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

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Mechanical Engineering

Semester End Examination; June/July - 2015

Kinematics of Machines

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.*
ii) Assume suitable missing data if any.

UNIT - I

1. a. Define the following :

i) Degree of freedom (ii) Kinematic Chain (iii) Higher Pair (iv) Inversion of mechanism — 4

b. Explain with neat sketches one inversion each of single slides crank chain and double slider crank chain. — 16

2. Explain the following with the help of neat sketches

i) Geneva Mechanism

ii) Toggle Mechanism

iii) Ratchet and pawl mechanism

iv) Pantograph — 20

UNIT – II

3. The slider C of the toggle mechanism shown in Fig. Q3 is constrained to move on a horizontal path. The crank O_1A rotates in the counter clockwise direction at a uniform speed of 180 rpm. O_1A = 200 mm, AB = 400 mm, O_2B = 300 mm, and BC = 600 mm, Determine;

(i) Velocity of slider C,

(ii) angular velocity of links AB, O_2B and BC

(iii) rubbing velocities on the pins of 25 mm diameter at A and C, and

(iv) torque required at the crank O_1A for a force of 2KN at C. — 20

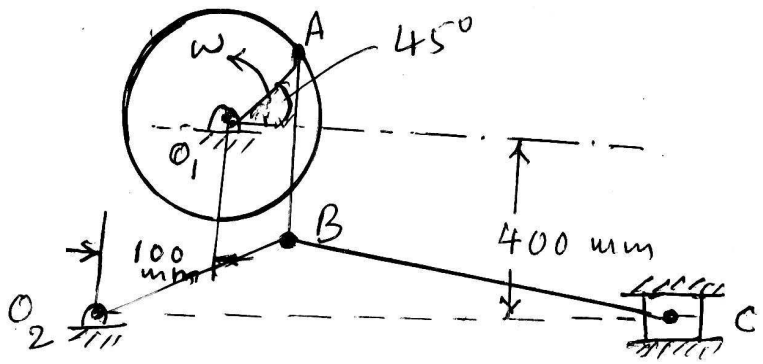

Fig. Q. 3

Contd…2

4. In the Crank and slotted lever type quick return motion mechanism shown in Fig. Q4, the Crank AB rotates at one rev/s. Determine;
   (a) velocity of ram at D,
   b) magnitude of coriolis acceleration component
   (c) acceleration of ram at D. AB = 200 mm, OC = 600mm, CD = 500mm, and OA = 250 mm

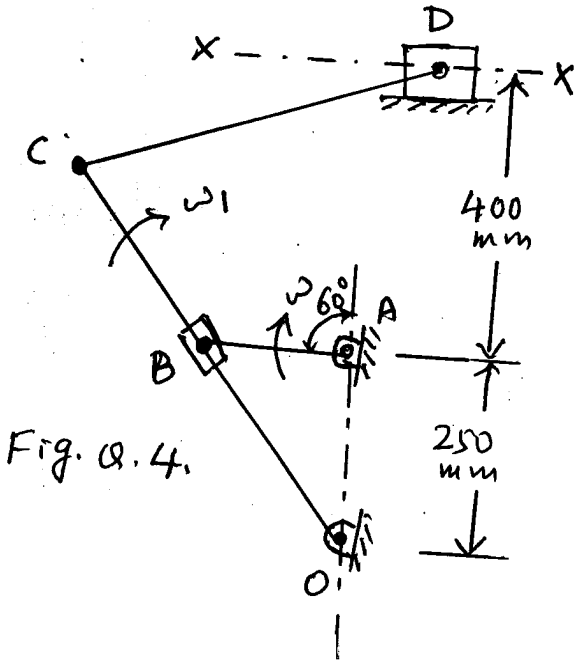

Fig. Q. 4. 20

UNIT - III

5 a. Classify the gears. 4

b. Compare involute and Cycloidal tooth profiles. 6

c. Derive an expression for the minimum number of teeth required on the pinion in order to avoid interference in involute gear teeth. 10

6. a. Derive expressions for arc of contact, length of path of contact, and the contact ratio. 10

b. A pinion of 24 teeth drives a gear of 60 teeth at a pressure angle of 20°. The pitch radius of the pinion is 38 mm, and the outside radius is 41 mm. The pitch radius of the gear is 95 mm, and the outside radius is 98.5 mm, Calculate the length of action and contact ratio. 10

UNIT - IV

7 a. With neat schematics and velocity ratio, Explain different types of gear trains. 12

b. The speed ratio of a reverted gear train is to be 15. The module of gears 1 and 2 is 3 mm and that of gears 3 and 4 is 2.5 mm, Calculate the suitable number of teeth for the gears. The centre distance between gear shafts is 250 mm. 8

8 a. Derive an expression for ratio of belt tensions in flat belt drive. 6

b. Obtain the condition for maximum power transmission. 4

Contd…3

c. A compressor requires 100 kW to run at 240 rpm from an electric motor of Speed 750 rpm, by means of a V belt drive. The diameter of the compressor shaft pulley should not be more than 1m while the centre distance between the shafts is 2 m. The belt speed should not exceed 25 m/s. Determine the number of V-belts required to transmit the power if each belt has a cross sectional area of 375 mm^2, density1000 kg/m^3 and an allowable tensile stress of 2.5 MPa. The pulley groove angle is 40° and coefficient of friction between the belt and the pulley sides is 0.25 10

UNIT - V

9. A cam of base circle 50 mm is to operate a roller follower of 20 mm diameter. The follower is to have SHM. The angular speed of the cam is 360 rpm. Draw the cam profile for the Cam lift of 40 mm. Angle of ascent = 60° angle of dwell = 40°, and angle of descent = 90° followed by dwell again. Also calculate the maximum velocity and acceleration during ascent and descent. 20

10. A Cam is to operate a flat faced follower having uniform acceleration and deceleration during ascent and descent. The least radius of the Cam is 50 mm, During decent, the deceleration period is half of the acceleration period. The ascent lift is 37.5 mm. The ascent is for ¼ th period, dwell for ¼th, descent for 1/3rd, and dwell for the remaining 1/6th period. The Cam rotates at 600 rpm. Find the maximum velocity and acceleration during ascent and descent, draw the Cam profile. 20

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