

- Q.6 Attempt any two:
- Explain the following: 5
    - Limiting friction
    - Angle of friction
    - Coefficient of friction
  - Describe with a neat sketch the working of a single plate friction clutch. 5
  - Classify breaks. Discuss any one of them. 5

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Total No. of Questions: 6

Total No. of Printed Pages: 4

Enrollment No.....



Faculty of Engineering  
End Sem Examination Dec-2023

RA3CO24 Kinematics & Dynamics of Machines

Programme: B.Tech.

Branch/Specialisation: RA

**Duration: 3 Hrs.**

**Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

- Q.1
- In which of the following mechanism the relative motions of the rigid bodies are in one plane or in parallel planes? 1
    - Spatial mechanism
    - Spherical mechanism
    - Flexure mechanism
    - Planar mechanism
  - A kinematic chain is known as a mechanism when- 1
    - None of the links is fixed
    - One of the links is fixed
    - Two of the links are fixed
    - Two of the links are fixed
  - The synthesis of mechanism deals with \_\_\_\_\_. 1
    - The determination of input and output angles of a mechanism
    - The determination of dimensions of the links in a mechanism
    - The determination of displacement, velocity and acceleration of the links in a mechanism
    - The determination of number of joints in a mechanism
  - When a mechanism is required to guide a point, it falls under the category of \_\_\_\_\_ synthesis. 1
    - Function generation
    - Path generation
    - Body guidance
    - Linkage guidance
  - The direction of the linear velocity of any point on a link with respect to another point on the same link is \_\_\_\_\_. 1
    - Parallel to the link joining the points
    - Perpendicular to the link joining the points
    - At  $45^\circ$  to the link joining the points
    - At  $135^\circ$  to the link joining the points

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- vi. The component of the acceleration, parallel to the velocity of the particle, at the given instant, is- **1**  
 (a) Radial (b) Tangential  
 (c) Coriolis (d) Axial
- vii. A CAM is used to impart desired motion to a follower by direct contact. Which of the follower motion will produce least jerk to the system? **1**  
 (a) Simple Harmonic (b) Constant acceleration  
 (c) Cycloidal (d) Constant velocity
- viii. In case of radial CAMs, the smallest circle that can be drawn from the centre of the CAM and tangential to the pitch-curve is termed as **1**  
 (a) Base circle (b) Pitch circle  
 (c) Prime circle (d) Trace circle
- ix. The types of breaks commonly used in railway train is \_\_\_\_\_. **1**  
 (a) Shoe Brake  
 (b) Band Brake  
 (c) Band and Block Break  
 (d) Internal Expanding Break
- x. For a safe design, a friction clutch is designed assuming \_\_\_\_\_. **1**  
 (a) Uniform pressure theory  
 (b) Uniform wear theory  
 (c) Varying pressure theory  
 (d) Varying wear theory
- Q.2 i. Differentiate between machine and mechanism. **2**  
 ii. Explain the term kinematic link. Give the classification of kinematic link. **3**  
 iii. Sketch and describe the four-bar chain mechanism. Explain Grubler's criterion for determining degree of freedom for mechanisms. **5**
- OR iv. Explain Inversion of mechanism. Explain quick return mechanism with neat sketch. **5**
- Q.3 i. Explain dimensional synthesis in brief. **2**  
 ii. Explain the term: function generation, path generation and motion generation. **8**

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- OR iii. Describe the procedure to design a four-link mechanism by relative pole method when three position of the input ( $\theta_1, \theta_2, \theta_3$ ) and the output link ( $\Phi_1, \Phi_2, \Phi_3$ ) are known. **8**
- Q.4 i. Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions? **3**  
 ii. In a four-bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD =  $60^\circ$ . **7**
- OR iii. 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: **7**  
 (a) Linear velocity and acceleration of the midpoint of the connecting rod  
 (b) Angular velocity and angular acceleration of the connecting rod, at a crank angle of  $45^\circ$  from inner dead centre position.
- Q.5 i. Explain with sketches the different types of cams and followers. **4**  
 ii. A cam is to give the following motion to a knife-edged follower: **6**  
 (a) Outstroke during  $60^\circ$  of cam rotation  
 (b) Dwell for the next  $30^\circ$  of cam rotation  
 (c) Return stroke during next  $60^\circ$  of cam rotation  
 (d) Dwell for the remaining  $210^\circ$  of cam rotation.  
 The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.
- OR iii. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with uniform acceleration and retardation. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower. **6**