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Question Paper Code : 91633

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

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

Note : A–3 Drawing Sheet is to be supplied to the examination

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Differentiate between rigid and resistant bodies.

2. The ratio between the width of the front axle and that of wheel base of a steering mechanism is 0.44. At the instant when the front inner wheel is turned by 18°, what should be the angle turned by the outer front wheel for perfect steering?

3. What is the need of finding acceleration of linkage in a mechanism?

4. Name any two mechanisms having Coriolis component.

5. Write down the classification of cams according to the manner of constraint of the follower.

6. Define the term Jump speed of a cam.

7. What is meant by interference in gears? How can it be avoided?

8. Differentiate between involute profile and cycloidal profile.

9. What are the laws of solid dry friction?

10. What is meant by crowning of pulleys in flat belt drives? Also write its purpose.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Briefly explain the classifications of kinematic pairs with neat sketches. (8)

(ii) Explain the inversions of slider crank mechanism with examples. (8)

Or

(b) A Hooke's joint connects two shafts whose axes intersect at 18°. The driving shaft rotates at a uniform speed of 210 rpm. The driven shaft with attached masses has a mass of 60 kg and the radius of gyration of 120 mm. Determine the torque required at the driving shaft if a steady torque of 180 Nm resists rotation of the driven shaft and the angle of rotation is 45° and angle between the shafts at which the total fluctuation of speed of the driven shaft is limited to 18 rpm. (16)

12. (a) Fig.12 (a) shows the link mechanism of a quick-return mechanism of the slotted lever type, the various dimensions of which are OA = 400 mm, AR = 700 mm, RS = 300 mm. For the configuration shown, determine the acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates at 210 rpm. (16)

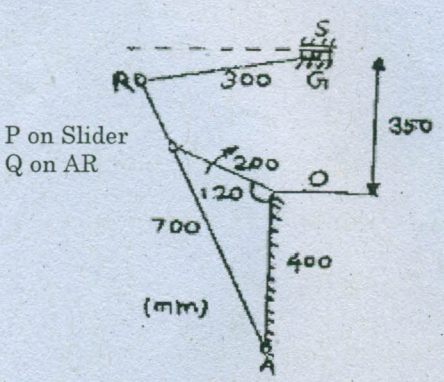

Fig. 12 (a)

Or

(b) Deduce an expression to find out the velocity and acceleration of a piston in a reciprocating machine. (16)

13. (a) Draw the profile of a cam operating a roller reciprocating follower with the following data : Minimum radius of cam = 25 mm, Lift = 30 mm and 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)

Or

(b) The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent. Minimum radius of cam = 25 mm, roller diameter = 7.5 mm, lift = 28 mm, offset of follower axis = 120 mm towards right, angle of ascent = 60°, angle of descent = 90°,angle of dwell between ascent and descent = 45° and speed of the cam = 200 rpm. Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the out stroke and the return stroke. (16)

14. (a) Two involute gears in a mesh have a module of 8 mm and a pressure angle of 20°. The larger gear has 57 while the pinion has 23 teeth. If the addenda on pinion and gear wheels are equal to one module, find the

(i) Contact ratio

(ii) Angle of action of the pinion and the gear wheel

(iii) Ratio of the sliding to rolling velocity at beginning of the contact, pitch point and end of contact. (16)

Or

(b) (i) In the epicyclic gear train shown in Fig 14 (b) (i) the compound wheels A and B as well as internal wheels C and D rotate independently about the axis O. The wheels E and F rotate on the pins fixed to the arm a. All the wheels are of the same module. The number of teeth on the wheels are $T_A = 52$, $T_B = 56$, $T_E = T_F = 36$.

Determine :

(1) The speed of C if the wheel D fixed and arm a rotates at 200 rpm clockwise.

(2) The speed of C, if the wheel D rotates at 200 rpm counter clockwise and the arm a rotates 20 rpm counter clockwise. (8)

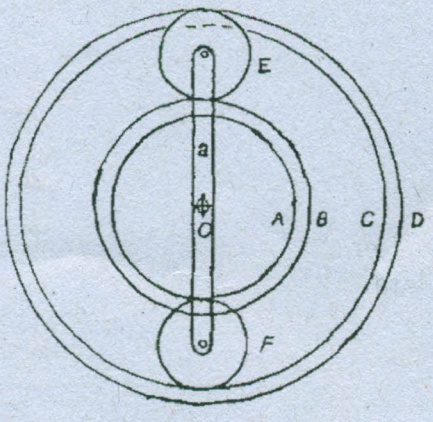

Fig. 14 (b) (i)

(ii) With a neat sketch explain the working principle of differential. (8)

15. (a) (i) In a screw jack, the diameter of the threaded screw is 40 mm and the pitch is 8 mm. The load is 20 kN and it does not rotate with the screw but is carried on a swivel head having a bearing diameter of 70 mm, The coefficient of friction between the swivel head and the spindle is 0.08 and between the screw and nut is 0.1. Determine the total torque required to raise the load and efficiency. (8)

(ii) A single plate clutch transmits 20 kWat 900 rpm. The maximum pressure intensity between plates is 85 kN/m^2. The outer diameter of the plate is 360 mm. Both the sides of the plate are effective and the coefficient of friction is 0.25. Determine the inner radius of the plate and axial force to engage the clutch. (8)

Or

(b) (i) Two parallel shafts that are 3.5 m apart are connected by a flat belt running between two pulleys of 1000 mm and 400 mm diameters, the larger pulley being the driver runs at 220 rpm. The belt weighs 1.2 kg per metre length. The maximum tension in the belt is not to exceed 1.8 kN. The Co efficient of friction is 0.28. Owing to slip on one of the pulleys, the velocity of the driven shaft is 520 rpm only. Determine the torque on each shaft, power transmitted, power lost in friction and efficiency of the belt drive. (10)

(ii) A bicycle and rider, travelling at 12 km/h on a level road, have a mass of 105 kg. A brake is applied to the rear wheel which is 80 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find the distance covered by the bicycle and number of turns on its wheel before coming to rest. (6)