Register Number:……..

KUMARAGURU
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B.E DEGREE EXAMINATIONS: MAY 2017

(Regulation 2015)

Fourth Semester

MECHANICAL ENGINEERING

U15MET402**:** Kinematics of Machinery

COURSE OUTCOMES

CO1: Apply the fundamental concepts in developing various mechanisms.

CO2: Make use of different methods to determine the velocity and acceleration in planar mechanisms.

CO3: Construct the cam profile for the specific follower motion.

CO4: Identify appropriate gear and gear trains for particular application.

CO5: Solve problems in frictional mechanisms.

CO6: Apply the concepts of friction to solve problems in flexible drives.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match List-I (Principle/Method) with List II (Corresponding Application) and select the correct answer using the code given below the lists: CO_1 $[K_1]$

List I	List II
A. Klein's construction	i. Instantaneous centers in linkages
B. Kennedy's theorem	ii. Relative acceleration of linkages
C. D'Alembert's principle	iii. Mobility of linkages
D. Grubber's rule	iv. Dynamic forces in linkage

	A	B	C	D
a)	ii	iv	iii	i
b)	iii	iv	ii	i
c)	ii	i	iv	iii
d)	iii	i	ii	iv

2. How many degrees of freedom does a constrained motion mechanism have? CO_1 $[K_1]$

a) -1 b) 0

c) 1 d) 2

3. Which of the following are examples forced closed kinematic pairs? CO_1 $[K_3]$

1. Cam and follower mechanism 2. Door closing mechanism

3. Slider-crank mechanism 4. Automotive clutch operating mechanism

select the answer using the code given below:

a) 1,2 & 4 b) 1 & 3

c) 2,3 & 4 d) 1,2,3 & 4

4. The total number of instant centres for a mechanism containing n links is given by CO_1 $[K_1]$

a) (n-1)/2 b) n(n-1)/2

c) n d) n/2

5. Assertion (A): The elements of higher pairs must be force closed CO_1 $[K_3]$

Reason (R): This is required in order to provide completely constrained motion

a) Both A and R are Individually true and R is the correct explanation of A

b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false

d) A is false but R is true

6. In high-speed engines, the cam follower moves with CO_3 $[K_1]$

a) simple harmonic motion b) cycloidal motion

c) uniform velocity d) uniform acceleration & retardation

7. Sequencing type item based on the number of links present in the mechanism CO_1 $[K_1]$

1. Paucellier Mechanism 2. Hart Mechanism 3. Slider crank Mechanism 4. Pantograph

a) 2-3-4-1 b) 1-3-2-4

c) 3-4-2-1 d) 4-1-3-2

8. If the axes of first and last gear of a compound gear train are co-axial, the gear train is known as CO_4 $[K_1]$

a) simple gear train b) compound gear train

c) epicyclic gear train d) reverted gear train

9. Assertion (A): A hydraulic fluid is one form of link. CO_5 $[K_3]$

Reason (R): A link need not necessarily be a rigid body but it must be a resistant body.

a) Both A and R are Individually true and R is the correct explanation of A

b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false

d) A is false but R is true

10. When the belt is stationary, it is subjected to tension, known as initial tension. The value of this tension is equal to the CO_6 $[K_1]$

a) tension in the tight side of the belt b) tension in the slack side of the belt

c) sum of the tensions in the tight side and slack side of the belt

d) average tension in tight side and slack side of the belt

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11.	What is meant by the efficiency of a mechanism?	CO_1	$[K_1]$
12.	Name the inversions of single slider chain and give an application for each of them.	CO_1	$[K_1]$
13.	What is velocity of rubbing and how is it found?	CO_2	$[K_2]$
14.	State Kennedy's theorem of instant centres.	CO_2	$[K_1]$
15.	Define the terms base circle and prime circle with reference to cams.	CO_3	$[K_1]$
16.	Define undercutting with reference to cams.	CO_3	$[K_1]$
17.	Mention the ways by which interference in gears can be avoided.	CO_4	$[K_2]$
18.	Compare involute gear tooth profile with cycloidal profile.	CO_4	$[K_2]$
19.	Sketch single flat and multiple flat collar bearings.	CO_5	$[K_1]$
20.	State the effect of slip on the velocity ratio of belt drives.	CO_6	$[K_2]$

