U.S.N | | | | | | | | | | |

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; May / June - 2019

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) Mechanism iv) Mobility

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

c. Sketch and explain; i) Oldham's coupling ii) Pantograph mechanism. 12

2 a. Explain the following with help of neat sketches:

i) Elliptical trammel 6

ii) Whitworth quick return motion mechanism 7

iii) Ackermann steering mechanism for correct steering 7

UNIT - II

3 a. Locate the entire instantaneous centre for the four bar mechanism. 5

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

c. Locate all the instantaneous centres of the slider crank mechanism as shown in Fig.Q.3(c). The length of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s. Find; 10

i) Velocity of the slider A ii) Angular velocity of the connecting rod AB

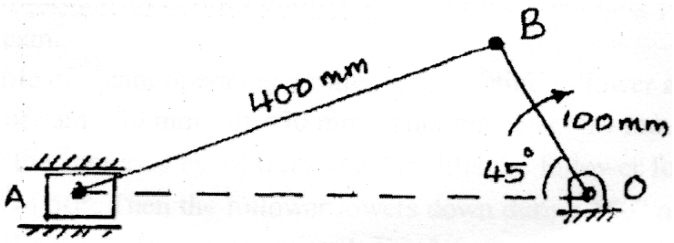

Fig.Q.3.c

4. PQRS is a four bar chain with link PS fixed. The length of the links are PQ = 62.5, 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 = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of link QR and RS. 20

UNIT - III

5 a. Classify the Gears. 4

b. State and prove law of Gearing. 6

Contd…2

c. 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 the; i) Minimum number of teeth on each wheel to avoid interference ii) Contact ratio — 10

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

b. 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, arc of contact and the contact ratio. — 12

UNIT - IV

7 a. Sketch and explain; i) Compound gear train ii) Reverted gear train iii) Epicyclic gear train — 9

b. An epicyclic gear consists of three gears A, B and C the gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 rpm. Sketch the arrangement and determine the speed of gears B and C, if the gear A is fixed. — 11

8 a. Explain the following term in a belt drive : i) Centrifugal tension ii) Slip — 4

b. Drive an expression for ratio of tension in V-belt drive. — 8

c. The initial tension in a flat belt drive is 1800 N. The angle of lap on the smaller pulley is 170°. The coefficient of friction of the belt and pulley surface is 0.25. The pulley has a diameter of 0.9 m and it runs at 540 rpm. Determine the power that can be transmitted at the above speed. Neglect centrifugal tension. — 8

UNIT - V

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

b. A cam with 30 mm minimum radius drives a flat faced reciprocating follower during first 120° rotation of the cam follower moves outwards through a distance of 30 mm with uniform velocity. The follwer dwells during next 60° cam rotation. During next 90°cam rotation, the follower moves inwards with SHM. Follower dwell for the remaining period of cam rotation , draw the profile of the cam. — 12

10. Draw the profile of a cam operating a roller reciprocating follower and with the following data : Minium radius of cam = 30 mm, lift = 30 mm, roller diameter = 14 mm, axis of the follower is off set to the right of the cam axis by 18 mm. The cam lifts the follower for 120° with SHM followed by dwell period of 50°. Then the follower lowers down during 160° of cam rotation with UARM followed by dwell period . The acceleration being 3/5 times of retardation. The cam rotates at a uniform speed of 150 rpm (CW direction). Calculate the maximum velocity and acceleration of the follower during the ascent period. — 20

* * * *