

CBCS SCHEME

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17ME42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021

Kinematics of Machinery

Time: 3 hrs.

Max. Marks: 100

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

Module-1

- 1 a. Define the following terms : i) Inversion ii) Degree of freedom
iii) Structure iv) Mechanism. (04 Marks)
- b. Explain with neat sketch, Beam Engine and Whit worth quick return mechanism. (10 Marks)
- c. Find the degrees of freedom (F) for the given diagram. (06 Marks)

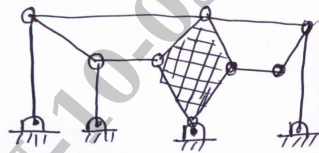


Fig. Q1(c)(i)

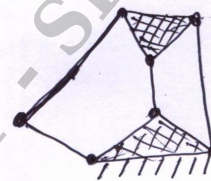


Fig. Q1(c)(ii)

OR

- 2 a. Derive the expression for the condition of correct steering. (05 Marks)
- b. Explain with sketch Pantograph Mechanism and Geneva Wheel Mechanism. (10 Marks)
- c. With a neat sketch, explain Peaucellier Straight line mechanism. (05 Marks)

Module-2

- 3 a. Define the following :
i) Linear and Angular velocity ii) Linear and Angular Acceleration. (04 Marks)
- b. A four bar mechanism ABCD is pin jointed at ends and the link AD is fixed of length 600mm. The links AB BC and CD are 300mm, 360mm and 360mm respectively. At certain instant the link AB makes an angle of 60° with link AD. If the link AB rotates at an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec^2 both clockwise. Determine angular velocity and angular acceleration of links BC and CD by graphical methods. (16 Marks)

OR

- 4 a. What is Instantaneous centre of rotation of a body? Discuss different types of instantaneous centres. (04 Marks)
- b. Explain Klein's construction for slider crank mechanism. (08 Marks)
- c. In a slider crank mechanism the crank $OA = 300\text{mm}$ and connecting rod $AB = 1200\text{mm}$. The crank OA is turned 30° from I.D.C. Locate all instantaneous centre if the crank rotates at 15 rad/sec clockwise, find i) Velocity of slider B ii) Angular velocity of connecting rod AB. (08 Marks)

Module-3

- 5 Using Complex Algebra derive expression for Velocity, Angular velocity, Acceleration and Angular acceleration of Coupler link and output link of a four bar mechanism. (20 Marks)

OR

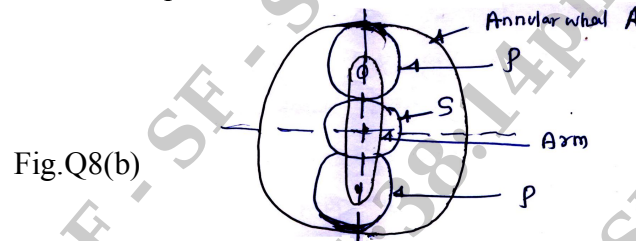
- 6 a. Derive Freudenstein's equation for slider crank mechanism. (08 Marks)
 b. In a reciprocating engine length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at a uniform speed of 300 rpm CW. Crank is at 30° from I.D.C. Determine
 i) Velocity of piston and angular velocity of connecting rod.
 ii) Acceleration of piston and angular acceleration of connecting rod by Complex Algebra method from first principle. (12 Marks)

Module-4

- 7 a. State and prove that the Law of Gear tooth action for constant velocity ratio. (08 Marks)
 b. The following are particulars of pair of spur gears. Number of teeth on pinion = 19 , Number of teeth on gear = 47 , Pressure angle = 20° , Module = 6.5mm , Addendum = 6.5mm, determine i) Number of pairs of teeth of contact.
 ii) Angle turned through by pinion and gear when one pair of teeth is in contact.
 iii) Ratio of velocity of sliding to rolling velocity at the instant the engagements begins, the engagement terminates and at pitch point. (12 Marks)

OR

- 8 a. Sketch and explain i) Reverted gear train ii) Epicyclic gear train. (06 Marks)
 b. An Epicyclic gear train as shown in fig. Q8(b) below, has a sunwheel S of 30 teeth and two planet wheels P of 50 teeth. The planet wheels mesh with the internal teeth of a fixed annulus A. The driving shaft carrying the sunwheel transmits 4 KW at 300 rpm. The driven shaft is connected to an arm which carries the planet wheels. Determine the speed of the driven shaft and the torque transmitted if the overall efficiency is 95%.



(14 Marks)

Module-5

- 9 Draw to a full size, the profile of the cam which will give a lift of 38mm to a follower carrying a roller of 25mm diameter. The axis of follower is off-set by 18mm to the right of the axis of the cam. Ascent of follower takes place with SHM in 0.05sec followed by a period of rest 0.0125 sec. The follower by thin descent with VARM during 0.125 sec, the acceleration being $3/5$ times retardation. The cam rotates in clockwise direction at a constant speed of 240 rpm and the base circle radius is 50mm. (20 Marks)

OR

- 10 a. Explain the following : i) Disc cam with Translating follower ii) Wedge cam with translating follower iii) Cylindrical cam with oscillating follower. (06 Marks)
 b. In a four stroke petrol engine the crank angle is 4° after I.D.C when the suction valve opens and 50° after B.D.C when the suction valve closes. The lift is 10 mm the nose radius is 2.5mm and the least radius of cam is 20mm. The shaft rotates at 600 rpm. The cam is of circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity , maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertial of moving parts weighing 250gm. (14 Marks)

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