

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B. Tech. Summer 2018 - 19 Examination

Semester: 3

Subject Code: 03109204

Subject Name: Kinematics of Machines

Date: 31/05/2019

Time: 02:00 pm to 04:30 pm

Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions - (Each of one mark) All questions are compulsory **(15)**

1. Lead screw of a lathe with nut form which type of kinematic pair?
 - a Lead screw and nut
 - b Revolute pair
 - c Prismatic pair
 - d Revolute pair
2. An imaginary circle which by pure rolling action, gives the same motion as actual gear, is called?
 - a Pitch circle
 - b Addendum circle
 - c Base circle
 - d None of these
3. When the axes of first and last gear are co-axial, then the gear train is known as?
 - a Parallel shaft gear train
 - b Compound gear train
 - c Planetary gear train
 - d None of these
4. The angle between the direction of the follower motion and a normal to the pitch curve is called?
 - a Pressure angle
 - b Follower angle
 - c Pitch angle
 - d None of these
5. The component of acceleration, parallel to the velocity of the particle, at the given instant is called?
 - a Tangential acceleration
 - b Normal acceleration
 - c Coriolis acceleration
 - d None of these
6. Which of the following is an inversion of a slider crank chain?
 - a Beam Engine
 - b Watt's indicator
 - c Elliptical Trammel
 - d Withworth Quick Return Mechanism
7. The total number of instantaneous centers for a mechanism consisting of n links are :
 - a $n/2$
 - b n
 - c $(n-1)/2$
 - d $n(n-1)/2$
8. Coriolis component of acceleration is taken into account for :
 - a Slider crank mechanism
 - b four bar mechanism
 - c quick return mechanism
 - d none of these
9. The Synthesis of mechanism deals with :
 - a The determination of input and output angles of a mechanism
 - b The determination of dimensions of the links of a mechanism
 - c The determination of displacement, velocity and acceleration of the links in a mechanism
 - d none of these
10. The driving and driven shafts connected by a Hooke's joint will have equal speeds if:

θ = Angle through which the driving shaft turns, and
 α = Angle of inclination of the driving and driven shafts.

 - a $\cos\theta = \sin\alpha$
 - b $\sin\theta = \pm\sqrt{\tan\alpha}$
 - c $\tan\theta = \pm\sqrt{\cos\alpha}$
 - d $\cot\theta = \cos\alpha$
11. The Grubler's criterion for determining the degree of freedom (n) of a mechanism having a plane motion is: (where L = Number of links); and j = Number of binary joints).
 - a $L(n-1)-j$
 - b $2(L-1)-2j$
 - c $3(L-1)-2j$
 - d $4(L-1)-3j$
12. According to Aronhold Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a :
 - a straight line
 - b parabolic curve
 - c ellipse
 - d none of these
13. Mitre gears are used for:
 - a great speed reduction
 - b equal speed
 - c minimum axial thrust
 - d minimum backlash
14. A differential gear in automobiles is used to :
 - a reduce speed
 - b assist in changing speed
 - c provide jerk free movement
 - d help in turning
15. In a four bar chain or quadric cycle chain :
 - a each of the four pairs is a turning pair
 - b one is a turning pair and three are sliding pairs
 - c three are turning and one is sliding
 - d each of the pair is a sliding pair

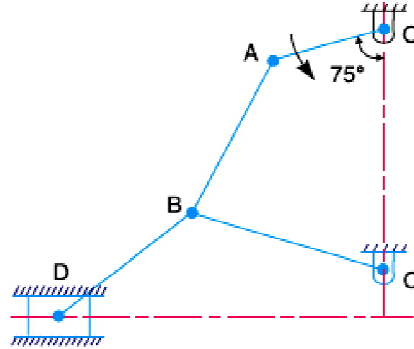
(15)

Q.2 Answer the following questions. (Attempt any three)

- A) Classify kinematic pairs according to the type of relative motion between the elements.
- B) Classify Followers according to the surface in contact.
- C) Sketch an intermittent motion mechanism and explain its practical application.
- D) State and prove law of gearing.

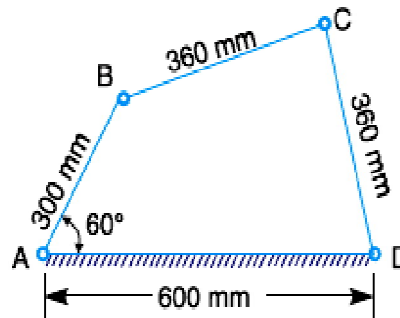
Q.3 A) Define Inversion of a mechanism. Sketch and explain the various inversions of a four bar mechanism. **(07)**

B) For the mechanism as shown below, angular velocity of crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of link BD, when the crank is inclined at an angle 75° to the vertical. The dimensions of various links are : OA = 28 mm; AB = 44 mm; BC = 49 mm; and BD = 46 mm. The centre distance between the centres of rotation O and C is 65 mm. The path travel of slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. **(08)**



OR

B) In a pin jointed four bar mechanism as shown below, the crank rotates uniformly at 100 r.p.m. Locate all the instantaneous centres and find the angular velocity of the link BC. **(08)**



Q.4 A) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of valve is 37.5 mm, and the least radius of the cam is 40 mm. The follower is provided with a roller radius of 20 mm, and its line of stroke passes through the axis of the cam. **(07)**

OR

A) Define Precision points w.r.t. function generation. **(07)**
A mechanism is to be designed to generate function $y = x^{0.8}$ for the range $1 \leq x \leq 3$, using 3 precision points. Find the values of x and y.

B) Sketch and describe working of any one type of quick return mechanism. Give an application of it. Derive an expression for the ratio of time taken in forward and return stroke for the mechanism. **(08)**