May 2025

B. Tech. (ME) (Fourth Semester)

Kinematics of Machines (PCC-ME-403/21)

Time : 3 Hours]   [Maximum Marks : 75

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other. Drawing sheets are required to solve the question paper.

Part A

1. (a) What is inversions of mechanism ?   1.5

    (b) What are different types of links ?   1.5

    (c) Explain 'Constrained motion'.   1.5

    (d) Explain 'Displacement diagram'.   1.5

    (e) Classify the Cams.   1.5

(f) Name the different types of gear trains. **1.5**

(g) What are different types of brakes ? **1.5**

(h) What is difference between brake and dynamometers ? **1.5**

(i) Name the different types of gears. **1.5**

(j) What is structural error ? **1.5**

Part B

2. Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms. **15**

3. In Fig 1. given below, the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are : OA = 28 mm; AB = 44 mm; BC = 49 mm; and BD = 46 mm. The centre distance between

the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. 15

Figure 1
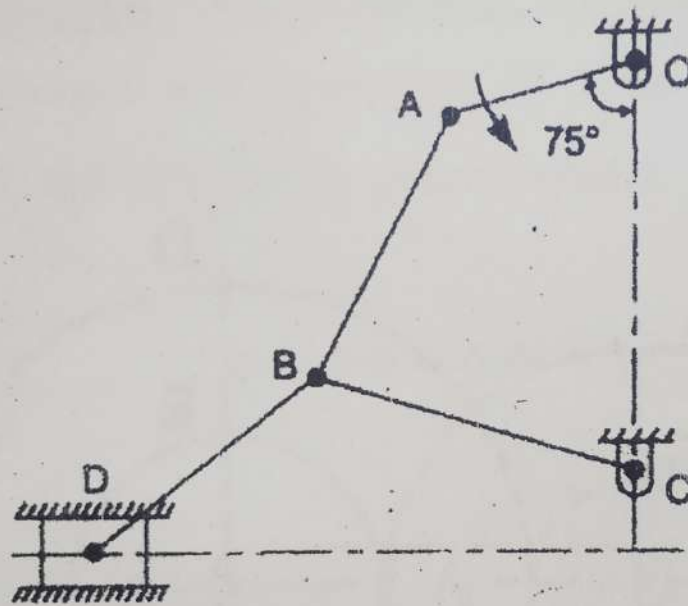
4. Synthesize a four-bar mechanism to generate a function $y = \sin x$ for $0 \leq x \leq 90°$. The range of the output crank may be chosen as $60°$ while that of input crank be $120°$. Assume three precision points which are to be obtained from Chebyshev spacing. Assume fixed link to be 52.5 mm long and θ_1 (Input angle) $= 105°$ and θ_1 (Output angle) $= 66°$. 15

5. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D-E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise. 15
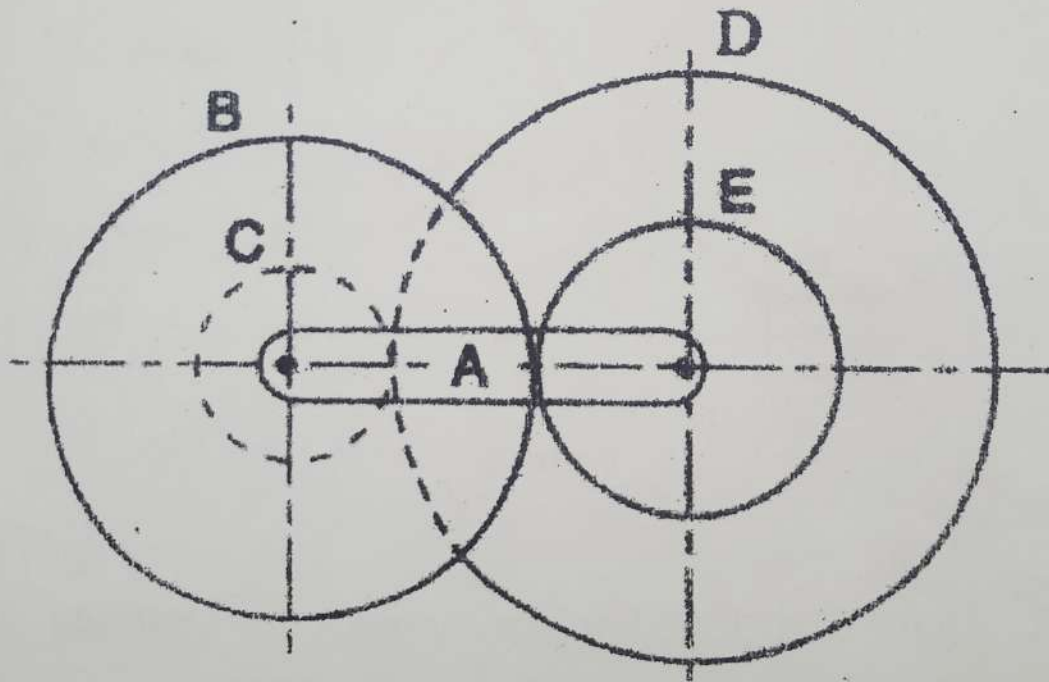
6. A cam drives a flat reciprocating follower in the following manner :

During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during

next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. 15

7. What is the difference between absorption and transmission dynamometers ? Describe the construction and operation of a prony brake or rope brake absorption dynamometer. 15

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