BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(ME)-2021/B.Tech.(ME)-2023
Course Name – Kinematics & Theory of Machines
Course Code - PCC-ME404
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) A mechanism with four links is classified as
a) Simple mechanism. b) Inversion of the mechanism.
c) Both (a) and (b). d) None of these.

(ii) Define the mechanism for scaling and enlarging drawings upto a desired ratio.
a) Beam engine. b) Elliptical trammel.
c) Pantograph. d) Quick return mechanism.

(iii) Identify a turning pair from the following kinematic links.
a) Piston and cylinder of a reciprocating steam engine. b) Shaft with collars at both ends fitted in a circular hole.
c) The lead screw of a lathe with a nut. d) Ball and socket joint.

(iv) Identify the minimum number of possible inversions for the 'L' number of links within a kinematic chain.
a) L. b) (L+1).
c) (L-1). d) (L+2).

(v) Choose the correct examples of forced closed kinematic pairs from the following: 1. Cam and Roller Mechanism. 2. Door Closing Mechanism. 3. Slider-Crank Mechanism. 4. Automotive Clutch Operating Mechanism.
a) 1, 2 and 4. b) 1 and 3.
c) 2, 3 and 4. d) 1, 2, 3 and 4.

(vi) Identify the minimum number of links required for a simple mechanism.
a) 1 link. b) 2 links.
c) 3 links. d) 4 links.

(vii) Predict the Degree of Freedom of a slider crank mechanism.
a) 2. b) 3.
c) 0. d) 1.

(viii) Predict the correct turning pair between a bolt and a nut.

a) A turning pair. b) Spherical pair.
c) Sliding pair. d) Screw pair.

(ix) Predict an example of the inversions of a double slider crank mechanism.

a) Whitworth return motion. b) Scotch Yoke.
c) Rotary engine. d) Oldham's Coupling.

(x) Predict from the following pair which is not correctly matched.

a) Positive drive - Belt drive. b) High-velocity ratio - Worm gearing.
c) To connect non-parallel and non-intersecting shafts - Spiral gearing. d) Diminished noise and smooth operation - Helical gears.

(xi) Identify the machine in which a single slider four-bar linkage mechanism is used by considering slider as a fixed one.

a) Hand pump. b) Rolling mechanism.
c) Quick return. d) Oscillating cylinder.

(xii) Identify the correct combination of kinematic pairs used in a four-bar chain mechanism.

a) All turning pairs. b) One turning pair and the others are sliding pairs.
c) One sliding pair and the others are turning pairs. d) All sliding pairs.

(xiii) Predict the correct number of elements and higher pairs for a simple mechanism.

a) 3 elements with 1 higher pair. b) 2 elements with 1 higher pair.
c) 1 element with 1 higher pair. d) 4 elements with 1 higher pair.

(xiv) Identify the correct location of the Pitch point on a cam.

a) Any point on the pitch curve b) The point on the cam pitch curve has the maximum pressure angle.
c) Any point on the pitch circle. d) The point on the cam pitch curve has the minimum pressure angle.

(xv) Predict the degree of freedom of a spherical pair.

a) 1. b) 2.
c) 3. d) 4.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Discuss the basic function of a cam. (3)

3. Describe the term "Mobility of a Mechanisms". (3)

4. Illustrate the function of a governor. (3)

5. With a neat sketch, illustrate the following terms, (i) Pinion and (ii) Gear Wheel. (3)

6. Illustrate the Rayleigh's method of finding the natural frequency of transverse vibrations. (3)

OR

With a neat sketch, compare the motions of different types of damping systems. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Illustrate the classification of Gears with suitable example. (5)
8. Define the terms "Damping Ratio" and "Transmissibility Ratio". (5)
9. The speed ratio of a reverted gear train is to be 15. The module of gears 1 and 2 is 3 mm and that of gears 3 and 4 is 2.5 mm. Estimate the suitable number of teeth for the gears. The Centre distance between gear shafts is 250 mm. (5)
10. Interpret the following term "stability of a governor". Draw and explain the controlling force versus radius of rotation diagrams for a stable, unstable and isochronous governor. Interpret the conditions for stability. (5)

11. Explain the effect of spring mass for the calculation of natural frequency of any kind of mechanical system. (5)

12. A single degree damped vibrating system consists of a suspended mass of 2.5 Kg and spring constant 30 N/cm. The amplitude decreases to 25% of initial value after 4 oscillations. Evaluate the value of Logarithmic Decrement. (5)

OR

A spring-mass system K_1, m has a natural frequency = f_1. If a second spring K_2 is added in series with the first spring, the natural frequency is lowered to (1/2) f_1. Evaluate K_2 in terms of K_1. (5)

****