Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) Examination January 2026 (2019 Scheme)

Course Code: RAT202

Course Name: KINEMATICS AND DYNAMICS OF MECHANISMS

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

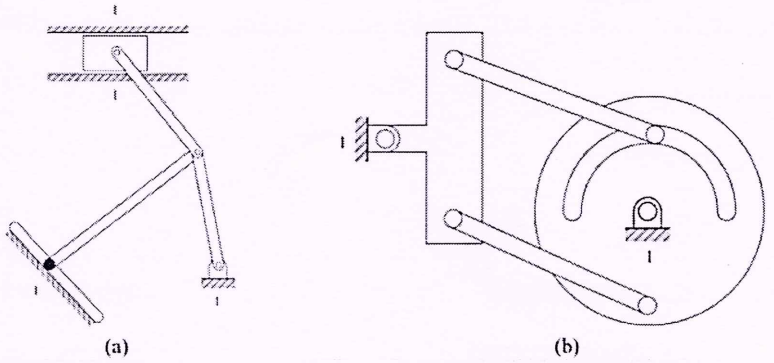
		Marks
1	Differentiate between a lower pair and a higher pair with examples.	3
2	What is meant by the inversion of a mechanism? List the inversions of a single slider-crank chain.	3
3	How do velocity images help in analyzing complex linkages?	3
4	What is the Coriolis component of acceleration, and in which situation does it occur?	3
5	State D'Alembert's principle.	3
6	Differentiate between applied forces and constrained forces.	3
7	Explain the method to reduce a dynamic analysis problem into an equivalent problem of static equilibrium.	3
8	Write Euler's equation for pure rigid body rotation about a point.	3
9	What is meant by under-damping, over-damping, and critical damping?	3
10	What are the different types of vibrations?	3

PART B

(Answer one full question from each module, each question carries 14 marks)

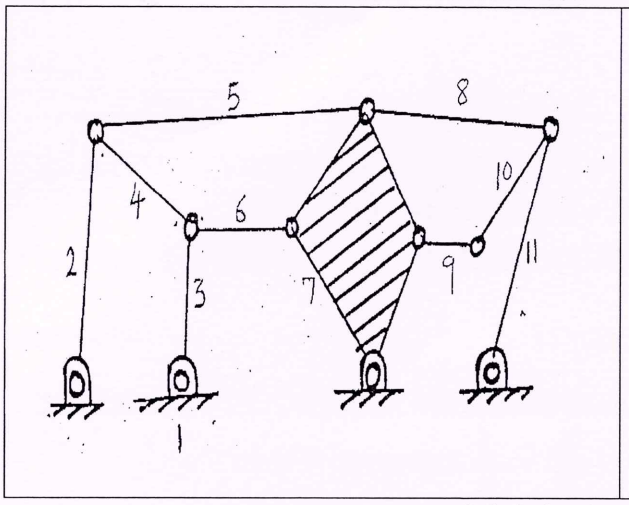
Module -1

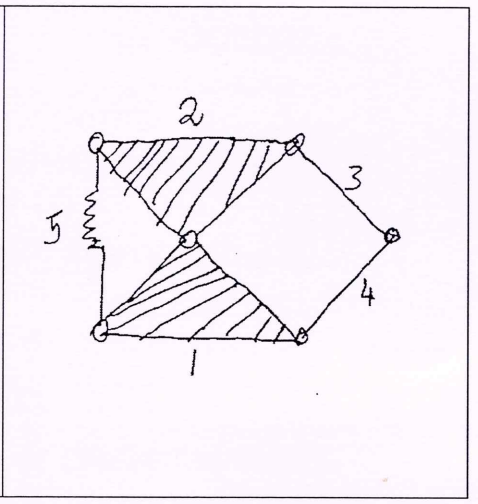
11	Use Kutzbach's criteria to determine the mobility of the planar mechanisms illustrated below. Clearly number each link and label the lower pair by "L" and the higher pair by "H".	14



(a) (b)

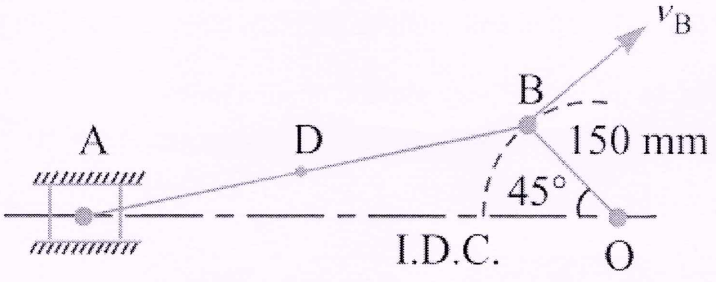
12	Find the degrees of freedom (mobility) of the following:	14





Module -2

13 The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: 1. linear velocity and acceleration of the midpoint of the connecting rod, and 2. angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position 14

