



INSTITUTE OF AERONAUTICAL ENGINEERING

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

QUESTION BANK

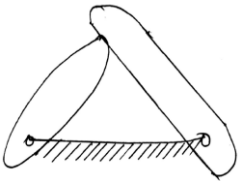
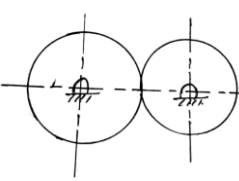
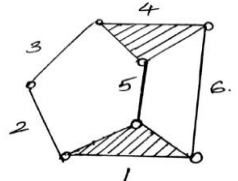
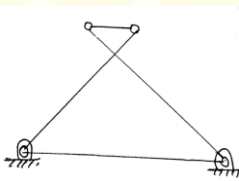
Course Name	:	KINEMATICS OF MACHINERY
Course Code	:	A40309
Class	:	II B. Tech II Semester
Branch	:	Mechanical Engineering
Year	:	2016 – 2017
Course Faculty	:	V V S H Prasad, Professor & G.Karunya, Assistant Professor

OBJECTIVES

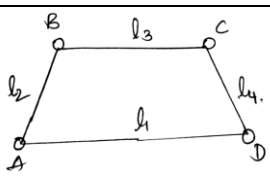
To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

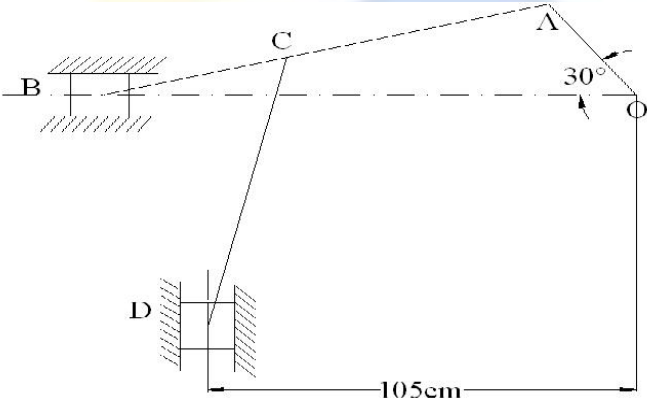
S. No	Question	Blooms Taxonomy Level	Course Outcome
UNIT-I MECHANISMS			
PART A -SHORT ANSWER QUESTIONS			
1	Define link.	Knowledge	1
2	Define mechanism.	Knowledge	1
3	Explain the quick return motion mechanism of crank and slotted lever.	Comprehension	1
4	Explain the whit-worth quick return motion mechanism.	Knowledge	1
5	Define machine and structure.	Comprehension	1
6	Define inversion of a mechanism?	Knowledge	1
7	Explain Grubler's criterion.	Knowledge	1
8	Explain the degrees of freedom of a mechanism.	Knowledge	1
9	List the types of kinematic pairs.	Knowledge	1
10	Define the types of links with examples.	Knowledge	1
11	What is Grashof's linkage?	Knowledge	1,3
12	Double crank mechanism in a parallelogram linkage. Justify your answer with neat diagram	Knowledge, Application	1,3
13	Under what conditions deltoid linkage form as Galloway mechanism.	Knowledge	1,3

