Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) Examinations May 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)

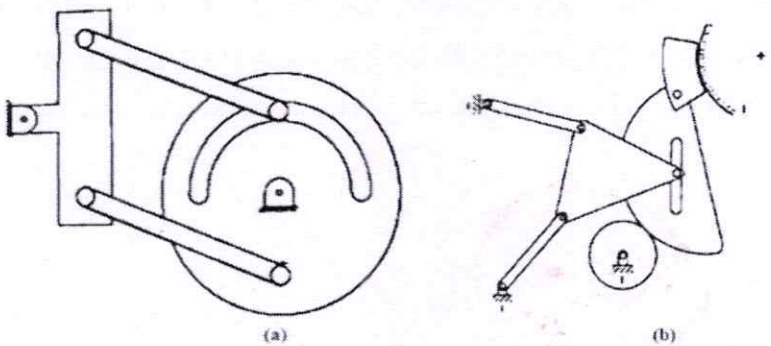
		Marks
1	Differentiate between lower and higher pair with examples	3
2	Explain loop closure equation with an example	3
3	What is the difference between forward velocity analysis and inverse velocity analysis	3
4	What is a centripetal and tangential component of acceleration	3
5	State D'Alemberts principle	3
6	Draw different types of followers	3
7	Explain the concept of mass moment of inertia and radius of gyration	3
8	Describe forward dynamic analysis problem	3
9	Write the relation of principal moments and principal axes	3
10	Explain free, damped and forced vibrations	3

PART B

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

Module -1

11 a) 14



Use the Kutbach criterion to determine the mobility of the planar mechanisms illutrated above. Clearly number links and label lower (P) and higer (h) pairs on the diagram.

OR

12 a) Illustrate loop closure equation with the help of a four-bar mechanism and slider crank mechanism 10

b) Briefly explain any three types of robotic configurations 4

Module -2

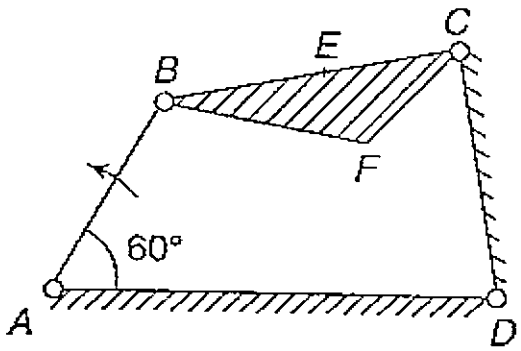
13 In a four-link mechanism shown in figure, the dimensions of the links are as under: AB = 50 mm, BC = 66 mm, CD = 56 mm and AD = 100 mm at the instant when ∠DAB = 600, the link AB has an angular velocity of 10.5 rad/s in the counter-clockwise direction, Determine 14

(i) the velocity of point C

(ii) the velocity of point E on the link BC when BE = 40 mm

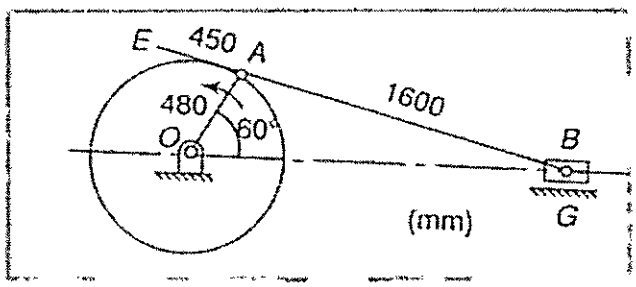
(iii) the angular velocities of the links BC and CD

(iv) the velocity of an offset point F on the link BC if BF = 45 mm, CF = 30 mm and BCF is read clockwise



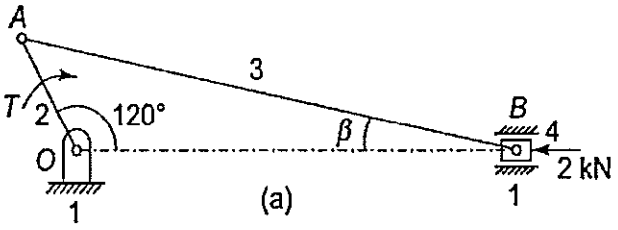
OR

14 For the configuration of a slider-crank mechanism shown in figure, calculate: (i) The acceleration of the slider at B. (ii) The acceleration of the point E. (iii) The angular acceleration of the link AB. OA rotates at 20 rad/s counter-clock wise. 14



Module -3

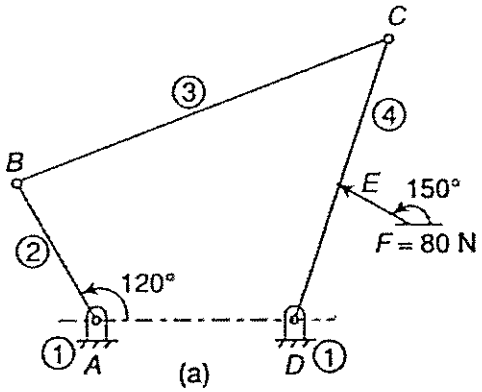
15 A slider-crank mechanism with the following dimensions is acted upon by a force F=2 kN at B as shown in Figure: OA=100 mm, AB=450 mm. Determine the input torque T on the link OA for the static equilibrium of the mechanism for the given configuration. 14



(i)

OR

16 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



(i)

Module -4

17 Derive Euler's equation of rigid body rotation motion. 14

OR

18 Describe the formulation of Newton-Euler equation of motion for the two DOF planar robot manipulator 14

Module -5

19 Explain the following 14

(i) Moment of inertia

(ii) Product of inertia and principal axes

(iii) Rotation matrices

OR

20 A vibrating system consists of a mass of 50 kg, a spring of stiffness, 30 kN/m and a damper. The damping provided is only 20% of the critical value. 14

Determine:

(I) The damping factor.

(II) The natural frequency of damped vibrations.

(III) The critical damping coefficient.

(IV) The logarithmic decrement.

(V) The ratio of two consecutive amplitude.

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