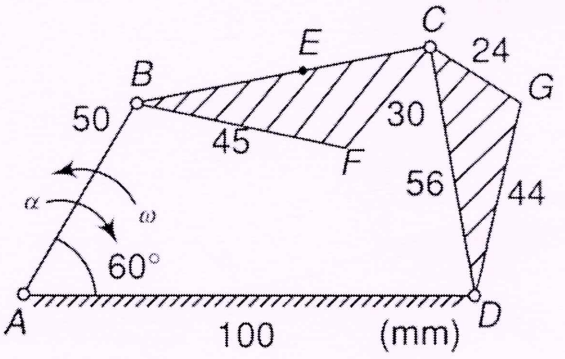


14 A four bar mechanism shown in the figure, calculate 14

(a) the angular acceleration of the link BC and CD

(b) the linear acceleration of the points E, F and G

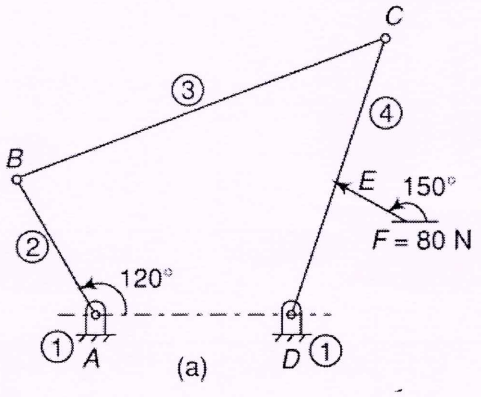
Link AB has an angular velocity of 10.5 rad/s and a retardation of 26 rad/s^2 in counter clock wise direction.



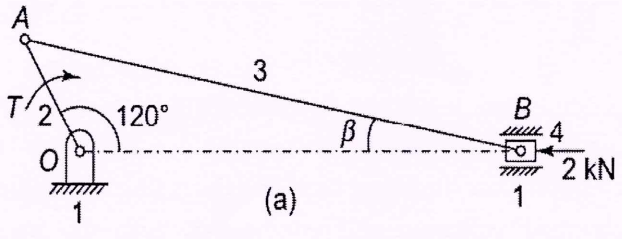
$BE = 40$ mm
$BC = 66$ mm

Module -3

15 A four link mechanism with the following dimensions is acted upon by a force 80N at 150°on the link DC. AD=500 mm, AB=400 mm, BC = 1000 mm, DC = 750 mm, DE = 350 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration. 14

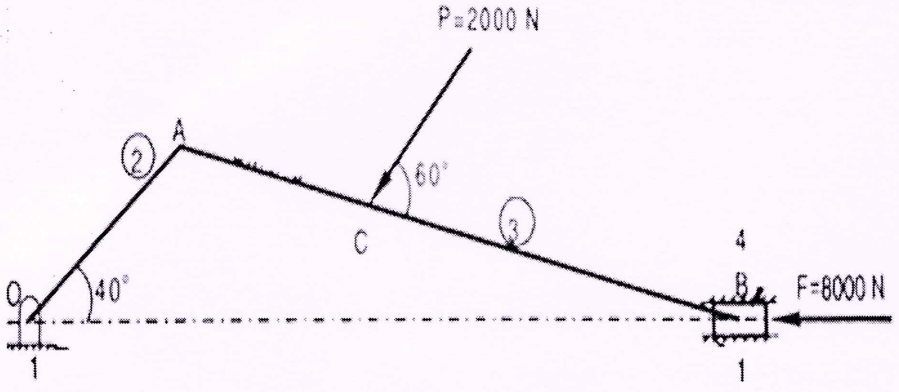


16 A slider crank mechanism with the following dimensions is acted upon by a force F=2 kN at B as shown in Figure: OA=100 mm, AB=450 mm. Determine the input torque T on the link OA for the static equilibrium of the mechanism for the given configuration. 14

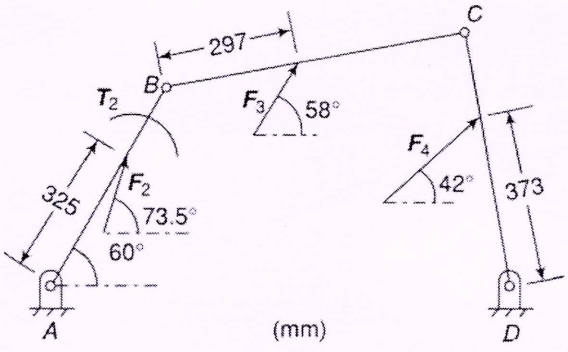


Module -4

17 Determine the torque required to be applied at the crank shaft of a slider crank mechanism to bring it in equilibrium. The slider is subjected to a horizontal force of 8000 N and a force of magnitude 2000 N is applied on the connecting rod as shown in the figure. The dimensions of various links are as under. OA= 250mm, AB = 750mm and AC= 250 mm, <BOA = 40°. 14



18 A four link mechanism is subjected to the following external forces Refer to Figure & table below). Determine the shaft torque T_2 on the input link AB for static equilibrium of the mechanism. Also find the forces on the bearings A,B,C & D. 14



Link	Length	Force	Magnitude	Point of application of force(r)
AB (2)	500 mm	F_2	$80 \angle 73.5^0$ N	325 mm from A
BC (3)	660 mm	F_3	$144 \angle 58^0$ N	297 mm from B
CD (4)	560 mm	F_4	$60 \angle 42^0$ N	373 mm from D
AD (1)	1000 mm	-	Fixed link	

Module -5

19 A mass of 70kg is suspended from a spring of stiffness 80N/mm. A dashpot is fitted to the system and it is found that the amplitude of vibration diminishes to 10 percent of its original value after 5 complete oscillations. Find (a) the value of damping coefficient (b) the frequency of damped vibration and compare it with the frequency of free vibration. 14

20 A vibrating system consists of mass of 10kg, a spring of stiffness 5.4N/mm. If the vibrating system has a dashpot attached which exerts 50N force when mass has velocity of 1m/s. Find (a) critical damping coefficient (b) damping factor (c) logarithmic decrement (d) ratio of the two consecutive amplitudes. 14

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