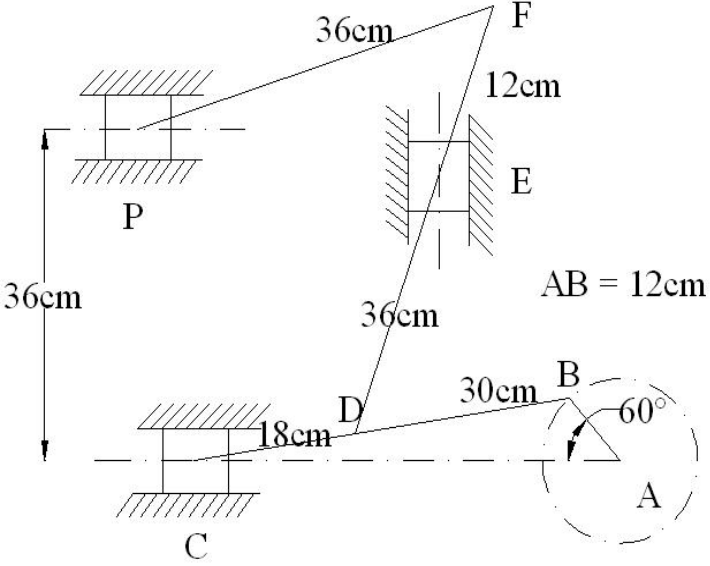
S. No	Question	Blooms Taxonomy Level	Course Outcome
14	What will you conclude if the degrees of freedom of a linkage is (i) one (ii) zero (iii) minus one	Knowledge	1,3
15	Derive Grublers criterion for the constrained motion of a planar mechanism with lower pairs.	Knowledge, Application	1,3
16	Determine the degrees of freedom of linkage shown in figure 1.  (fig 1)  (fig 2)	Knowledge, Application	1,3
17	Determine the degrees of freedom of linkage shown in figure 2.	Knowledge, Application	1,3
18	Determine the degrees of freedom of linkage shown in figure 3.  (fig 3)  (fig 4)	Knowledge, Application	1,3
19	Determine the degrees of freedom of linkage shown in figure 4.	Knowledge	1,3
20	Justify your answer for 1 spring pair = 2 binary pairs	Knowledge	1,3
21	Slider crank mechanism is an extension of four bar mechanism. Justify	Knowledge	1,3
22	What is Velocity Ratio?	Knowledge	1,3
PART B -LONG ANSWER QUESTIONS			
1	a) Define link and kinematic pair. b) Enumerate the inversions of double slider crank chain mechanism.	Knowledge, Application	1, 3
2	a) Define machine and mechanism. b) Enumerate the inversions of single slider crank chain mechanism	Knowledge, Application	1,3
3	a) Explain the quick return motion mechanism of crank and slotted lever. b) The length of the fixed link in a crank and slotted lever quick return mechanism is 300 mm and crank is 110 mm. Determine the inclination of the slotted lever with the vertical in the extreme position.	Comprehension, Application	1, 3
4	a) Identify the difference between a machine and a structure. b) Classify kinematic pairs.	Knowledge, Application	1,3
5	a) Explain the Whitworth quick return motion mechanism. b) In a Whitworth quick return motion mechanism, the distance between the fixed centers is 50 mm and the length of the driving crank is 75 mm. The length of the slotted lever is 150 mm and the length of the connecting rod is 135 mm. Find the ratio of time of cutting and return strokes and also the effective stroke.	Knowledge, Application	1,3
6	a) Define machine and structure. b) Explain different types of constrained motions.	Comprehension, Application	1, 3
7	a) Explain the function of Oldham's coupling. b) Prove that the elliptical trammel describes an ellipse.	Knowledge, Application	1,3
8	a) Define inversion of a mechanism? b) Explain the inversions of a quadric cycle chain?	Knowledge, Application	1, 3
9	a) Explain Grubler's criterion.	Knowledge,	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	b) Identify the degrees of freedom for four bar mechanism, slider crank mechanism and five bar mechanism.	Application	
10	a) What is meant by degrees of freedom of a mechanism? b) Explain the applications of Kutzbach criterion to plane mechanisms.	Knowledge, Application	1,3
11	A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centre of oscillation of the slotted lever and the centre of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke.	Comprehension, Application	1, 3
12	In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.	Knowledge, Application	1,3
13	The Whitworth quick return motion mechanism has the driving crank 150 mm long. The distance between fixed centres is 100 mm. The line of stroke of the ram passes through the centre of rotation of the slotted lever whose free end is connected to the ram by a connecting link. Find the ratio of time of cutting to time of return	Knowledge, Application	1,3
14	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	Comprehension, Application	1, 3
15	In a crank and slotted lever quick return motion mechanism, the distance between the fixed centre's O and C is 200 mm. The driving crank CP is 75 mm long. The pin Q on the slotted lever, 360 mm from the fulcrum O , is connected by a link QR 100 mm long, to a pin R on the ram. The line of stroke of R is perpendicular to OC and intersects OC produced at a point 150 mm from C . Determine the ratio of times taken on the cutting and return strokes.	Knowledge, Application	1,3
16	In a crank and slotted lever quick return mechanism, the driving crank length is mm and inclines at 30° to the vertical. The distance between the fixed centre's 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	Knowledge, Application	1, 3
17	A Whitworth quick return motion mechanism, has the following particulars : Length of stroke = 150 mm ; Driving crank length = 40 mm; Time of cutting stroke= 2Time of return stroke. Find the lengths of connecting rod and slotted lever.	Knowledge, Application	1,3
18	A Four bar mechanism shown in fig foe each set of link proportions in the table below. Determine the mechanism described and draw the inversions of each mechanism.	Knowledge, Application	1,3

