R16

Code No: 133BB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, December - 2019
KINEMATICS OF MACHINERY
(Common to ME, MSNT)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
***Illustrate your answers with NEAT sketches wherever necessary*.**

PART- A

(25 Marks)

1.a) Define Grubler's criterion for a mechanism. [2]
b) What is the difference between Kinematic link and Kinematic pair? [3]
c) What is '*Velocity image*' of a kinematic link? [2]
d) Define 'Coriolis' component of acceleration. [3]
e) What is the main advantage of the Hart mechanism over the Peaucellier mechanism and what is its limitation? [2]
f) What are the limitations of a single Hooke's joint ? How are these limitations overcome in a double Hooke's joint? [3]
g) What is the difference between radial cams and cylindrical cams? [2]
h) What are the merits and demerits of cams with special profiles? [3]
i) What are 'Idler gears'? When are they used? [2]
j) Define the terms**:** Path of Contact, Arc of Recess, Pressure angle. [3]

PART-B

(50 Marks)

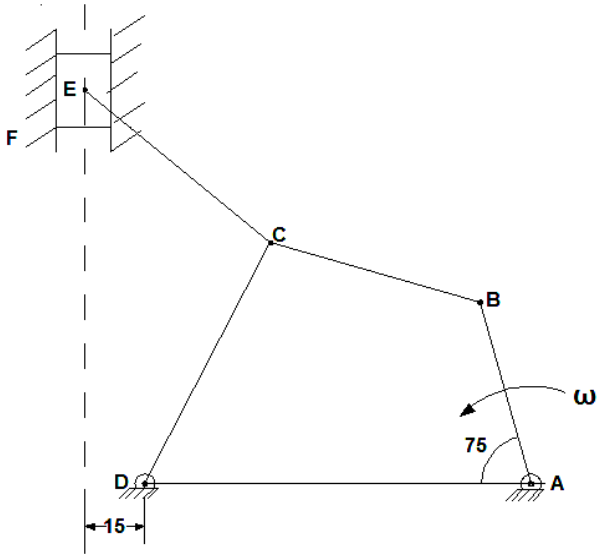
2.a) Sketch and explain the working of *Scotch Yoke Mechanism*. How can it be used to convert rotary motion into reciprocating motion?
b) In a crank and slotted lever mechanism, the distance between the fixed centers is 250 mm and the driving crank length is 100 mm. Find the inclination of the slotted bar with the vertical in the extreme position. [5+5]

OR

3.a) Distinguish between the crank and lever mechanism and coupled wheels mechanism of locomotive as inversions of a four bar chain mechanism.
b) Two parallel shafts are connected by an Oldham coupling. The distance between the shafts is 35 mm. The speed of the driving shaft is 600 rpm. What is the maximum speed of sliding of the tongue of the intermediate piece in the slot in the flange? [5+5]

4.a) Draw and explain the Klein's construction for the velocity diagram of a Reciprocating Engine Mechanism? With this construction, how do you find the velocities of the piston and connecting rod in terms of the uniform angular velocity of the crank?
b) In a four bar chain ABCD, AD is fixed and 15 cm long. The crank AB is 4 cm long, and rotates at 120 rpm clockwise, while the link CD (which is 8 cm long) oscillates about D. Links BC and AD are of equal length. Find the angular velocity of CD by instantaneous centre method. Angle BAD = 60^0. [5+5]

5. In the mechanism shown in Figure below, the dimensions of various links (in mm)are: AB = 30; BC = 45; CD = 40; AD = 65; CE = 40; ∠ DAB = 75^0;
The crank AB rotates at 600 rpm counter-clockwise. Determine the velocity and acceleration of the slider. (*The dimensions in the figure are in* ***mm***). [10]



6.a) Draw a neat sketch of the *Grass-hopper mechanism* and explain its working.

b) A car with a wheel track of 147.2 cm and wheel base of 274 cm is fitted with an Ackerman's steering mechanism. The distance between the axis of the pivot pins is 122 cm and the tie–rod is 110.6 cm long. The track arm is 15.25 cm long. Find the turning circle radius of the car, so that true rolling motion is there for all the wheels. [5+5]

OR

7.a) A circle, with AD as diameter, has a point B on its circumference. There is a point C on AB produced such that if B turns about A, the product AB × AC remains constant. Prove that the point C moves in a straight line perpendicular to AB produced.

b) A Hooke's joint is used to connect two shafts, which are having 160 degrees as included angle. The driving shaft rotates uniformly at 1400rpm. Find the maximum acceleration of driven shaft and max torque required if the driven shaft carries a fly wheel of mass 12 kg and 80 mm of radius of gyration. [5+5]

8.a) The follower of a tangent cam is operated through a roller of 50 mm diameter and its line of stroke intersects the axis of the cam. Minimum radius of the cam is 40 mm, nose radius is 12 mm, and the lift is 25 mm. If the speed of rotation of the cam is 800 rpm, find the velocity and acceleration of the follower at the instant when the cam is 25^0 from the full – lift position.

b) Draw the Displacement diagram for Uniform and ***unequal*** acceleration and retardation motion of a Follower, *e.g.*, the acceleration being twice the retardation. Assume the necessary data. [5+5]

OR

9. A cam rotating in clockwise direction at a uniform speed of 1000 rpm is required to give a roller follower the motion defined below**:**
a) Follower moves outwards through 50 mm during 120^0 of cam rotation.
b) Follower dwells for next 60^0 of cam rotation
c) Follower returns to its original position during next 90^0 of cam rotation
d) Follower dwells for rest of cam rotation
The minimum radius of the cam is 50 mm and the diameter of roller is 10 mm. The line of stroke of follower is off-set by 20 mm from the axis of the cam shaft. If the displacement of the follower is to take place with SHM on both the strokes, draw the profile of the cam. Also determine the maximum velocity and acceleration during the outwards and return strokes. [10]

10.a) Explain with a neat sketch the "Differential Gear Box".
b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of gear is involute with 20^0 pressure angle, 12 mm module and 10 mm addendum. Find the contact ratio.
[5+5]

OR

11. In a reverted epicycle;ic gear train, the arm A carries two gears B and C, and a compound gear D – E. The gear B meshes with gear E, and the gear C meshes with gear D. The number of teeth on gears B, C, and D are 75, 30, and 90 respectively. Find the speed and direction of gear C when the gear B is fixed and the arm A makes 100 rpm clockwise.
[5+5]

---oo0oo---