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10ME/AU44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020

Kinematics of Machines

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.

PART - A

- 1 a. Define the following : i) Kinematic chain ii) Structure iii) Machine iv) Mechanism v) Inversions. (10 Marks)
b. With a neat sketch, explain the working of an elliptical trammel. Prove that it traces an ellipse. (10 Marks)
- 2 a. With neat sketches, explain any two inversions of single slider crank chain. (06 Marks)
b. Explain with a neat sketch, Geneva Wheel Mechanism. (06 Marks)
c. Explain with a neat sketch, the working of Pantograph Mechanism. State its applications. (08 Marks)
- 3 The crank and connecting rod of a theoretical steam engine are 0.5m and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the IDC position, determine the following :
a. Velocity of piston.
b. Angular velocity of connecting rod.
c. Velocities of rubbing at the pins of the crank shaft , crank and cross head when the diameters of their pins are 50mm, 60mm and 30mm respectively.
d. Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. (20 Marks)
- 4 a. Derive analytical expression for velocity and acceleration of the piston in a reciprocating Engine Mechanism. (08 Marks)
b. The crank and connecting rod of a reciprocating engine are 200mm and 700mm respectively. The crank is rotating in clockwise direction at 120 rad/sec. Find by Klein's construction i) Velocity and acceleration of the piston ii) Velocity and acceleration of the midpoint of the connecting rod iii) Angular velocity and angular acceleration of the connecting rod at the instant when the crank is at 30° to IDC. (12 Marks)

PART - B

- 5 An internal combustion engine has a crank of 150mm length and a connecting rod of 600mm length. The crank rotates at a constant speed of 300 rpm counter clockwise. Determine the position velocity and acceleration of the slider when the crank angle is 45° from then inner dead center position by complex algebra. (20 Marks)
- 6 a. Derive the expression for length of path of contact, length of arc of contact and contact ratio for a pair of involute gears in contact. (10 Marks)
b. Two wheels have 24 and 30 teeth and standard addendum equal to one module. Pressure angle = 20° . Find the length of path of contact and length of arc of contact in terms of circular pitch. (10 Marks)

- 7 a. Sketch and explain different types of gear trains. (08 Marks)
- b. An epicyclic gear train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through an idler wheel C. D being concentric with A. The wheels B and C are carried on an arm which revolves clockwise at 100 rpm about the axis of A and D. If the wheels B and D have 25 teeth and 40 teeth respectively. Find the number of teeth on C and the speed and sense of rotation of C. (12 Marks)
- 8 A cam is to be designed for a knife edge follower for the following data :
Cam lift = 40mm during 120° of cam rotation with UARM. However the acceleration being Double the retardation, Dwell for the next 30° . During the next 150° of cam rotation the follower returns through its original position with cycloidal motion. Dwell during the remaining 60° . The radius of the base circle of the cam is 50mm. Draw the profile of the cam when the line stroke is offset 20mm from the axis of the cam shaft to the right. The cam rotates in clockwise direction. (20 Marks)

- 4 FEB 2020