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	 <table border="1" data-bbox="606 280 1069 481"> <thead> <tr> <th>Mechanism number</th> <th>AD (cm) l₁</th> <th>DC l₂</th> <th>CB l₃</th> <th>AB l₄</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>5</td> <td>4</td> <td>3.6</td> <td>2.2</td> </tr> <tr> <td>2</td> <td>3</td> <td>8.1</td> <td>5.4</td> <td>9</td> </tr> <tr> <td>3</td> <td>1</td> <td>4.9</td> <td>3</td> <td>3.9</td> </tr> <tr> <td>4</td> <td>2.2</td> <td>17</td> <td>4.6</td> <td>4</td> </tr> </tbody> </table>	Mechanism number	AD (cm) l ₁	DC l ₂	CB l ₃	AB l ₄	1	5	4	3.6	2.2	2	3	8.1	5.4	9	3	1	4.9	3	3.9	4	2.2	17	4.6	4		
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20	Explain the whit-worth quick return motion mechanism.	Knowledge, Application	1,3																									
UNIT-II KINEMATICS																												
PART A-SHORT ANSWER QUESTIONS																												
1	Define Instantaneous centre.	Knowledge	1																									
2	State and explain the Kennedy's theorem.	Comprehension	1																									
3	Explain Klien's construction for determining acceleration of slider.	Comprehension	1																									
4	Define axode.	Knowledge	1																									
5	What is acceleration image?	Knowledge	1																									
6	Define relative velocity.	Comprehension	1																									
7	Define instantaneous axis.	Comprehension	1																									
8	Define centrode.	Knowledge	1																									
9	Explain Klien's construction for determining velocity of slider.	Knowledge	1																									
10	Define Coriolis component of acceleration.	Knowledge	1																									
11	Define rubbing velocity	Knowledge	1																									
12	Illustrate the space centrode and body centrode	Knowledge	1																									
13	Name the various components of acceleration	Comprehension	1																									
14	List the various types of instantaneous centres.	Knowledge	1																									
15	What is the formulation to calculate the no of instantaneous centres are in a mechanism	Comprehension	1																									
16	What are the expression for radial and tangential component of acceleration?	Knowledge	1																									
17	How will you determine the magnitude of Coriolis component of acceleration	Knowledge	1																									
18	How will you determine the direction of Coriolis component of acceleration	Knowledge	1																									
19	State the properties of instantaneous centre method	Knowledge	1																									
20	What is velocity Image?	Knowledge	1																									
PART B -LONG ANSWER QUESTIONS																												
1	a) Mention different types of instantaneous centres. b) Locate the instantaneous centres for crank and slotted lever quick return mechanism?	Knowledge, Application	1,3																									
2	a) Define Instantaneous centre b) Locate all the Instantaneous centers of slider crank mechanism with crank length of 25mm rotating clockwise at a uniform speed of 100 rpm. The crank makes 45° with IDC and the connecting rod is 400 mm long	Knowledge, Application	1, 3																									

