</p>
<p>7.</p>	<p>Consider the differential shown in the figure Q7, the angular velocity of the shaft A is 350 rad/s CCW viewing from left hand side of the train. And the angular speed of the shaft B is 2000 rad/s CW viewing from the same end. Determine the angular speed of the shaft C.</p>  <p style="text-align: right;">Fig. Q7</p>	<p>10</p>
<p>8</p>	<p>In the slider crank shown in figure below, the crank O_2A rotates at a constant speed of 1000 rpm in clockwise direction. Determine the velocity and acceleration of the slider shown in the following configuration ($\theta_2 = 45^\circ$), given that $O_2A = 6$ cm and $AB = 16$ cm.</p> 	<p>10</p>

9.

Assuming no slip condition between the disks, find the velocity of the center of the disk C, if disk A is rotating with angular speed 100 rpm in CW direction. Dimensions are given in mm. The points E and F are fixed centres.

10

