P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Kinematics of Machinery

Time: 3 hrs   *Max. Marks: 100*

*Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define the following :   4

  i) Higher pair   ii) Kinematic chain   iii) Mobility of Mechanism   iv) Structure.

  b. Determine the mobility of the four bar and single slider crank chain mechanism.   4

  c.   Explain with the help of neat sketches; i) Elliptical trammel   ii) Pantograph mechanism.   12

2 Explain with the help of neat sketches :   6

  a) Peaucelliar's Straight line mechanism.

  b) Whitworth quick return motion mechanism.   7

  c) Devis steering gear mechanism.   7

UNIT - II

3 a. Locate all the instantaneous centres for the slider crank mechanism.   5

  b. State and prove Kennedys theorem of instantaneous centre.   5

  c. A pin jointed four bar mechanism ABCD is shown in Fig.Q3.C Link AB =150 mm, BC = 180 mm, CD = 180 mm and the fixed link AD = 300. Link AB makes 60° with the link AD, and rotates uniformly at 100 rpm. Locate all the instantaneous centres and find the angular velocity of link BC and the linear velocity of link CD.

Fig.Q.3.C

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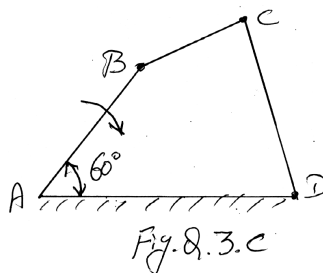
4. The crank of the slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine;

  (i) Linear velocity and acceleration of the midpoint of the connecting rod   20

  (ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.

UNIT - III

5 a. State and prove the law of gearing.   8

b. Two 20° involute spur gears mesh externally and give a velocity ratio of 3. The module is 3 mm and the addendum is equal to 1.1 module. If the pinion rotates at 120 rpm, determine; (i) The minimum number of teeth on each wheel to avoid interference   (ii) Contact ration.   12

6 a. Explain the terms; i) Pitch circle   ii) Dedendum   iii) Backlash   iv) Module.   4

b. Derive an expression for the length of the path of contact in a pair of meshed spur gear.   8

c. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact and arc of contact.   8

UNIT - IV

7 a. Sketch and explain; i) Compound gear train   ii) Reverted gear train.   6

b. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis 0. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the number of teeth are, $Z_C = 28$, $Z_D = 26$, $Z_E = Z_F = 18$.   14

i) Sketch the arrangement   ii) Find the number of teeth on A and B

iii) If the arm G makes 100 rpm clockwise and A is fixed find the speed of B.

8 a. Explain the phenomenon of slip and creep in belt drive.   4

b. Determine an expression for the ratio of belt tension for flat belt drive.   6

c. Determine the maximum power transmitted by a V-belt drive having the included angle of V-groove is 35°. The belt used in 18 mm deep with 18 mm maximum width and weighs 300 g/m length. The angle of lap is 145° and the maximum permissible stress in 1.5 N/mm^2. Take the coefficient of friction to be 0.2.   10

UNIT - V

9 a. Sketch and explain the terminology of radial cam.   8

b. A cam with 30 mm minimum radius drives a knife edge reciprocating follower, during first 120° rotation of the cam in CW direction follower moves outwards through a distance of 30 mm with Cycloidal. The follower dwells during next 60° cam rotation. During next 90° cam rotation, the follower moves inwards with UV. Follower dwell for the remaining period of cam rotation, develop the cam profile.   12

10. Draw the profile of a cam operating a roller reciprocating follower and with the following data: Minimum base radius of cam = 30 mm, lift = 40 mm, roller diameter = 16 mm. Axis of the follower is off set to the right of the cam axis by 18 mm. Ascent of the follower takes place with SHM is 90° followed by a period of rest 30°. Then the follower descents with UARM during 180°, the acceleration being 3/5 times of retardation and the cam rotates at a uniform speed of 240 rpm (CW direction). Calculate the maximum velocity and acceleration of the follower during the ascent period.   20

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