

INTERNATIONAL CENTRE FOR APPLIED SCIENCES MAHE, MANIPAL B.Sc. (Applied Sciences) in Engg. End – Semester Theory Examinations – Nov./ Dec. 2020 III SEMESTER - KINEMATIC OF MACHINES (IMET 232) (Branch: Mechatronics)

Time: 3 Hours	Date: 25 November 2020	Max. Marks: 50
✓ Answer ALI	the questions.	
✓ Missing data	a, if any, may be suitably assumed	

- 1A. Explain transmission angle with diagram. Draw the kinematic sketch of 05 Hand pump and Scott-Russel mechanism.
- 1B. Define Chebyshev spacing. Draw the kinematic sketch of all inversions 05 of double slider crank mechanism.
- 2A. Explain Grubler's equation for planar mechanism. Determine the 05 number of links and joints, Calculate degree of freedom of the given mechanism in Fig. 2A.



Fig. 2A

2B. Calculate the maximum and minimum transmission angles for the 05 mechanism as shown in Fig 2B. The figures indicate the dimensions in standard unit. Identify the type of mechanism whether crank-rocker or rocker-rocker or crank-crank.



3A. PQRS is a four bar chain with link PS fixed is shown in Fig. 3A. 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 diagram when angle QPS = 60° and Q and R lie on the same side of PS. Calculate the angular velocity of links QR and RS.



Fig. 3A

- **3B.** From the above question Q3A, draw the acceleration diagram. **05** Determine the angular acceleration of links QR and RS.
- 4A. Determine the lengths of the links of a four-bar linkage to generate the function $y = log_{10}(x)$ in the interval $1 \le x \le 10$. The crank rotates from an angle of 45° to 105°, where the follower rotates from an angle of 135° to 225°. Given that the length of the smallest link is 5 cm. Use three-point Chebyshev spacing..
- 4B. A reverted gear train shown in Fig. 4B. is used to provide a speed ratio
 05 of 10. The module of gears 1 and 2 is 3.2 mm and of gears 3 and 4 is 2 mm. Determine suitable number of teeth for each gear. No gear is to have less than 20 teeth. The centre distance between shafts is 160 mm.



- 5A. Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return.
- **5B.** Explain the Disc and Wedge Cams with a neat sketch.

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