DEPARTMENT OF MECHANICAL ENGINEERING
UNIVERSITY INSTITUTE OF ENGINEERINGAND TECHNOLOGY, CSJM UNIVERSITY, KANPUR

Kinematics and Mechanism (MEE-S203)

Semester: 2022-23 (Even Semester) **Year: 2nd Year (2K21)**

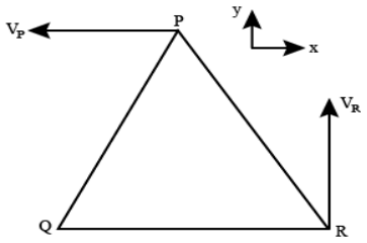
End Semester Examination

Time: 3 h **Maximum marks: 50**

All questions are compulsory

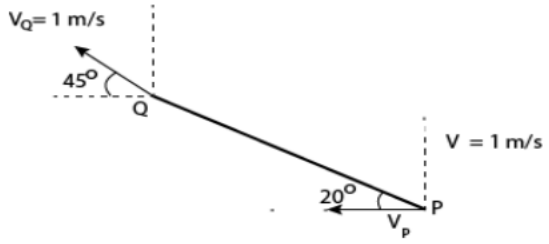
Section A

1. A rigid triangular body PQR, with sides of equal length of 1 unit moves on a flat plane. At the instant shown, edge QR is parallel to the x-axis, and the body moves such that velocities of points P and R are V_p and V_R, in the x and y directions, respectively. The magnitude of the angular velocity of the body is



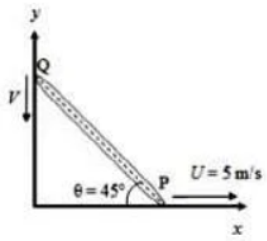
[2]

2 A rigid link PQ is 2m long and oriented at 200 to the horizontal as shown in the figure. The magnitude and direction of velocity VQ, and the direction of velocity VP are given. The magnitude of VP (in m/s) at this instant is



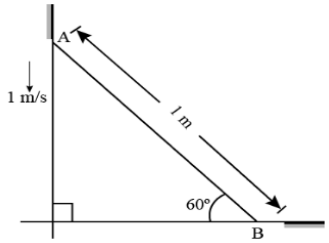
[2]

3. A rigid rod of length 1m is resting at an angle $\theta = 45^0$ as shown in figure. The end P is dragged with a velocity of v_P = 5 m/s to the right. At the instant shown, the magnitude of the velocity V_Q (in m/s) of point Q as it moves along the wall without losing contact is



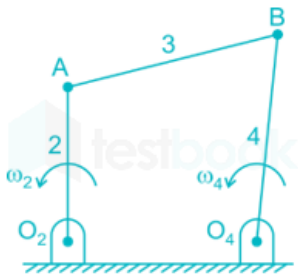
[2]

4. A rod of length 1 m is sliding in a corner as shown in figure. At an instant when the rod makes an angle of 60^0 with the horizontal plane, the velocity of point A on the rod is 1 m/s. The angular velocity of the rod at this instant is 1 m/s.



[2]

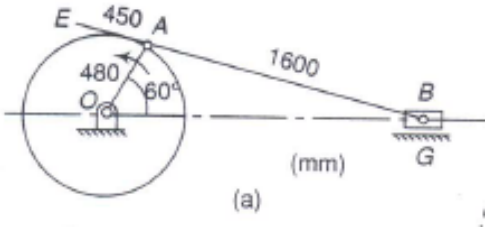
5. A four bar mechanism is shown in the figure. The link numbers are mentioned near the links. Input link 2 is rotating anticlockwise with a constant angular speed ω2. Length of different links are : O_2O_4 = O_2A = L, AB = O_4B = $\sqrt{2}$L The magnitude of the angular speed of the output link 4 is ω4 at the instant when link 2 makes an angle of 900 with O2O4 as shown. The ratio $\frac{\omega_4}{\omega_2}$ is _____.



