CBCS SCHEME

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15ME42

Fourth Semester B.E. Degree Examination, June/July 2019
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define: i) Kinematic chain ii) Mechanism iii) Machine iv) Degree of freedom **(08 Marks)**

b. Sketch and explain crank and slotted lever mechanism. **(08 Marks)**

OR

2 a. Explain Peaucelliers' exact straight line mechanism with a line diagram. **(06 Marks)**

b. Derive the expression for necessary condition of correct steering. Explain with a neat sketch, the Ackerman steering gear mechanism. **(10 Marks)**

Module-2

3 A four bar mechanism ABCD is made up of four links, pin jointed at the ends. AD is a fixed link which is 180 mm long. the links AB, BC and CD are 90 mm, 120 mm and 120 mm long respectively. At certain instant, the link AB makes an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 100 rpm clockwise, determine, (i) Angular velocity of the links BC and CD, (ii) Angular acceleration of the links CD and CB. Solve by relative method. **(16 Marks)**

OR

4 a. State and prove Kennedy's theorem. **(06 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction to the following specifications of a single slider crank mechanism.
Stroke = 300 mm
Ratio of length of connecting rod to crank length = 4
Speed of the engine = 300 rpm
Position of crank = 45° with inner dead center. **(10 Marks)**

Module-3

5 a. State loop-closure equation and explain in brief. **(04 Marks)**

b. In a reciprocating engine, the length of the crank is 250 mm and length of connecting rod is 1000 mm. The crank rotates at a uniform speed of 300 rpm clockwise. Crank is at 30° from inner dead center. Determine:
i) Velocity of piston and angular velocity of connecting rod
ii) Acceleration of piston and angular acceleration of connecting rod by complex algebra method from first principle. **(12 Marks)**

OR

6 a. Derive the Freudenstein's equation for four bar mechanism. **(10 Marks)**

b. Explain function generation in four bar mechanism. **(06 Marks)**

Module-4

7 a. Derive an expression for path of contact for two meshing spur gears having involute profile. **(08 Marks)**

b. A pair of spur gears has 16 teeth and 18 teeth, a module 12.5mm, an addendum 12.5 mm and a pressure angle 14.5 degrees. Prove that the gears have interference. Determine the minimum number of teeth and the velocity ratio to avoid the interference. **(08 Marks)**

OR

8 An epicyclic gear train as shown in Fig.Q8 consists of a sunwheel(S), a stationary internal gear (E) and three identical planet wheels (P) carried on a star shaped planet carrier(C). The size of different toothed wheels are such that the planet carrier C rotates at $\left(\frac{1}{5}\right)$ of the speed of the sun wheel. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine:

i) Number of teeth on different wheels of train

ii) Torque necessary to keep the internal gear stationary.

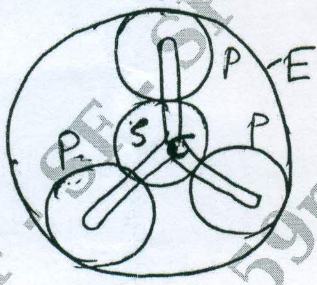

Fig.Q.8 **(16 Marks)**

Module-5

9 A roller follower is raised through a distance of 35 mm in 120° rotation of the cam, remains at rest for the next 30° and is lowered during further 120° rotation of cam, The raising of the follower takes place with cycloidal motion and the lowering with uniform acceleration retardation motion. However the uniform acceleration period is 2/3 of the uniform retardation period. The least radius of the cam is 25 mm and the roller radius is 10 mm. Draw the cam profile. Also determine the maximum velocity and acceleration during rise and return. Speed of the cam is 200 rpm and rotates in clockwise direction. **(16 Marks)**

OR

10 A symmetrical circular arc cam operating a flat faced follower has the following particulars. Least radius of the cam is 30 mm, lift is 20 mm, angle of lift is 75°, nose radius is 5 mm, speed is 600 rpm; find:

i) The principal dimensions of the cam

ii) The acceleration of the follower at the beginning of lift, at the end of contact with the circular flank, at the beginning of contact with nose and at the apex of nose. **(16 Marks)**

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