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Question Paper Code : 40918

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Third/Fourth Semester

Mechanical Engineering

ME 8492 — KINEMATICS OF MACHINERY

(Common to : Mechanical Engineering (Sandwich)/Mechatronics Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between a machine and mechanism.
2. State the condition of Kutzbach criterion to plane mechanism.
3. When does coriolis component of acceleration occur?
4. Write the equation to determine the number of instantaneous centres of a mechanism.
5. Define pressure angle of cams and its best value.
6. Write some applications of cams.
7. State the advantage of involute gear tooth profile.
8. What do you mean by Herringbone gears?
9. What is the effect of centrifugal tension in belt drives?
10. List out the conditions for self locking in screws.

PART B — (5 × 13 = 65 marks)

11. (a) Sketch and explain any three kinematic inversion of a single slider crank chain.

Or

- (b) Describe the working of two different types of quick return mechanism. Derive an expression for the ratio of time taken in forward and return stroke for one of these mechanisms.

12. (a) In a four – bar mechanism ABCD, the link lengths are PQ = 6.5 mm; QR = 175 mm; RS = 11.5 mm; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.

Or

- (b) Derive expressions for angular velocity and angular acceleration for a single slider crank chain mechanism.

13. (a) The following data are for a disc cam mechanism with roller follower. Minimum radius of the cam = 35 mm; Lift of the follower = 40 mm; offset the follower = 10 mm right Roller diameter = 15 mm.

Cam rotation angles are as mentioned below: During ascent = 120°, Dwell = 80°, during descent = 80°, dwell = 80°. Cam rotates in clockwise direction and the follower motion is simple harmonic during ascent and descent. Draw the profile of cam.

Or

- (b) (i) Sketch a cam – roller follower arrangement indicating important cam terminologies and explain them in detail. (6)

- (ii) Sketch and briefly compare the displacement, velocity and acceleration diagrams for uniform velocity, uniform acceleration and retardation, simple harmonic motion, used in cam mechanism. (7)

14. (a) State and prove the fundamental law of gearing. Determine the minimum number of teeth to avoid interference in worst case of meshing with 14 1/2° pressure angle.

Or

- (b) Derive the equation to determine the length of path of contact between two spur gears of different size.

15. (a) Select a wire rope for a vertical mine hoist to lift a load of 20 kN from a depth of 500 m. A rope speed of 3 m/s is to be attained in 10 seconds.

Or

- (b) A car engine has its rated output of 12 kW. The maximum torque developed is 100 Nm. The clutch used is of single plate type having two active surfaces. The axial pressure is not to exceed 85 kN/m². The external diameter of the friction plate is 1.25 times the internal diameter. Determine the dimensions of the friction plate and the axial force exerted by the springs, coefficient of friction = 0.3.

PART C — (1 × 15 = 15 marks)

16. (a) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 50 rpm. The angle embraced is 165° and the coefficient of friction (μ) between the belt and the pulley is 0.3. If safe working stress for the leather belt is 10 mm, determine the width of the belt taking centrifugal tension into account.

Or

- (b) A pair of involute spur gears with 16° pressure angles and pitch of module 6 mm is in mesh. The number of teeth in pinion is 16 and its rotational speed is 240 rpm. The gear ratio is 1.75. In order to avoid the interference, determine
- (i) Addenda on pinion and wheel. (5)
 - (ii) Length of path of contact. (5)
 - (iii) Maximum velocity of sliding on the either side of pitch point. (5)

