Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB10

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

B. Tech IV Semester End Examinations (Regular), May – 2020

Regulations: IARE-R18

KINEMATICS OF MACHINES

(MECHANICAL ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1.	a)	Classify the kinematic links with neat sketches	**[7M]**
	b)	In a crank and slotted lever quick return mechanism, the distance between the fixed centers is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on the cutting and return Strokes	**[7M]**
2.	a)	Analyze the quick return motion mechanism of crank and slotted lever.	**[7M]**
	b)	In a crank and slotted lever quick return mechanism, the driving crank length is 30 mm and inclines at 30^0 to the vertical. The distance between the fixed centres is 200 mm and the length of the slotted lever is 500mm. Find the ratio of the times taken on the cutting and idle strokes. Determine the effective stroke also..	**[7M]**

MODULE – II

3.	a)	Sketch and explain the various inversions of a four bar chain..	**[7M]**
	b)	Create all the Instantaneous centers of slider crank mechanism with crank length of 25mm rotating clockwise at a uniform speed of 100rpm. The crank makes 45^0 with IDC and the connecting rod is 400mm long. Determine the velocity of the slider and the angular velocity of connecting rod?	**[7M]**
4.	a)	Analyze the Kennedy's theorem for a mechanism.	**[7M]**
	b)	Evaluate the velocity and acceleration of the link QR and RS in a four bar mechanism in which PQRS is a four bar mechanism with fixed link PS. Crank PQ rotates uniformly and makes an angle of 60^o with PS in anti-clockwise direction.. The length of the links are PQ=62.5mm, QR= 175mm, RS= 112.5mm and PS= 200mm. Crank PQ rotates at 10 radians/ second?	**[7M]**

MODULE – III

5.	a)	Explain a Hooke's joint and its applications?	**[7M]**
	b)	A Hooke's joint connects two shafts whose axes intersect at 25^0. What will be the angle turned by the driven shaft when the velocity ratio is maximum, minimum and unity.	**[7M]**

6. a) Analyze a Davis steering gear mechanism. **[7M]**

b) The distance between the steering pivots of a Davis steering gear is 1.3 m. The wheel base is 2.75 m. what will be the inclination of the track arms to the longitudinal axis of the vehicle moving in a straight path. **[7M]**

MODULE – IV

7. a) Analyze the classifications of followers according to the path of motion. **[7M]**

b) Create the profile of a cam so that the follower is to move outwards through 30 mm during 180^0 of cam rotation with SHM and dwell for 20^0 of cam rotation followed by returning to initial position with Uniform velocity during160^0 of cam rotation. The base circle diameter of cam is 28 mm and the roller diameter is 8 mm. The axis of the follower passes through the axis of cam shaft. **[7M]**

8. a) Create the displacement and velocity diagrams for Simple Harmonic motion.. **[7M]**

b) Design a cam to raise a valve with simple harmonic motion through 15mm is 1/3rd of a revolution; keep it fully raised through 1/12th of a revolution and to lower it with SHM in 1/6th of a revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20mm and the minimum radius of the cam is 25mm. The axis of the valve rod passes through the axis of the cam shaft. If the cam shaft rotates at uniform speed of 100 rpm; find the maximum velocity and acceleration of the valve during raising and lowering. Also draw the profile of the cam. **[7M]**

MODULE – V

9. a) Define the terms gear ratio, angle of action and dedendum in gears. **[7M]**

b) Two gears have 30 and 42 involute teeth of module 8 mm and 20^0 pressure angle. If the addendum on each wheel is 12mm find the dedendum for each gear wheel and contact ratio. **[7M]**

10. a) Evaluate an expression for the length of path of contact. **[7M]**

b) The arm of an epicyclic gear train rotates at 100 rpm in the anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm (clockwise). **[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

I	Understand the basic principles of kinematics and the related terminology of machines.
II	Identify mobility, enumerate links and joints in the mechanisms.
III	Explain the concept of analysis of different mechanisms.
IV	Understand the working of various straight line mechanisms, gears, gear trains, steering gear mechanisms, cams and a Hooke's joint.
V	Determine the mechanisms for displacement, velocity and acceleration of links in a machine.

