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Question Paper Code : 21846

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Mechanical Engineering

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

(Regulations 2008/2010)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the three conditions to obtain a four bar crank rocker mechanism?

2. Define inversion of kinematic chain.

3. Define the rubbing velocity.

4. Define coriolis component of acceleration.

5. Why sometimes the axes of translating roller followers in cam follower mechanisms are offset from the axis of cam rotating?

6. Define tangential cam.

7. State the law of gearing.

8. What is interference in involute gear and how is it prevented?

9. State the functional difference between a clutch and a brake.

10. What are the advantages of wire ropes over fabric ropes?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Sketch and explain the inversion of a 4 bar mechanism, all the four pairs are turning pairs. (10)

(ii) Sketch and explain any two types of straight line motion generating mechanism. (6)

Or

(b) (i) Explain mechanical advantage and transmission angle related to four bar mechanism. (8)

(ii) Explain the Ratchet and Escapism mechanism with neat diagram. (8)

12. (a) For the configuration of a slider crank mechanism shown in fig.12 (a)

Calculate (i) the acceleration of the slider at B (ii) the acceleration of point E (iii) the angular acceleration of link AB. Link OA rotates at 20 rad/s count er clockwise (16)

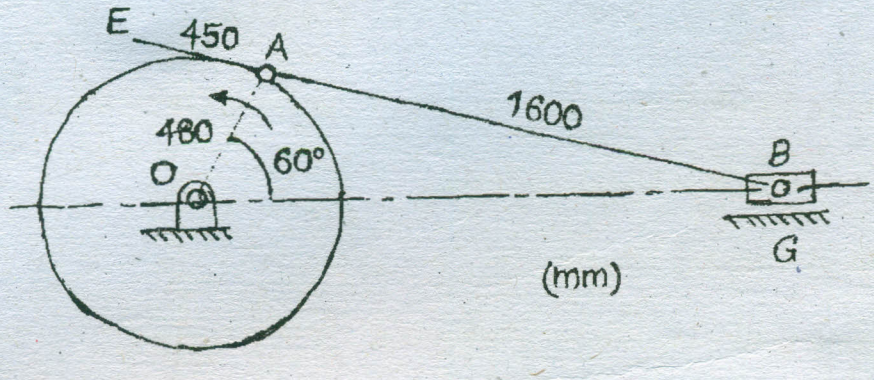

Fig. 12 (a)

Or

(b) One cylinder of a rotary engine is shown in the configuration diagram shown in Fig. 12(b) OA is the fixed crank, 200 mm long. OP is the connecting rod and is 520 mm long. The line of stroke is along AR 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 the fixed centre A.

Determine :

(i) Acceleration of piston (slider) inside the cylinder

(ii) Angular acceleration of the connecting rod. (16)

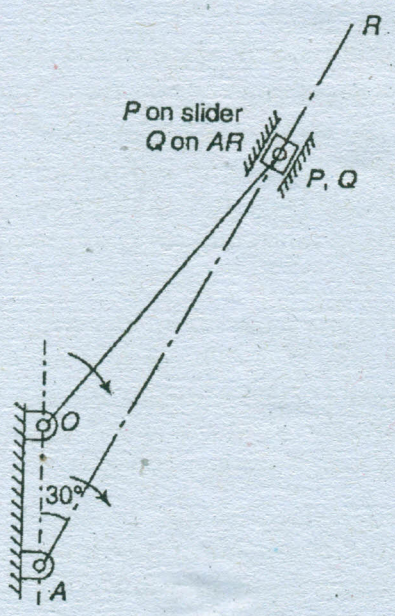

Fig. 12 (b)

13. (a) A cam with a minimum radius of 25 mm is to be designed for a knife-edge follower with the following data :

– To raise the follower through 35 mm during 60° rotation of the cam.

– Dwell for next 40° of the cam rotation.

– Descending of the follower during the next 90° of the cam rotation.

– Dwell during the rest of the cam rotation.

Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10mm from axis of rotation of the cam. (16)

Or

(b) Draw the profile of a cam operating a roller reciprocating follower and with the following data :

Minimum radius of cam = 25 mm, Lift = 30 mm, Roller diameter = 15 mm. The cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration of the follower during the descent period. (16)

14. (a) The following data relate to a pair of 20° involute gears in mesh :

Module = 6 mm, Number of teeth on pinion = 17. Number of teeth on gear = 49; Addenda on pinion and gear wheel = 1 module.

Find :

(i) The number of pairs of teeth in contact;

(ii) The angle turned through by the pinion and the gear wheel when one pair of the teeth is in contact and

(iii) The ratio of the sliding to rolling motion when the tip of a tooth on the larger wheel (1) is just making contact (2) is just leaving contact with its mating tooth and (3) is at the pitch point. (16)

Or

(b) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D, E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C, and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 rpm clockwise. (16)

15. (a) (i) The following data relate to screw jack, Pitch of the thread screw = 8 mm, Diameter of the thread screw = 40 mm, Coefficient of friction between screw and nut = 0.1, Load = 20 kN Assuming that the load rotates with the screw, determine (1) the ratio of torque required to raise and lower the load (2) the efficiency of the machine. (6)

(ii) A friction clutch is used to rotate a machine from a shaft rotating at a uniform speed of 250 rpm. The disc type clutch has both of its sides effective, the coefficient of friction being 0.3. The outer and the inner diameters of the friction plate are 200 mm and 120 mm respectively. Assuming uniform wear of the clutch, the intensity of pressure is not to be more than 100 kN/m^2. If the moment of inertia of the rotating parts of the machine is 60.5 kg-m^2, determine the time to attain the full speed by the machine and the energy lost in slipping of the clutch.

What will be the intensity of pressure, if the condition of uniform pressure of the clutch is considered? Also, determine the ratio of power transmitted with uniform wear to that with uniform pressure. (10)

Or

(b) 2.5 kW of powers is transmitted by an open-belt drive. The linear velocity, of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165° The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases;

(i) Initial tension in the belt is increased by 8%

(ii) Initial tension in the belt is decreased by 8%

(iii) Angle of lap is increased by 8% by the use of an idler pulley, for the same speed and the tension on the tight side, and

(iv) Coefficient of friction is increased by 8% by suitable dressing to the friction surface of the belt. (16)
