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**Question Paper Code : 21559**

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Mechanical Engineering

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

(Regulation 2008/2010)

(Common to PTME 2203 – Kinematics of Machinery for B.E. (Part-Time) Third  
Semester Mechanical Engineering – Regulation 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by Kinematic Pair?
2. State the difference between mechanism and structure.
3. Write about rubbing velocity.
4. Write down the expression for finding the number of instantaneous centres in a mechanism.
5. What are the major types of cams?
6. Define Angle of dwell.
7. List down the common forms of teeth.
8. What is the condition stated by the law of gearing?
9. List down the laws of friction.
10. Distinguish between open and cross belt drive in terms of its application.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the inversions of Four bar chain with examples.

Or

- (b) Sketch and explain the following:

(i) Elliptical trammel (8)

(ii) Scotch yoke mechanism. (8)

12. (a) The following data refer to the dimensions of the links of a four-bar mechanism:  $AB = 50 \text{ mm}$ ;  $BC = 66 \text{ mm}$ ;  $CD = 56 \text{ mm}$  and  $AD$  (fixed link) =  $100 \text{ mm}$ . At the instant when  $\angle DAB = 60^\circ$ , the link  $AB$  has an angular velocity of  $10.5 \text{ rad/s}$  in the counter clockwise direction. Determine the velocity of point  $C$ , velocity of point  $E$  on the link  $BC$  while  $BE = 40 \text{ mm}$  and the angular velocities of the links  $BC$  and  $CD$ . Also sketch the mechanism and indicate the data.

Or

- (b) A single slider-crank mechanism is shown in Fig. 12 b. Determine the acceleration at  $B$  &  $E$  and the angular acceleration of the link  $AB$ . The crank rotates at  $20 \text{ rad/s}$  counter-clockwise.

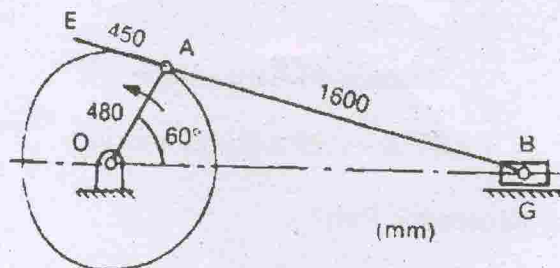


Fig. 12 (b)

13. (a) A cam with a minimum radius of  $25 \text{ mm}$ , rotating clockwise at uniform speed of  $300 \text{ rpm}$  is to be designed to give motion to a flat faced mushroom follower as detailed below:

(i) To raise through a distance of  $25 \text{ mm}$  in  $120^\circ$  rotation of the cam

(ii) To remain at rest for the next  $30^\circ$

(iii) To lower during further  $120^\circ$  rotation of the cam

(iv) To remain in the same position during rest of the revolution.

The raising of the follower takes place with cycloidal motion and the lowering with uniform acceleration and retardation. However, the uniform acceleration is  $2/3$ rd of the uniform retardation. Draw the displacement diagram and profile of the cam.

Or

- (b) A circular cam operating a flat faced follower has a least diameter of 40 mm. The lift is 12mm and angle of action is  $160^\circ$ . The Speed of rotation is 500 rpm. If the period of acceleration of the follower is 60% of the retardation during the lift, determine the following:

- (i) The principal dimensions of the cam
- (ii) The acceleration at the main points.

Also determine the maximum acceleration and deceleration during the lift.

14. (a) With the help of a neatly drawn sketch of a spur gear, explain elaborately the nomenclature of gears.

Or

- (b) An epicyclic gear train is shown in Fig. 14(b). The input S has 24 teeth. Gears P and C constitute a compound planet having 30 and 18 teeth respectively. If all the gears are of the same pitch, find the speed ratio of the gear train assuming A to be fixed.

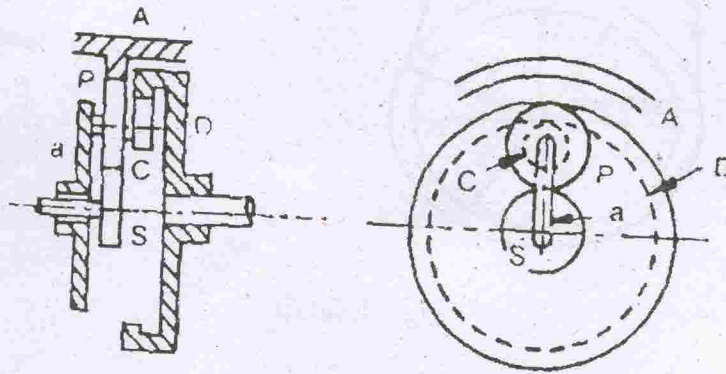


Fig. 14 (b)

15. (a) (i) A friction clutch of multi-plate type is meant for transmitting a power of 55 kW at 1800 rpm. Coefficient of friction for the friction surfaces is 0.1. Axial intensity of pressure is not to exceed  $160 \text{ kN/m}^2$ . The internal radius is 80 mm and is 0.7 times the external radius. Determine the number of plates needed to transmit the required torque. (10)
- (ii) A vertical shaft of 100 mm diameter rotating at 150 rpm, rests on a flat end foot step bearing. The coefficient of friction is equal to 0.05 and shaft carries a vertical load of 15 kN. Find the power lost in friction assuming the following conditions:

- (1) Uniform pressure (3)
- (2) Uniform wear. (3)

Or

- (b) (i) Find the power transmitted by a belt running over a pulley 700 mm diameter at 300 rpm,  $\mu = 0.3$  and angle of lap  $160^\circ$  and maximum tension in the belt is 2.453kN. (6)
- (ii) A simple brake as shown in Fig 15 (b) (ii) is used on a shaft carrying a flywheel of mass 450 Kg. The radius of gyration of the flywheel is 500 mm. and runs at 320 rpm. The coefficient of friction is 0.2 and the diameter of brake drum is 250 mm, Determine the following:
- (1) Torque applied due to a hand load of 150 N (4)
  - (2) The number of turns of the wheel before it is brought to rest. (4)
  - (3) The time required to bring it to rest from the moment of application of the brake. (2)

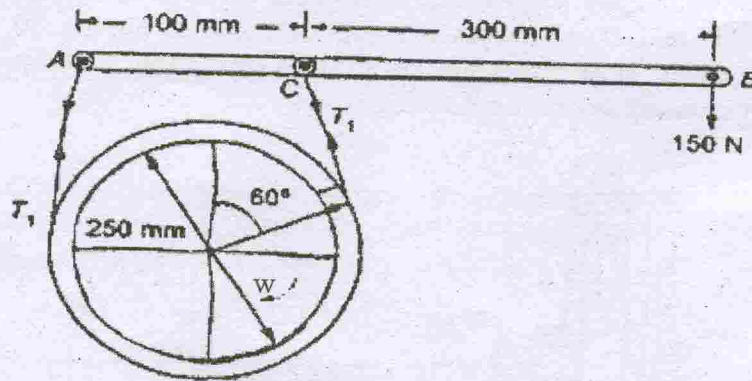


Fig. 15 (b) (ii)