KUMARAGURU
college of technology
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GENERAL INSTRUCTIONS TO THE CANDIDATES

1. Candidates are instructed to answer the questions as per Bloom's Taxonomy knowledge level (K_1 to K_6)
2. Candidates are strictly instructed not to write anything in the question paper other than their roll number.
3. Candidates should search their pockets, desks and benches and handover to the Hall Superintendent/ Invigilator if any paper, book or note which they may find therein as soon as they enter the examination hall.
4. Candidates are not permitted to bring electronic watches with memory, laptop computers, personal systems, walkie-talkie sets, paging devices, mobile phones, cameras, recording systems or any other gadget / device /object that would be of unfair assistance to him / her.
5. Corrective measures as per KCT examination policies will be imposed for malpractice in the hall like copying from any papers, books or notes and attempting to elicit the answer from neighbours.

B.E DEGREE EXAMINATIONS: DEC 2015
(Regulation 2014)
Third Semester
MECHATRONICS ENGINEERING

U14MCT302: Kinematics Of Machinery

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

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. The motion of a piston in the cylinder of a steam engine is an example of   CO1 [K_1]
   a) Sliding   b) Rolling
   c) May be rolling or sliding depending upon the shape of teeth   d) Partly sliding and partly rolling

2. Consider the following statement regarding radial cam nomenclature   CO3 [K_1]
   1. Motion of the trace point describes movement of the follower.
   2. The curve generated by the locus of trace point is called cam profile.
   3. Actual working curve of cam is called pitch curve
   4. Smallest circle that can be drawn tangential to cam profile is called base circle.
   Which of these statements is correct?
   a) 1, 3 and 4   b) 1 and 2 only
   c) 2 and 3 only   d) 1, 2, and 3

3. The direction of linear velocity of any point on a link with respect to another point on the same link is …..   CO2 [K_1]
   a) parallel to the link joining the point   b) Perpendicular to the link joining the point

c) At 45º to link joining the point   d) At 65º to link joining the point

4. The pressure angle of a cam is the angle between the direction of the follower motion and a normal to the   CO3 [K₁]

    normal to the

    a) pitch circle   b) base circle

    c) pitch curve   d) prime circle

5. In a circular arc cam with roller follower, the acceleration in any position of the lift will depend only upon   CO3 [K₁]

    depend only upon

    a) total lift, total angle of lift, minimum radius of cam and cam speed   b) radius of circular arc, cam speed, location of centre of circular arc and roller diameter

    c) mass of cam follower linkage, spring stiffness and cam speed   d) total lift, centre of gravity of the cam and cam speed

6. In the case of an involute toothed gear, involute starts from   CO4 [K₂]

    a) Addendum circle   b) Dedendum circle

    c) Pitch circle   d) Base circle

7. In a gear train, when the axes of the shafts, over which the gears are mounted, move relative to a fixed axis, is called   CO4 [K₁]

    a fixed axis, is called

    a) simple gear train   b) compound gear train

    c) reverted gear train   d) epicyclic gear train

8. Assertion (A): All motor vehicles have differential gear mechanism at the back axle.   CO4 [K₂]

    Reason (R): this mechanism is fitted to enable the vehicles to run on bumpy roads.

    a) Both A and R true and R is the correct explanation of A   b) Both A and R true and R is not a correct explanation of A

    c) A is true but R is false   d) A is false but R is true

9. In a screw jack, the effort required to lower the load W is given by   CO5 [K₁]

    a) $P = W \tan(\alpha - \varphi)$ b) $P = W \tan(\alpha + \varphi)$

    c) $P = W \tan(\varphi - \alpha)$ d) $P = W \cos(\alpha + \varphi)$

CO1 [K₂]

10.

A	4 links, 4 turning pairs	1	Completely constrained motion
B	3 links, 3 turning pairs	2	Successfully constrained motion
C	5 links, 5 turning pairs	3	Rigid frame
D	Footstep bearing	4	Incompletely constrained motion

