B.Tech II Year II Semester (R13) Supplementary Examinations December/January 2015/2016

KINEMATICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) Enumerate the inversions of single slider crank chain.
(b) Define mechanical advantage and transmission angle of mechanism.
(c) Define Grashof's law.
(d) What is the fundamental equation of steering gears? Name two types of steering gears.
(e) What is coriolis acceleration? Give its formula.
(f) What do you mean by centroid of a body? What are its types?
(g) State the fundamental law of gearing? State when the meshing surfaces can be called Conjugate.
(h) Distinguish between the machine and the structure.
(i) What is the phenomenon of creep in belt drives?
(j) What are the various materials used for flat belts, V-belts and ropes?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) In a crank and slotted lever mechanism, the driving crank is 40 mm long, and the time ratio of cutting stroke to return stroke is 2. If the length of working stroke of the ram is 110 mm, find the distance between the fixed centers, and the slotted lever length

(b) Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 rpm. If the total permissible variation in speed of the driven shaft is not to exceed $\pm$ 6% of mean speed, find the greatest permissible angle between the center lines of the shafts.

OR

3 The driving shaft of a Hooke's joint runs at uniform speed of 240 rpm and the angle of α between the shafts is 20^0. The driven shaft with attached masses has a mass of 55 kg at a radius of gyration of 150 mm.

(i) If a steady torque of 200 N-m resists rotation of the driven shaft, find the torque required at the driving shaft, when $\theta = 45^0$.

(ii) At what value of α will the total fluctuation of speed of the driven shaft be limited to 24 rpm.

UNIT – II

4 Two shafts are connected by a Hooke's joint which are inclined at 15^0 and the speed of driving shaft is 800rpm. Find the highest and lowest speeds of driven shaft and its maximum acceleration.

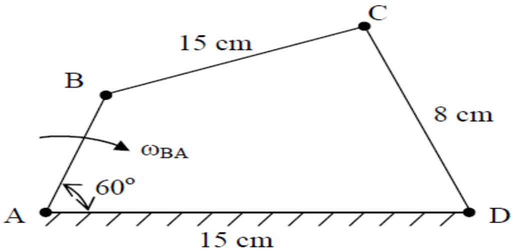
OR

5 Two parallel shafts that are 3.5 meter apart are connected by two pulleys of 1 m and 400 mm diameters, the larger pulley being the driver runs at 220 rpm. The belt weighs 1.2 kg per meter length. The maximum tension in the belt is not to exceed 1.8 kN. The coefficient of friction is 0.28. Owing to slip on one of the pulleys, the velocity of the driving shaft is 520 rpm only. Determine: (i) Torque required on each shaft. (ii) Power transmitted. (iii) Power lost in friction. (iv) Efficiency of the drive.

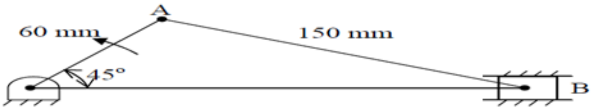
Contd. in page 2

UNIT – III

6 (a) In a four bar chain ABCD figure given below, link AD is fixed and is 15 cm long. The crank AB is 4 cm long, rotates at 180 rpm (cw) while link CD rotates about D is 8 cm long .BC = AD. Find angular velocity of link CD.



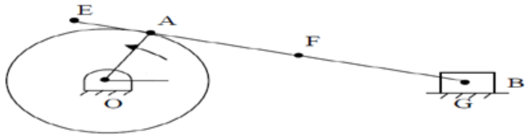
(b) In a crank and slotted lever mechanism shown below, crank rotates of 300 rpm in a counter clockwise direction. Find: (i) Angular velocity of connecting rod. (ii) Velocity of slider.



Configuration diagram

OR

7 In a slider crank mechanism shown below the crank is 200 mm long and rotates at 40 rad/sec in a CCW direction. The length of the connecting rod is 800 mm. When the crank turns through 60^0 from Inner-dead centre. Determine: (i) The velocity of the slider. (ii) Velocity of point E located at a distance of 200 mm on the connecting rod extended. (iii) The position and velocity of point F on the connecting rod having the least absolute velocity. (iv) The angular velocity of connecting rod. (v) The velocity of rubbing of pins of crank shaft, crank and cross head having pins diameters 80, 60 and 100 mm respectively.

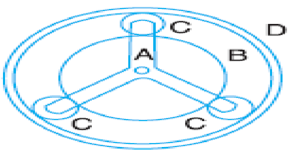


UNIT – IV

8 A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20^0 involute forms, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.

OR

9 In an epicyclic gear of the ‘Sun and Planet’ type shown in figure, the pitch circle diameter of the internally toothed ring is to be 224 mm and the module is 4 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable numbers of teeth for all the wheels.



UNIT – V

10 A cam with 30 mm minimum radius is rotating clockwise is rotating clockwise at 1200 rpm to give the follower motion to a roller follower of 20 mm diameter.

(i) Lift = 25 mm

(ii) Follower rises during 120^0cam rotation with SHM.

(iii) Follower to dwell for 60^0 cam rotation.

(iv) Follower to return 90^0 cam rotation with uniform acceleration and deceleration.

(v) Follower to dwell for remaining period.

Draw the profile of the cam and determine maximum velocity and acceleration during rise and return stroke.

OR

11 A symmetrical cam has a base circle 60 mm radius, arc of action 110^0, straight flanks and tip is a circular arc. The line of action of the follower passes through the centre line of cam shaft. The follower which has 40 mm diameter roller has a lift of 26 mm. Calculate the velocity and acceleration of the follower when moving outward and contact is just reaching the end of straight flank. The cam rotates at 500 rpm.