

CBCS SCHEME

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15ME42

Fourth Semester B.E. Degree Examination, July/August 2021 Kinematics of Machines

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Define the following with an example for each :
 - i) Flexible link ii) Spherical pair iii) Successfully constrained pair
 - iv) Quick return motion. (04 Marks)
- b. Determine the DOF of : i) Toggle mechanism ii) Robert's mechanism. (04 Marks)
- c. With a neat sketch, explain Whitworth Quick Return Motion Mechanism. (08 Marks)

- 2 a. State Grashoff's criterion and explain the inversions of Grashoff's chain. (04 Marks)
- b. Derive and state condition for Correct steering. (04 Marks)
- c. With a neat sketch, explain Oldham's coupling. (08 Marks)

- 3 Fig. Q3, shows a mechanism in which dimensions of various links are as follows :
 $OP = RS = 50\text{mm}$, $PQ = QS = 450\text{mm}$.
 The uniform speed of crank OP is 180 rpm. Determine angular velocity of QS and rubbing velocity at the pin Q which is 60mm in diameter. Also find angular acceleration of QS , velocity of R . (16 Marks)

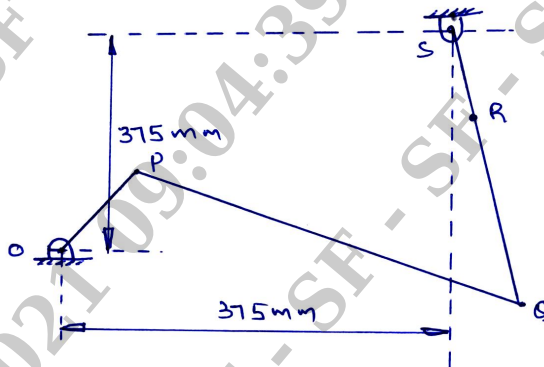


Fig. Q3

- 4 a. Determine the Instantaneous centres for the mechanisms shown below in Fig. Q4(a)(i) & (ii)

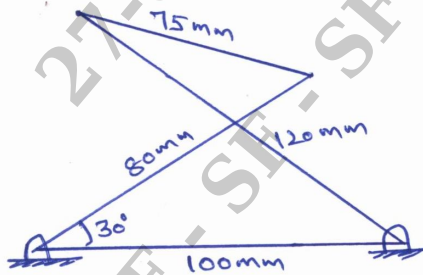


Fig. Q4(a)(i)

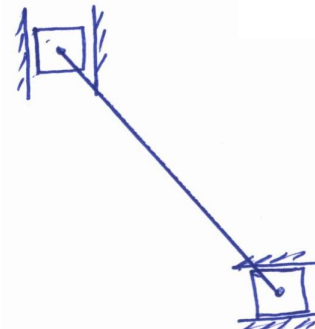


Fig. Q4(a)(ii)

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- b. Find the velocity of point 'C' of the mechanism shown in the Fig. Q4(b). The link P, A is 100 rpm.

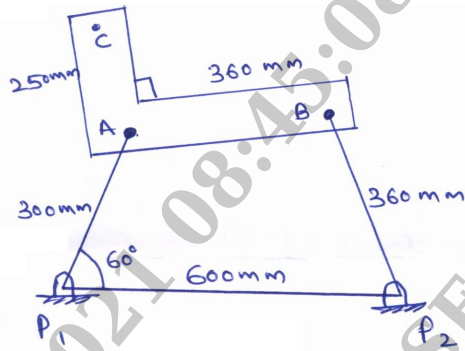


Fig. Q4(b)

(10 Marks)

- 5 In an IC Engine Mechanism, Crank radius is 50mm and connecting rod length is 200mm. The crank is rotating at 100 rad/s CW. At a particular instant the crank is at 40° from TDC position. For this position of the mechanism, find out the velocity of piston using Complex Algebra method. (16 Marks)
- 6 Design a four bar mechanism to co-ordinate 3 positions of the input and output links as follows. Using Freudenstein's equation.

	1	2	3
θ	20°	35°	50°
ϕ	35°	45°	60°

Draw the mechanism in second position.

(16 Marks)

- 7 a. Define the following with respect to gear : i) Law of gearing ii) Pressure angle
 iii) Involute profile iv) Interference v) Module. (05 Marks)
- b. Two 20° pressure angle involute gears in mesh have a module of 10mm. The addendum is one module. The large gear has 50 teeth and the pinion 13 teeth.
 i) Does interference occur?
 ii) If yes, to what value should the pressure angle be changed to eliminate interference? (11 Marks)

- 8 An epicyclic gear train is shown in Fig. Q8, wheel D is held stationary by the shaft A and arm B rotates at 200 rpm. The wheel E (20 teeth) and F (40 teeth) are fixed together and rotate freely on a pin carried by the arm. The wheel G(30 teeth) is mounted on shaft C. Find the speed of shaft C, stating the direction of rotation relative to that of B. If the gearing transmits 7.5 kw, what is the holding torque on shaft A? (16 Marks)

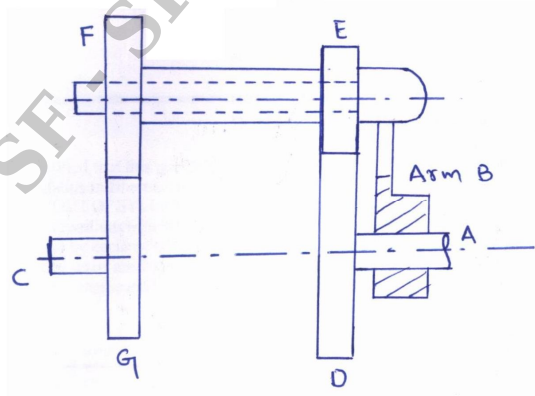


Fig. Q8

- 9 A cam operates an offset roller follower. The least radius of the cam is 30mm, roller diameter is 30mm and offset is 20mm, the cam rotates at 360 rpm. The angle of ascent is 48° , angle of dwell is 42° and angle of descent is 60° . The motion is to be SHM during ascent and uniform acceleration and deceleration during descent. Draw the cam profile. (16 Marks)
- 10 A circular arc cam drives a flat faced follower. The base circle radius is 40mm and nose radius is 10mm. If the total angle of action is 120° and the total lift of the follower is 20mm, find
- Maximum velocity and acceleration.
 - Maximum retardation of the follower when the cam rotates at 600 rpm. (16 Marks)

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