Roll No											

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023

Semester : Semester IV - 2021
Course Code : MEC4002
Course Name : Sem IV - MEC4002 - Kinematics of Machines
Program : MEC

Date : 22-JUN-2023
Time : 9.30AM - 12.30PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS **(5 X 2 = 10M)**

1. Identify the kinematic chains to which the following mechanisms belong :
a. Steam engine mechanism ;
b. Beam engine ;
c. Whitworth quick return motion mechanism;
d. Elliptical trammels.

(CO2) [Knowledge]

2. In a kinematic chain, how many binary joint is equivalent to a quaternary joint?

(CO1) [Knowledge]

3. Among these following motion - completely constrained motion, incompletely constrained motion, and successfully constrained motion, Identify the correct motion for the motion of a piston in the cylinder of a steam engine.

(CO1) [Knowledge]

4. A linkage is shown below in the figure in which links ABC and DEF are ternary links whereas AF, BE and CD are binary links.
The degrees of freedom of the linkage when link ABC is fixed are.

(CO1) [Knowledge]

5. Determine DOF for the following mechanism.

(CO2) [Knowledge]

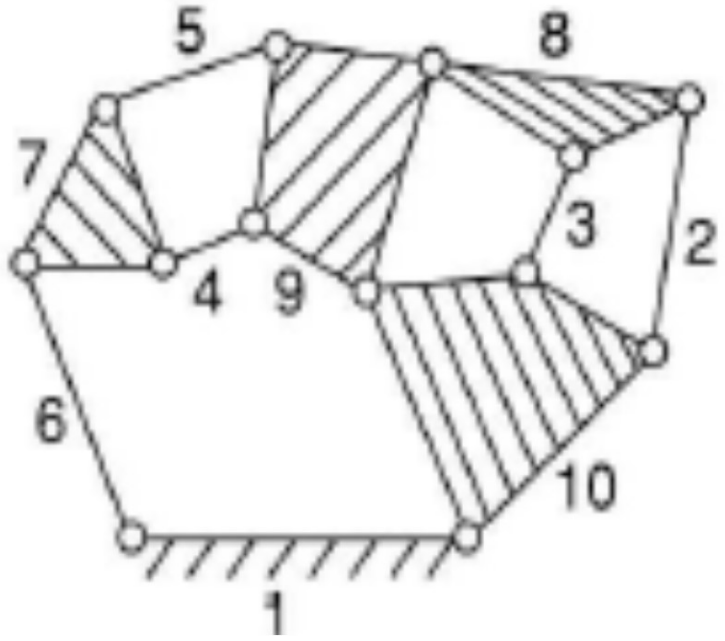
PART B

ANSWER ALL THE QUESTIONS **(6 X 10 = 60M)**

6. A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm.

(CO4) [Comprehension]

7. kinematic linkages shown in figure below, calculate the following:
a) the number of binary links (Nb)
b) the number of ternary links (Nt)
c) the number of quaternary links (Nq)
d) the number of total links (N)
e) the number of loops (L)
f) the number of joints or pairs (P1)
g) the number of degrees of freedom (F)

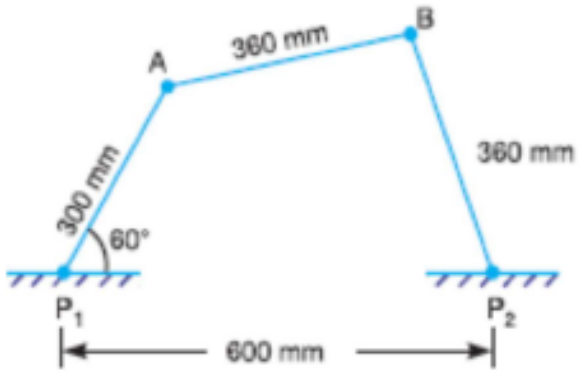


(CO1) [Comprehension]

8. With neat sketch diagram briefly explain all the terminology used for a Gear.

(CO4) [Comprehension]

9. The dimensions and configuration of the four bar mechanism, shown in Fig. are as follows: P1A = 300 mm; P2B = 360 mm; AB = 360mm, and P1P2 = 600 mm. The angle AP1P2 = 60°. The crank P1A has an angular velocity of 10 rad/s, clockwise. Determine the angular velocities of P2B, and AB and the velocity of the joint B.



(CO3) [Comprehension]

10. Describe various inversions of a slider-crank mechanism giving examples.

(CO2) [Comprehension]

11. PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity of links QR and RS.

(CO3) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **(2 X 15 = 30M)**

12. An epicyclic gear consists of three gears A, B and C as shown in Figure. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m.. If the gear A is fixed, determine the speed of gears B and C.

(CO4) [Application]

13. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. At a crank angle of 45° from inner dead centre position, Determine :

a. Linear velocity and acceleration of the midpoint of the connecting rod,

and

b. angular velocity and angular acceleration of the connecting rod,

(CO3) [Application]