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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011
MECHANICAL ENGINEERING BRANCH
FOURTH SEMESTER – (REGULATION 2004)

ME 281 – KINEMATICS OF MACHINES

Time : 3 hr.

Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

- 1 What is the significance of degrees of freedom of a kinematic chain when it functions as a mechanism? Give examples.
- 2 Define Inversion of Mechanism.
- 3 What are the types of instantaneous Centres?
- 4 Define Transmission Angle and Mechanical Advantage.
- 5 Where are the roller follower extensively used?
- 6 What are the different motions of the follower?
- 7 Explain the terms module and pressure angle with regard to gears.
- 8 State methods to find the velocity ratio of epicyclic gear train.
- 9 Why self locking screws have lesser efficiency?
- 10 Explain the phenomena of slip and creep in a belt drive.

PART B (5 x 16 = 80 Marks)

- 11 Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms.

(16)

- 12a (i) Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions ? (8)
- (ii) What is the difference between ideal mechanical advantage and actual mechanical advantage? (8)

[OR]

- 12b In a pin jointed four bar mechanism ABCD, the lengths of various links are as follows: $AB = 25 \text{ mm}$; $BC = 87.5 \text{ mm}$; $CD = 50 \text{ mm}$ and $AD = 80 \text{ mm}$. The link AD is fixed and the angle $BAD = 135^\circ$. If the velocity of B is 1.8 m/s in the clockwise direction, find 1. velocity and acceleration of the mid point of BC, and 2. angular velocity and angular acceleration of link CB and CD. (16)

- 13a A cam drives a flat reciprocating follower in the following manner :
During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm . Draw the profile of the cam. (16)

[OR]

- 13b Draw the profile of disc cam to give uniform acceleration and retardation out stroke of 25 mm to a knife edge follower during first half of revolution. Return of cam also takes place with uniform motion during remaining half of cam revolution. Assume minimum radius of cam as 25 mm . (16)

- 14a Two mating involute spur gear of 20° pressure angle have a gear ratio of 2. The number of teeth on the pinion is 20 and its speed is 250 r.p.m. The module pitch of the teeth is 12 mm. If the addendum on each wheel is such that the path of approach and the path of recess on each side are half the maximum possible length, find : 1. the addendum for pinion and gear wheel ; 2. the length of the arc of contact ; and 3. the maximum velocity of sliding during approach and recess. Assume pinion to be the driver. (16)

[OR]

- 14b (i) Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ? (6)
- (ii) How the velocity ratio of epicyclic gear train is obtained by tabular method? (6)
- (iii) What are the various types of the torques in an epicyclic gear train ? (4)

- 15a A square threaded bolt of root diameter 22.5 mm and pitch 5 mm is tightened by screwing a nut whose mean diameter of bearing surface is 50 mm. If the coefficient of friction between nut and bolt is 0.1 and nut and bearing surface is 0.16, determine the force required at the end of spanner 500 mm long when the load on the bolt is 10 kN. (16)

[OR]

- 15b (i) Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 rpm. The diameter of the driving pulley is 300 mm. The driven pulley runs at 300 rpm and the distance between the centers of two pulleys is 3 m. The density of the leather can be taken as 1000 kg/mm^3 . Take $\mu = 0.3$ and maximum allowable shear in the leather = 2.5 MPa and the drive is open type. (8)

- (ii) A band brake acts on the $\frac{3}{4}$ th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is 0.25, find the (8) operating force when the drum rotates in anticlockwise direction.