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. In a mechanism shown in Fig.1, the angular velocity of the crank OA is 15 rad/s and the slider at E is constrained to move at 2.5 m/s. The motion of both the sliders is vertical and the link BC is horizontal in the position shown. Determine CO_2 $[K_3]$
    (i) the rubbing velocity at B if the pin diameter is 15 mm
    (ii) the velocity of slider D

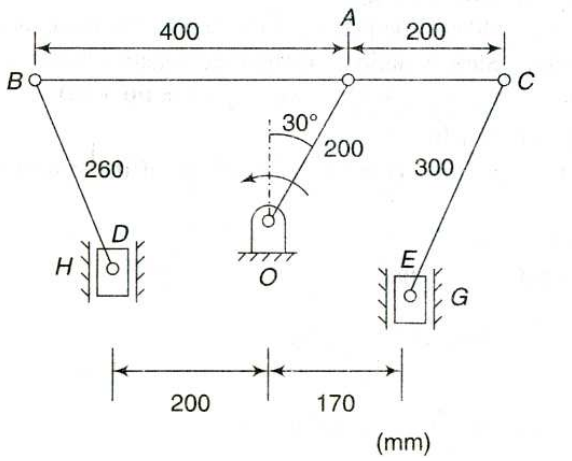

Fig. 1

22. Present the classification of kinematic pairs based on the number of restraints imposed on the relative motion of the two links connected together with the aid of suitable illustrations. CO_1 $[K_2]$

23. The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent. CO$_3$ [K$_2$]

Minimum radius of cam = 25 mm, Roller diameter =7.5 mm, Lift = 28 mm, Offset of follower axis = 12 mm towards right, Angle of ascent = 60^o, Angle of descent = 90^o, Angle of dwell between ascent and descent = 45^o, Speed of the cam = 200 rpm.

Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the outstroke and the return stroke.

24. In the epicyclic gear train shown in Fig.2, the compound wheels A and B as well as internal wheels C and B rotate independently about the axis O. The wheels E and F rotate on the pins fixed to arm α. All the wheels are of the same module. The number of teeth on the wheels are T_A = 52, T_B=56, T_E =T_F =36 CO$_4$ [K$_3$]

Determine the speed of C if

the wheel D fixed and arm α rotates at 200 rpm clockwise

the wheel D rotates at 20 rpm counter-clockwise and the arm α rotates at 200 rpm clockwise.

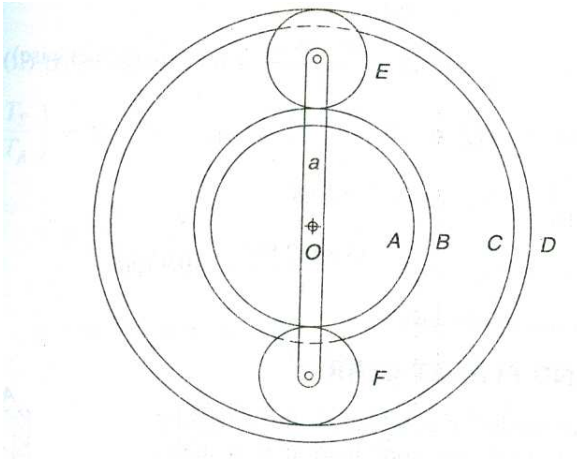

Fig. 2

25. A conical pivot with angle of cone as 100^o supports a load of 18 kN. The external radius is 2.5 times the internal radius. The shaft rotates at 150 rpm. If the intensity of pressure is to be 300kN/m^2 and coefficient of friction as 0.05, what is the power lost in working against the friction. CO$_6$ [K$_3$]

26. If the capacity of a single plate clutch decreases by 13% during the initial wear period, determine the minimum value of the ratio of internal diameter to external diameter for the same axial load. Consider both the sides of the clutch plate to be effective. CO$_5$ [K$_3$]

27. Explain the working of indexing mechanism with suitable illustrations. CO$_1$ [K$_1$]

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