Semester: 2021-22 (Odd Semester)   Year: 2nd Year (2K21)

Mid Semester Examination

Time: 1.5 h   Maximum marks: 30

All questions are compulsory

Section A

9 marks (9 questions of 1 mark each)

1. ABCD is a four-link Mechanism. AB = 100 mm, BC = 150 mm, CD = 200 mm and AD = 175 mm. Can it act as a double-crank mechanism?
(a) No.
(b) <u>Yes, if AB is fixed</u>
(c) Yes, if BC is fixed
(d) Yes, if AD is fixed

2. The slider A, of an elliptical trammel shown in the figure moves towards O with a velocity of 3 m/s at the instant when AB makes an angle of 40^0 with the horizontal. Determine the velocity of the mid point of the link AB at this instant
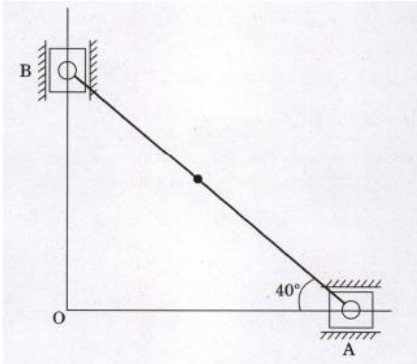
3. The number of instantaneous centres of rotation in a slider crank quick –return mechanism is **15**.

4. A planer mechanism has 10 links and 12 rotary joints. Using Grubler's criterion, the number of degrees of freedom of the mechanism is **3**.

5. The magnitude of the velocity of any point on the kinematic link relative to the other point on the same kinematic link is the product of
(a) A square root of an angular velocity of the link and the distance between the two points under consideration
(b) An angular velocity of the link and the square of distance between the two points under consideration
(c) A square of an angular velocity of the link and the distance between the two points under consideration
(d) <u>An angular velocity of the link and the distance between the two points under consideration</u>

**6**. Match the degree of freedom of kinematic pair

List-1	List-II
1. Spherical pair	A. 1
2. Cylindrical pair	B. 2
3. Screw pair	C. 3
4. Ball and socket joint	

1. Spherical pair : 3
2. Cylindrical pair: 2
3. Screw pair: 1
4 Ball and socket joint: 3

7. For a crank and slotted lever quick return mechanism, α = 150°. Find the ratio of time of cutting stroke to time of return stroke.

8. Define: kinematic link, kinematic pair, kinematic chain.

9. Distinguish between mechanism and machine.

Section B
9 marks (3 questions of 3 marks each)

1. For the configuration of a slider –crank mechanism, calculate the
  (a) acceleration of the slider at B   (**ans: 67.502 m/s²**)
  (b) angular acceleration of the link AB (**ans: 104.6 rad/s²**)
      OA rotates at 20 rad/s counter-clockwise
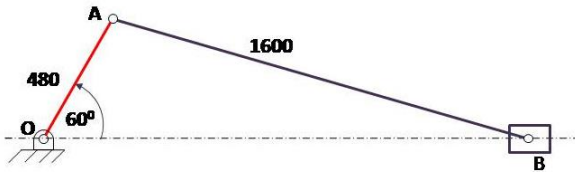
2. A mechanism in which OA = QC = 100 mm, AB = QB = 300 mm and CD = 250 mm. The crank OA rotates at 150 rpm in the clockwise direction. Determine the velocity of the slider at D.


(a)
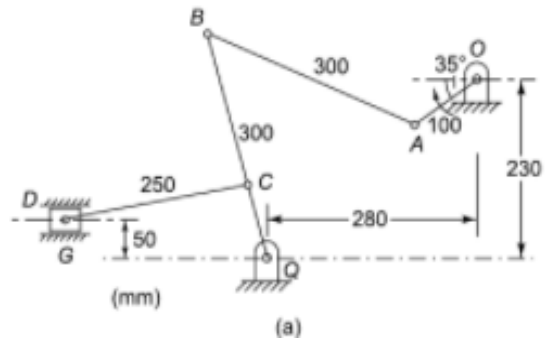
3. State kennedy theorem. Locate all instantaneous centre of rotation for a four-bar mechanism.

Section C

12 marks (2 questions of 6 marks each, Each question can have parts)
1. The crank OP of a crank- and slotted-lever mechanism rotates at 100 rpm in the counter-clockwise direction. Various lengths of the links are OP = 90 mm, OA = 300 mm, AR = 480 mm and RS = 330 mm. The slider moves along an axis perpendicular to AO and is 120 mm from O.
  (a) Determine velocity of the slider when the AOP is 135⁰ and quick return ratio.
  (b) Determine angular velocity of link AR, RS.
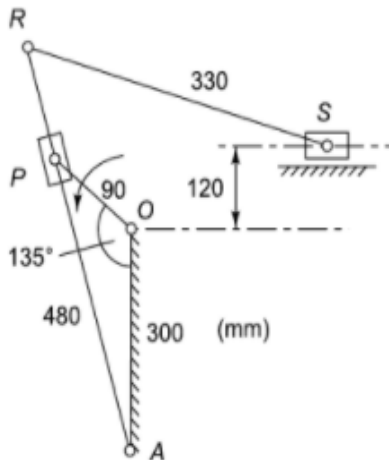
2. PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60⁰ and Q and R lie on the same side of PS.
  (a) Find the angular velocity links QR and RS.
     (**3.75 rad/s, 1.98 rad/s**)

(b) Find the angular acceleration of links QR and RS