[2]

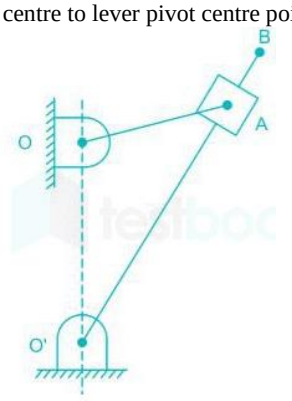
Section B

1. For the configuration of a slider –crank mechanism, calculate the
(a) Velocity of slider B
(b) angular velocity of link AB
OA rotates at 20 rad/s counter-clockwise.



[4]

2. A simple quick return mechanism is shown in the figure. The forward to return ratio of the quick return mechanism is 2 : 1. If the radius of the crank O_1P is 125 mm, then the distance'd' (in mm) between the crank centre to lever pivot centre point should be

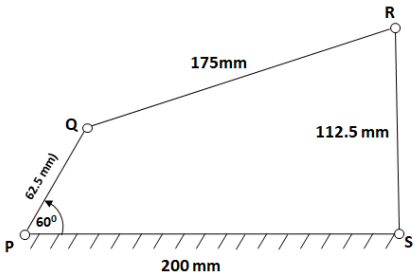


[4]

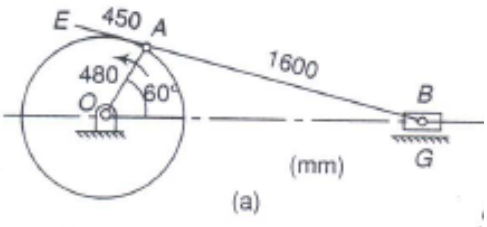
3. Derive the expression of coriolis acceraltion. [4]

4. Define the following terms
(a) module
(b) circular pitch
(c) path of contact
(d) contact ratio [4]

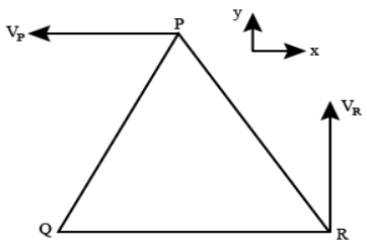
5. Locate instantaneous centre of rotation of given mechanism
(a)



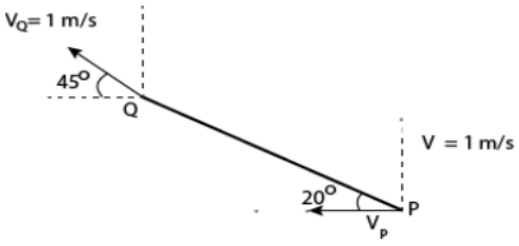
(b)



(c)



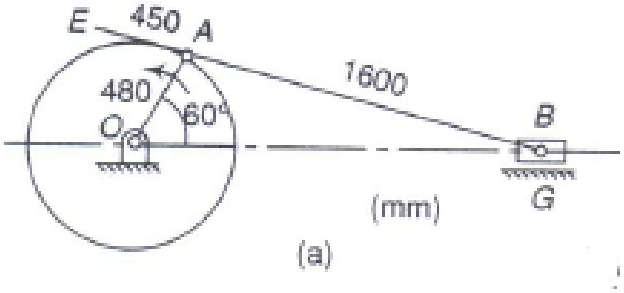
(d)



[4]

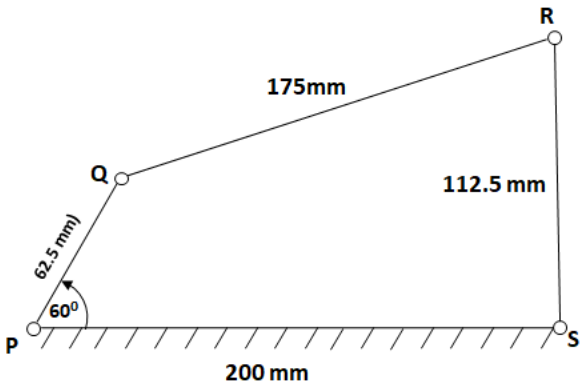
Section C

1. For the configuration of a slider –crank mechanism, calculate the
(a) Acceleration of the slider at B
(b) Angular acceleration of the link AB
OA rotates at 20 rad/s counter-clockwise.



[10]

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. when angle QPS = 60^0 and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.



[10]