B.Tech II Year II Semester (R13) Regular & Supplementary Examinations May/June 2016

KINEMATICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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

(a) What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism?

(b) Write notes on complete and incomplete constraints in lower and higher pairs, illustrating your answer with neat sketches.

(c) What is the condition for correct steering?

(d) How does the velocity ratio of a belt drive effect, when some slip is taking place between the belt and the two pulleys?

(e) Draw the acceleration diagram of a slider crank mechanism.

(f) Show that slider crank mechanism is a modification of the basic four bar mechanism.

(g) What do you understand by the term ‘interference’ as applied to gears?

(h) How the velocity ratio of epicyclic gear train is obtained by tabular method?

(i) Why a roller follower is preferred to that of a knife-edged follower?

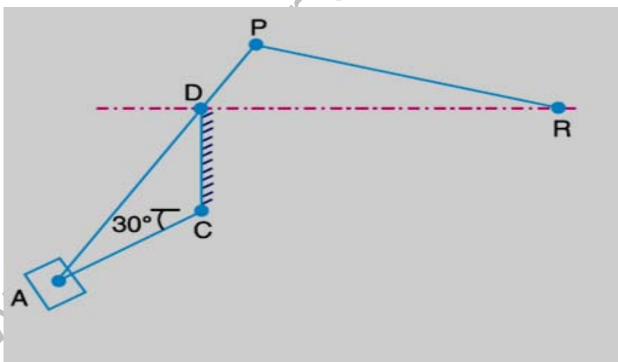
(j) What are the different types of motion with which a follower can move?

PART – B

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

UNIT – I

2 In a Whitworth quick return motion mechanism, as shown in figure below, the distance between the fixed centers is 50 mm and the length of the driving crank is 75 mm. The length of the slotted lever is 150 mm and the length of the connecting rod is 135 mm. Find the ratio of the time of cutting stroke to the time of return stroke and also the effective stroke.



OR

3 Give a neat sketch of the Modified Scott-Russel mechanism and Grasshopper mechanism.

UNIT – II

4 The driving shaft of a Hooke’s joint runs at a uniform speed of 240 r.p.m and the angle α between the shafts is 20°. 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 θ = 45°. (ii) At what value of ‘α’ will the total fluctuation of speed of the driven shaft be limited to 24 r.p.m?

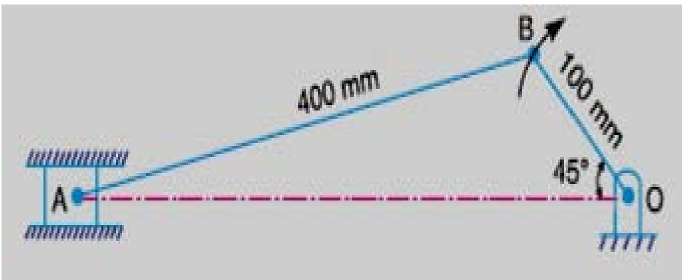
OR

5 A pulley is driven by a flat belt, the angle of lap being 120°. The belt is 100 mm wide by 6 mm thick and density1000 kg/m^3. If the coefficient of friction is 0.3 and the maximum stress in the belt is not to exceed 2 MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt.

Contd. in page 2

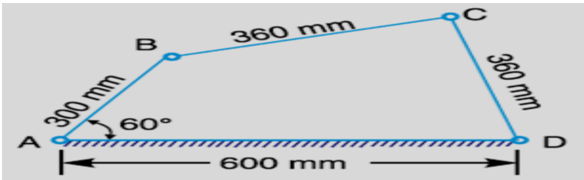
UNIT – III

6 Locate all the instantaneous centers of the slider crank mechanism as shown in figure below. The lengths 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: (i) Velocity of the slider A. (ii) Angular velocity of the connecting rod AB.



OR

7 In a pin jointed four bar mechanism, as shown in figure below, AB = 300 mm, BC = CD = 360 mm and AD = 600 mm. The angle BAD = 60°. The crank AB rotates uniformly at 100 r.p.m. Locate all the instantaneous centers and find the angular velocity of the link BC.

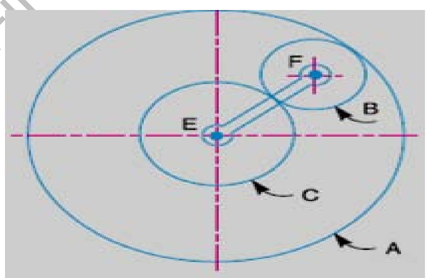


UNIT – IV

8 Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine: (i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel. (ii) The length of path and arc of contact. (iii) The number of pairs of teeth in contact. (iv) The maximum velocity of sliding.

OR

9 An epicyclic gear consists of three gears A, B and C as shown in figure below. 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 r.p.m. If the gear A is fixed, determine the speed of gears B and C.



UNIT – V

10 A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam

OR

11 A cam has straight working faces which are tangential to a base circle of diameter 90 mm. The follower is a roller of diameter 40 mm and the centre of roller moves along a straight line passing through the centre line of the cam shaft. The angle between the tangential faces of the cam is 90° and the faces are joined by a nose circle of 10 mm radius. The speed of rotation of the cam is 120 revolutions per min. Find the acceleration of the roller centre (i) When during the lift; the roller is just about to leave the straight flank. (ii) When the roller is at the outer end of its lift?

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