INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Four Year B.Tech V Semester End Examinations(Regular) - November, 2019

Regulation: IARE – R16

MECHANISM AND MACHINE DESIGN

Time: 3 Hours (AE) **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Discuss crank and slotted lever quick return motion mechanism. **[7M]**

   (b) Explain about completely, successfully and incompletely constrained motions of kinematics pairs with examples. **[7M]**

2. (a) Explain different kinds of kinematic pairs by giving example for each one of them. **[7M]**

   (b) Describe the various inversions of a single slider crank chain with neat diagrams. **[7M]**

UNIT – II

3. (a) Explain Klien's construction for determining velocity and acceleration of slider crank mechanism. **[7M]**

   (b) The dimensions of the various links of a mechanism, are as follows: OA=300 mm; AB=1200; BC=450 mm and CO=450 mm. If the crank OA rotates at 20 r.p.m. in the anticlockwise direction and gives motion to the mechanism, find, for given configuration
   i) Velocity of A and B
   ii) Angular velocity of AB
   iii) Linear acceleration of B. **[7M]**

4. (a) Obtain the expressions for velocity and acceleration of piston in reciprocating steam engine mechanism with neat sketch. **[7M]**

   (b) Figure 1 shows a slider moving outwards on a rod with a velocity of 4 m/s when its distance from the point O is 1.5 m. At this instant, the velocity of the slider is increasing at a rate of 10 m/s^2. The rod has an angular velocity 6 rad/s counter-clockwise about O and an angular acceleration of 20 rad/s^2 clockwise. Determine the absolute acceleration of the slider. **[7M]**
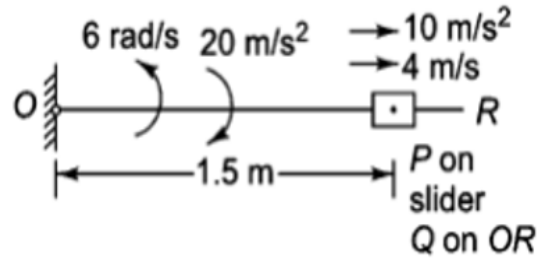
Figure 1

UNIT – III

5. (a) Find the velocity of a point on a link by instantaneous center method. **[7M]**

   (b) In a Davi's steering gear, the distance between the pivots of the front axle is 1 meter and the wheel base is 2.5 meters. Find the inclination of the track arm to the longitudinal axis of the car when it is moving along a straight path? **[7M]**

6. (a) Explain the effect of gyroscopic in all possible cases of an aeroplane taking a turn. **[7M]**

   (b) Locate all the instantaneous centres of the slider crank mechanism as shown in Figure 2. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find

   i) Velocity of the slider A

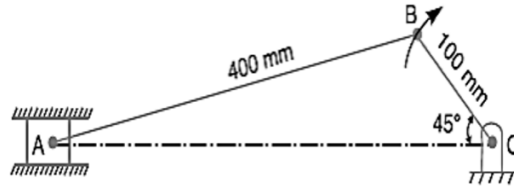   ii) Angular velocity of the connecting rod AB. **[7M]**

Figure 2

UNIT – IV

7. (a) Obtain the expression for velocity and acceleration during out stroke and return stroke of the follower. Draw displacement, velocity and acceleration diagrams when the follower moves with simple harmonic motion. **[7M]**

   (b) A cam operating a knife edge follower has the following data: Follower moves outward through 40 mm during 600 of cam rotation with uniform velocity, follower dwells for the next 450, follower returns to its original position during next 900 with uniform velocity and dwells for the remaining period. Draw the cam profile.

   [7M]

8. (a) Why we prefer roller follower over knife edge followers for high speed machines? **[7M]**

   (b) The total mass of a four-wheeled trolley car is 1950 kg. The car runs on rails of 1.6 m gauge and rounds a curve of 35 m radius at 29 km/h. The tack is banked at 13°. The external diameter of the wheels is 750 mm and each pair with axle has a mass of 190 kg with a radius of gyration of 320 mm. the height of the center of mass of the car above the wheelbase is 850 mm. Determine the pressure on each rail allowing for centrifugal force and gyroscopic couple actions. **[7M]**

UNIT – V

9. (a) Discuss condition for constant velocity ratio of toothed wheels. **[7M]**

    (b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. **[7M]**

10. (a) Discuss graphical synthesis of four bar mechanism **[7M]**

    (b) In an epicyclic gear train as shown in Figure 3, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B ? **[7M]**
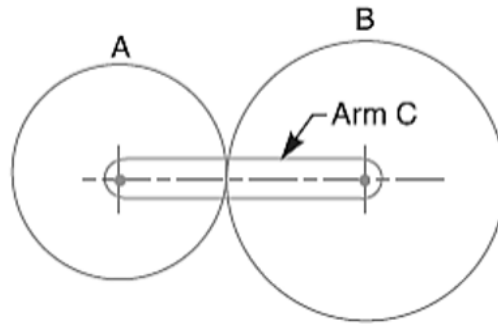

Figure 3