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Question Paper Code : 71846

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Third Semester

Mechanical Engineering

ME 2203/ME 35/ ME 1202 A/080120010/ 10122 ME 404 — KINEMATICS OF MACHINERY

(Regulation 2008/2010)

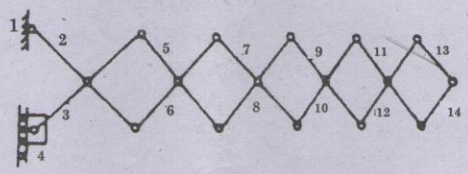
(Common to PTME 2203/ 10122 ME 404 — Kinematics of Machinery for B.E. (Part-Time) Third /Fourth Semester Mechanical Engineering – Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the number of freedom of the mechanism shown in the figure below:



2. What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? Give examples.

3. Explain how the acceleration of a point on a link (whose direction is known) is obtained when the acceleration of some other point on the same link is given in magnitude and direction.

4. Explain how the coriolis component of acceleration arises when a point is rotating about some other fixed point and at the same time its distance from the fixed point varies.

5. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with Cycloidal motion.

6. Which of the displacement diagrams in respect of follower motion should be chosen for better dynamic performance of a cam-follower mechanism?

7. What do you understand by the term 'interference' as applied to gears?

8. In a clock mechanism, what type of gear train used to connect minute hand to hour hand?

9. Which of the two assumptions-uniform intensity of pressure or uniform rate of wear, would you make use of in designing friction clutch and why?

10. Distinguish between brakes and dynamometers.

PART B — (5 × 16 = 80 marks)

11. (a) What is known as kinematic inversion? Sketch and explain the various inversions of a slider crank chain, also stating the actual machines in which these are used in practice. (16)

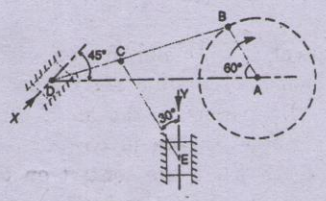
Or

(b) Explain why two Hooke's joints are used to transmit motion from the engine to the differential of an automobile. Two shafts are connected by a universal joint. The driving shaft rotates at a uniform speed of 1200 r.p.m. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 100 r.p.m. Also calculate the maximum and minimum speeds of the driven shaft. (16)

12. (a) The dimensions of the mechanism, as shown in Fig. below, are as follows:

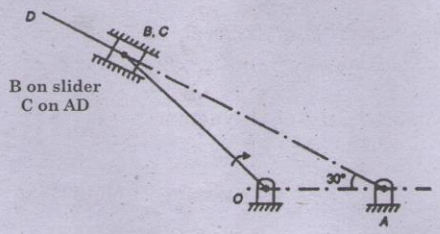
AB = 0.45 m; BD = 1.5 m: BC = CE = 0.9 m.

The crank AB turns uniformly at 180 r.p.m. in the clockwise direction and the blocks at D and E are working in frictionless guides. Draw the velocity diagram for the mechanism and find the velocities of the sliders D and E in their guides. Also determine the turning moment at A if a force of 500 N acts on D in the direction of arrow X and a force of 750 N acts on E in the direction of arrow Y. (16)



Or

(b) A single cylinder rotary engine is shown below. OA is the fixed link, 200 mm long. OB is the connecting rod and is 520 mm long. The line of stroke is along AD and at the instant is inclined at 30° to the vertical. The body of the engine consisting of cylinders rotates at a uniform speed of 400 rpm about fixed centre A. Determine the acceleration of slider B and angular acceleration of connecting rod. (16)



13. (a) The following particulars relate to a symmetrical circular cam operating a flat-faced follower:

Least radius = 25 mm nose radius = 8 mm, lift of the valve = 10 mm, angle of action of cam =120°, cam shaft speed = 1000 r.p.m. Determine the flank radius and the maximum velocity, acceleration and retardation of the follower. If the mass of the follower and valve with which it is in contact is 4 kg, find the minimum force to be exerted by the spring to overcome inertia of the valve parts. (16)

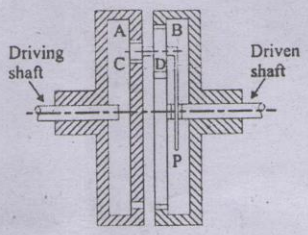
Or

(b) A cam rotating clockwise at a uniform speed of 200 r.p.m. is required to move an offset roller follower with a uniform and equal acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell (between ascent and descent) and the angle of descent is 120°, 60° and 90° respectively. The follower dwells for the rest of cam rotation. The least radius of the cam is 50 mm, the lift of the follower is 25 mm and the diameter of the roller is 10 mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam. Draw the cam profile and find the maximum velocity and acceleration of the follower during the outstroke. (16)

14. (a) Two spur gears of 24 teeth and 36 teeth of 8 mm module and 20° pressure angle are in mesh. Addendum of each gear is 7.5 mm. The teeth are of involute form. Determine: 1. the angle through which the pinion turns while any pair of teeth are in contact, and 2. the velocity of sliding between the teeth when the contact on the pinion is at a radius of 102 mm. The speed of the pinion is 450 r.p.m. (16)

Or

(b) An epicyclic train is shown in Fig. below. Internal gear A is keyed to the driving shaft and has 30 teeth. Compound wheel C and D of 20 and 22 teeth respectively are free to rotate on the pin fixed to the arm P which is rigidly connected to the driven shaft. Internal gear B which has 32 teeth is fixed. If the driving shaft runs at 60 r.p.m. clockwise, determine the speed of the driven shaft. What is the direction of rotation of driven shaft with reference to driving shaft? (16)



15. (a) The power transmitted between two shafts 3.5 metres apart by a cross belt drive round the two pulleys 600 mm and 300 mm in diameters, is 6 kW. The speed of the larger pulley (driver) is 220 r.p.m. The permissible load on the belt is 25 N/mm which is 5 mm thick. The coefficient of friction between the smaller pulley surface and the belt is 0.35. Determine: 1. necessary length of the belt; 2. width of the belt, and 3. necessary initial tension in the belt. (16)

Or

(b) A multiplate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surfaces are 100 mm and 50 mm respectively. The maximum axial spring force is limited to 1 kN. If the coefficient of friction is 0.35 and assuming uniform wear, find the power transmitted by the clutch at 1500 r.p.m. (16)