COURSE OUTCOMES:

CO 1	Understand designing a suitable mechanism depending on application.
CO 2	Understand displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
CO 3	Visualize drawing velocity and acceleration diagrams for different mechanisms.
CO 4	Select gear and gear train depending on application.
CO 5	Explore the knowledge on differential gear design.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

AMEB10.01	Classifications of the kinematic links, kinematic pairs and formation of the kinematic chain.
AMEB10.02	Distinguish between mechanism and machine
AMEB10.03	Design and develop inversions of quadratic cycle chain, slider crank mechanism, and double slider crank mechanism and cross slider mechanism.
AMEB10.04	Demonstrate type synthesis, number synthesis and dimensional synthesis.
AMEB10.05	Construct Graphical methods of velocity polygon and acceleration polygons for a given configuration diagram.
AMEB10.06	Understand other methods of acceleration diagrams like Klien's construction.
AMEB10.07	Develop secondary acceleration component i.e Correli's component involving quick return mechanisms
AMEB10.08	Alternative approach for determining velocity by using I centres and centriods methods.
AMEB10.09	Significance of exact and approximate straight line mechanisms.
AMEB10.10	Application of straight line mechanism in steam engine indicators.
AMEB10.11	Applications of Ackerman's and Davi's steering mechanisms in automobiles.
AMEB10.12	Develop the condition for exact steering.
AMEB10.13	Develop the polar velocity diagram for a single hook joint and double hook joint and develop condition for unity for higher and lower speeds.
AMEB10.14	Study different displacement profiles applicable in I.C engines cam shafts.
AMEB10.15	Plot the displacement, velocity and acceleration profiles with respect to time.
AMEB10.16	Understand the geometry of gears and deduce the expression for arc of contact.
AMEB10.17	Derive the expression for minimum number of teeth to avoid interference in case of pinion and gear as well as rack and pinion.

AMEB10.18	Application of different gear trains including epicyclic and deduce the train value using tabular and relative velocity method.
AMEB10.19	Significance of differential gear box in an automobile while taking turn on the road.
AMEB10.20	Enable the students to understand the importance of theory of machines for lifelong learning, Higher Education and competitive exams.

Mapping of Semester End Examinations to Course Learning Outcomes:

SEE Question No.		Course Learning Outcomes		CO's	Blooms Taxonomy Level
1	a	AMEB10.02	Distinguish between mechanism and machine	CO 1	Understand
	b	AMEB10.01	Design and develop inversions of quadratic cycle chain, slider crank mechanism, and double slider crank mechanism and cross slider mechanism.	CO 1	Understand
2	a	AMEB10.01	Classifications of the kinematic links, kinematic pairs and formation of the kinematic chain.	CO 1	Understand
	b	AMEB10.03	Design and develop inversions of quadratic cycle chain, slider crank mechanism, and double slider crank mechanism and cross slider mechanism.	CO 1	Understand
3	a	AMEB10.08	Alternative approach for determining velocity by using I centers and centroid methods.	CO 2	Understand
	b	AMEB10.08	Alternative approach for determining velocity by using I centers and centroid methods.	CO 2	Remember
4	a	AMEB10.08	Alternative approach for determining velocity by using I centers and centroid methods.	CO 2	Remember
	b	AMEB10.05	Construct Graphical methods of velocity polygon and acceleration polygons for a given configuration diagram.	CO 2	Remember
5	a	AMEB10.09	Significance of exact and approximate straight line mechanisms.	CO 3	Understand
	b	AMEB10.09	Significance of exact and approximate straight line mechanisms.	CO 3	Understand
6	a	AMEB10.13	Develop the polar velocity diagram for a single hook joint and double hook joint and develop condition for unity for higher and lower speeds.	CO 3	Understand
	b	AMEB10.11	Applications of Ackerman's and Davi's steering mechanisms in automobiles.	CO 3	Understand
7	a	AMEB10.15	Plot the displacement, velocity and acceleration profiles with respect to time.	CO 4	Understand
	b	AMEB10.14	Study different displacement profiles applicable in I.C engines cam shafts.	CO 4	Remember
8	a	AMEB10.15	Plot the displacement, velocity and acceleration profiles with respect to time.	CO 4	Remember
	b	AMEB10.14	Study different displacement profiles applicable in I.C engines cam shafts.	CO 4	Remember
9	a	AMEB10.16	Understand the geometry of gears and deduce the expression for arc of contact.	CO 5	Remember

	b	AMEB10.17	Derive the expression for minimum number of teeth to avoid interference in case of pinion and gear as well as rack and pinion.	CO 5	Understand
10	a	AMEB10.15	Plot the displacement, velocity and acceleration profiles with respect to time.	CO 5	Understand
	b	AMEB10.15	Plot the displacement, velocity and acceleration profiles with respect to time.	CO 5	Remember

Prepared by:
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