Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Odd) Examination Dec-2022

RA3CO24 Kinematics & Dynamics of Machines

Programme: B.Tech. Branch/Specialisation:

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. In a coupling rod of a locomotive, each of the four pairs is a _____ pair. **1**

(a) Sliding (b) Turning (c) Rolling (d) Screw

ii. The lead screw of a lathe with nut forms a- **1**

(a) Sliding pair (b) Rolling pair (c) Screw pair (d) Turning pair

iii. What are the possible synthesis of mechanism? **1**

(a) Type synthesis (b) Number synthesis

(c) Dimensional synthesis (d) All of these

iv. Which is the correct method of position synthesis? **1**

(a) Two position motion generated by analytical synthesis

(b) Three position motion generated by analytical synthesis

(c) Both of these

(d) None of these

v. The direction of linear velocity of any point on a link with respect to another point on the same link is- **1**

(a) Parallel to the link joining the points

(b) Perpendicular to the link joining the points

(c) At 45° to the link joining the points

(d) None of these

vi. The component of the acceleration, parallel to the velocity of the particle, at the given instant is called **1**

(a) Radial component (b) Tangential component

(c) Coriolis component (d) None of these

vii. The size of a cam depends upon- **1**

(a) Base circle (b) Pitch circle (c) Prime circle (d) Pitch curve

P.T.O.

viii. The reference point on the follower to lay the cam profile is known as- **1**
(a) Cam center (b) Pitch point (c) Trace point (d) Prime point

ix. The radius of a friction circle for a shaft of radius r rotating inside a bearing is- **1**
(a) r sin φ (b) r cos φ (c) r tan φ (d) r cot φ

x. The frictional torque transmitted by a cone clutch is same as that of- **1**
(a) Flat pivot bearing
(b) Flat collar bearing
(c) Conical pivot bearing
(d) Trapezoidal pivot bearing

Q.2 i. What is a machine? Giving example, differentiate between a machine and a structure. **2**

ii. Explain the term kinematic link. Give the classification of kinematic link. **3**

iii. In a crank and slotted lever quick return mechanism, the distance between the fixed centres is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on the cutting and return strokes. **5**

OR iv. The Whitworth quick return motion mechanism has the driving crank 150 mm long. The distance between fixed centres is 100 mm. The line of stroke of the ram passes through the centre of rotation of the slotted lever whose free end is connected to the ram by a connecting link. Find the ratio of time of cutting to time of return. **5**

Q.3 i. What do you understand by couples curve? **3**

ii. Describe the classification of synthesis problem. **7**

OR iii. Describe the method of designing a four-bar mechanism as a function generation. **7**

Q.4 i. Explain how the velocities of a slider and the connecting rod are obtained in a slider crank mechanism. **3**

ii. Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions? **7**

OR iii. In a pin jointed four bar mechanism ABCD, the lengths of various links are as follows: A B = 25 mm; BC = 87.5 mm; CD = 50 mm and AD = 80 mm. The link AD is fixed and the angle BAD = 135°. If the velocity of B is 1.8 m/s in the clockwise direction, find (a) velocity and acceleration of the midpoint of BC, and (b) angular velocity and angular acceleration of link CB and CD. **7**

Q.5 i. Why a roller follower is preferred to that of a knife-edged follower? **4**

ii. A flat ended valve tappet is operated by a symmetrical cam with circular arc for flank and nose. The straight-line path of the tappet passes through the cam axis. Total angle of action = 150°. Lift =6 mm. Base circle diameter =30 mm. Period of acceleration is half the period of retardation during the lift. The cam rotates at 1250 r.p.m. Find: (a) flank and nose radii; (b) maximum acceleration and retardation during the lift. **6**

OR iii. A disc cam is to give uniform motion to a knife edge follower during out stroke of 50 mm during the first half of the cam revolution. The follower again returns to its original position with uniform motion during the next half of the revolution. The minimum radius of the cam is 50 mm and the diameter of the cam shaft is 35 mm. Draw the profile of the cam when (a) the axis of follower passes through the axis of cam shaft, and (b) the axis of follower is offset by 20 mm from the axis of the cam shaft **6**

Q.6 Attempt any two:

i. Find the force required to move a load of 300 N up a rough plane, the force being applied parallel to the plane. The inclination of the plane is such that a force of 60 N inclined at 30º to a similar smooth plane would keep the same load in equilibrium. The coefficient of friction is 0.3. **5**

ii. Describe with a neat sketch a centrifugal clutch and deduce an equation for the total torque transmitted **5**

iii. Explain with neat sketch the working of single plate clutch. **5**

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Que 2:- [KDM — RAS CO 24 & Marking Scheme]

i) Defination of machine - 1 marks
Example - 1 marks

ii) Defination - 2 marks
classification - 1 marks.

iii) Given and diagram - 3 marks
the ratio of time taken on
cutting and return strokes - 2 marks
↳ Ans. [2]

iv) Given and diagram - 3 marks
ratio of time of cutting
to time of return - 2 marks
↳ Ans - [2.735]

Que:- 3

i) Related defination - 3 marks

ii) Defination - 2 marks
classification - 5 marks

iii) Diagram - 3 marks
method and related
theory → 4 marks.

Q-1 solution

1 — B
2 — C
3 — d
4 — c
5 — b
6 — b
7 — a
8 — c
9 — a
10 — d

Q-4 - Ans. (iii)

1.67 m/s; 110 m/sec²,
8.9 rad/sec, 870 rad/sec²
32.4 rad/sec, 1040 rad/sec²

Que-4

i) Related theory - 3 marks

ii) Defination - 2 marks

velocity at pin joint in same direction - 2.5 marks

velocity at pin joint in different direction - 2.5 marks.

iii)

Phase digram - 3 marks

velocity digram - 3 marks

Answer - 1 marks.

Que:5 Reasoning

i) ~~Regioning~~ - 4 marks

ii)

Given and diagram - 2 marks

flank and nose radii - 2 marks

maximum accelaration and retardation - 2 marks

3.5323 m/sec²

Retardation :- 195.64 m/sec²

iii)

given and profile (a) - 3 marks

given and profile (b) - 3 marks.

Que:6

i) Diagram - 3 marks

formulae - 1 marks

Answer - 1 marks.

[Ans - 146 N]

ii) Diagram - 1 marks

Explaination - 3 marks

equation - 1 marks.

iii) ~~Dig~~ Diagram - 2 marks

working - 3 marks.