	A	B	C	D
a)	1	3	4	2
b)	4	3	1	2
c)	3	4	1	2
d)	2	1	3	4

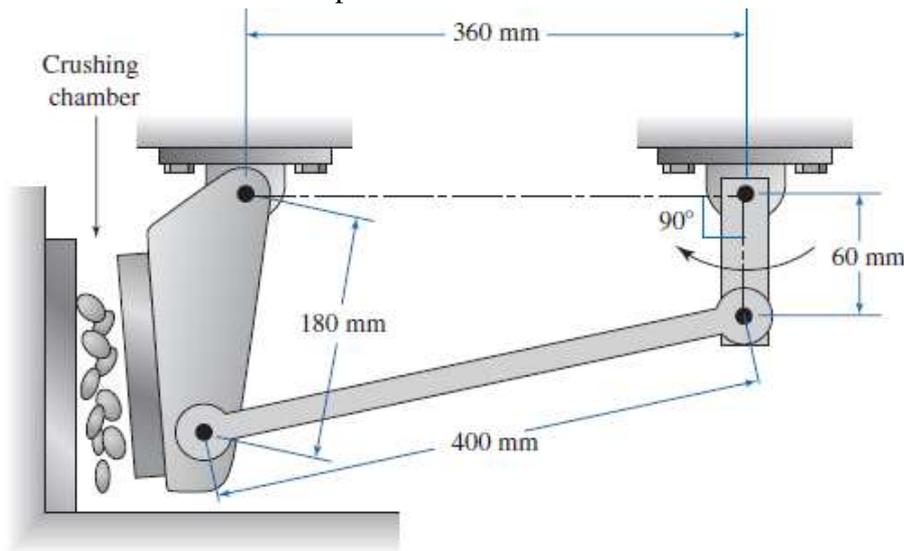**PART B (10 x 2 = 20 Marks)**

(Answer not more than 40 words)

11. Give any four examples for inversion of single slider mechanism.   CO1 [K₁]

12. List the Kinematic quantity.	CO1	[K1]
13. Define rubbing velocity.	CO2	[K$_1$]
14. List out the different types of instantaneous centre's.	CO2	[K$_1$]
15. What kind of cam and follower used in aircraft? Justify.	CO3	[K$_2$]
16. What is meant by pressure angle in cam?	CO3	[K$_1$]
17. What is the role of worm and worm gear in grill chicken machine?	CO4	[K$_2$]
18. In what way reverted gear train differs from compound gear train.	CO4	[K$_2$]
19. Define "angle of repose" with a neat sketch.	CO5	[K$_1$]
20. Recall coefficient of friction.	CO5	[K$_1$]

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

Q.No. 21 is Compulsory

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21. Describe the working of Whitworth and crank and slotted lever quick return motion mechanism with neat sketch.	CO1	[K$_3$]
22. Determine the angular velocity and acceleration of given mechanism as shown in figure the crank rotates at 120rpm.	CO2	[K$_3$]

23. A cam operating a knife edged follower has the following data: The follower moves outwards through 40mm during 60° of cam rotation. Follower dwell for the next 45°. Follower return to the original position during next 90°.follower dwells for the rest of the rotation. The displacement of the follower is to take place with uniform velocity during the both outward and return strokes. The least radius of the cam is 50mm. draw the profile of the cam when the axis of the follower passes through the cam axis and the axis of the follower is offset by 18mm towards right from the axis.	CO3	[K$_3$]
24. i) Two gears of module 4mm have 24 and 33 teeth. The pressure angle is 20° and (7)	CO4	[K$_2$]

each gear has a standard addendum of one module. Find the length of arc of contact and the maximum velocity of sliding if the pinion rotates at 120 r.p.m.

ii) The pitch circle diameter of the smaller of the two spur wheels which mesh externally and have involute teeth is 100 mm. The number of teeth is 16 and 32. The pressure angle is 20° and the addendum is 0.32 of the circular pitch. Find the length of the path of contact of the pair of teeth. (7) CO4 [K_3]

25. i) In a compound epicyclic gear train as shown in the figure, has gears A and an annular gears D & E free to rotate on the axis P. B and C is a compound gear rotate about axis Q. Gear A rotates at 90 rpm CCW and gear D rotates at 450 rpm CW. Find the speed and direction of rotation of arm F and gear E. Gears A,B and C are having 18, 45 and 21 teeth respectively. All gears having same module and pitch. (12) CO4 [K_3]
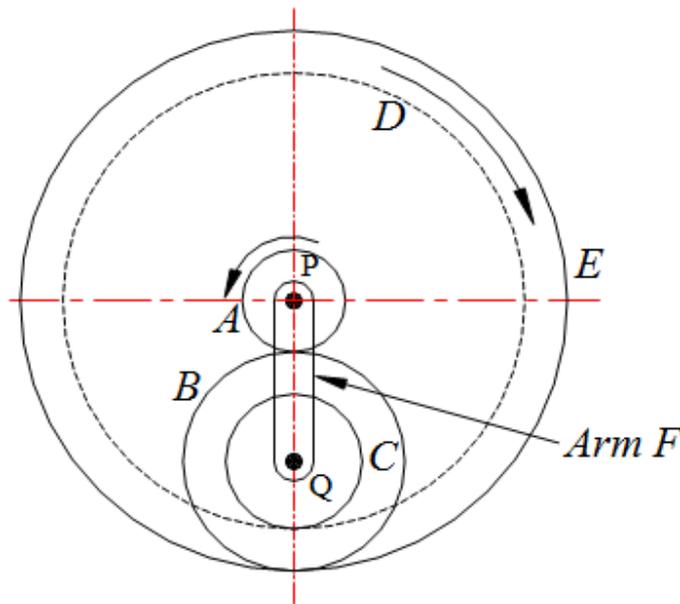
ii) What are the conditions to be satisfied for the interchangeability of all gears? (2) CO4 [K_1]

26. Relate friction with real time applications. Explain any two of them with neat sketch. CO5 [K_3]

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