S. No	Question	Blooms Taxonomy Level	Course Outcome
	.Determine the velocity of the slider and the angular velocity of connecting rod?		
3	a) State and explain the Kennedy's theorem. b) In a slider crank mechanism, the crank OA makes 400 rpm in the counter clockwise direction which is 60^0 from IDC. The lengths of the links are OA= 60 mm, OB= 220 mm and BA= 280 mm. Determine the velocity and acceleration of the slider B?	Comprehension, Application	1, 3
4	a) Explain Klien's construction for determining velocity and acceleration of slider crank mechanism. b) Explain the method of determining the Coriolis component of acceleration in crank and slotted lever quick return mechanism?	Comprehension, Application	1, 3
5	Determine 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 60^0 with PS in anti clockwise direction.. The length of the links are PQ=62.5 mm, QR= 175 mm, RS= 112.5 mm and PS= 200 mm. Crank PQ rotates at 10 radians/ second?	Knowledge, Application	1,3
6	a) Define centrode and axode. b) Derive the analytical method of determination of velocity and acceleration for a slider crank mechanism?	Knowledge, Application	1, 3
7	a) Explain how the acceleration of a point in a link is determined when the acceleration of some other point on the same link is given in magnitude and direction. b) Draw the acceleration diagram of a slider crank mechanism.	Knowledge, Application	1,3
8	a) What is acceleration image? b) Draw and explain the velocity diagram of Whitworth quick return mechanism by assuming suitable proportions.	Knowledge, Application	1,3
9	Derive an expression for the magnitude of Coriolis component of acceleration.	comprehension	1,3
10	a) What is the practical significance of evaluating velocity and acceleration of members of a mechanism? b) Assuming suitable proportions determine the velocity and acceleration of a slider in Toggle mechanism.	Knowledge, Application	1,3
11	The Crank of a slider crank mechanisms rotates clockwise at a Constant speed of 600 r.p.m. The crank is 125 mm and connecting rod is 500 mm long. Determine 1. Linear velocity and acceleration of the mid Point of the connecting rod, and 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45^0 from inner dead centre position.	Knowledge, Application	1,3
12	In a four link mechanism, the dimensions of the links are AB=200 mm, BC=400mm, CD=450 mm and AD=600mm. At the instant when $DAB=90^0$, the link AB has angular velocity of 36 rad/s in the clockwise direction. Determine (i) The velocity of point C, (ii) The velocity of point E on the link BC When BE =200 mm (iii) the angular velocities of links BC and CD, iv) acceleration of link of link BC.	Knowledge, Application	1,3
13	The dimensions of the various links of a mechanism, as shown in fig. are as follows: OA=300 mm;AB=1200; BC=450 mm and CD=450 mm. if the crank OA rotates at 20 r.p.m. in the anticlockwise direction and gives motion to the sliding blocks B and D, find, for given configuration: (1) Velocity of sliding at B and D, (2) Angular velocity of	Knowledge, Application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	CD (3) Linear acceleration of D and (4) angular acceleration of CD.		
14	a) Derive the expressions for Velocity and acceleration of piston in reciprocating steam engine mechanism with neat sketch b). Derive the expression for Coriolis component of acceleration with neat sketch.	Knowledge, Application	1,3
15	In a slider crank mechanism, the length of the crank and the connecting rod are 100 mm and 400 mm respectively. The crank position is 45° from IDC, the crank shaft speed is 600 r.p.m. clockwise. Using analytical method Determine (1) Velocity and acceleration of the slider, and (2) Angular velocity and angular acceleration of the connecting rod.	Knowledge, Application	1,3
16	Locate all instantaneous centers of the slider crank mechanism; the length of crank OB and Connecting rod AB are 125 mm and 500 mm respectively. The crank speed is 600 rpm clockwise. When the crank has turned 45° from the IDC. Determine (i) velocity of slider 'A' (ii) Angular Velocity of connecting rod 'AB'.	Knowledge, Application	1,3
17	1. In the mechanism shown in figure, the crank OA rotates at 20 rpm anticlockwise and gives motion of sliding blocks B and D. The dimensions of various links are OA = 300mm, AB = 1200mm, BC = 450 mm and CD = 450 mm. For the given configuration determine i) velocities of sliding at B and D, ii) angular velocity of CD iii) Linear acceleration of D and iv) angular acceleration of CD.	Knowledge, Application	1,3
			
18	The crank and connecting rod of a theoretical steam engine are 0.5 m and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine : a) Velocity of piston b) Angular velocity of connecting rod. C) Velocity of point E on the connecting rod 1.5m from the gudgeon pin. D) velocity of rubbing at the pins of the crank shaft, crank and crank cross head when the diameters of their pins are 50mm and 60mm and 30mm respectively.	Knowledge, Application	1,3
19	A four-bar mechanism has the following link length in mm. Input, A0A = 25, AB = 70, output B0B = 45 and frame A0B0 = 60. Coupler point A is above and B is below the horizontal frame link A0B0, respectively. When the input link is in an angular position of 105° counter clockwise from the frame link, draw the four bar mechanism and locate all the instantaneous centres. If the input link rotates with a constant angular	Knowledge, Application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	velocity of 2.5 rad/sec clockwise, determine the linear velocity of B of the output link and the angular velocity of the output link.		
20	In a steam engine mechanism shown in figure a) the crank AB rotates at 200 rpm. The dimensions of various links are AB = 12cm, BC = 48cm, CD = 18cm and DE = 36cm, EF = 12 cm and FP = 36cm. Find the velocities of C,D,E,F and P. 	Knowledge, Application	1,3

UNIT-III
STRAIGHT LINE MOTION MECHANISMS

PART A-SHORT ANSWER QUESTIONS

1	What are straight line mechanisms?	Knowledge	1
2	What is Pantograph.	Comprehension	1
3	What is Ackerman steering gear mechanism	Comprehension	1
4	What is a Hooke's joint?	Knowledge	1
5	What is a Double Hooke's joint.	Knowledge	1
6	What is Davi's steering gear mechanism?	Knowledge	1
7	What are the applications of Hooke's joint.	Comprehension	1
8	List the exact straight line mechanisms.	Comprehension	1
9	List the approximate straight line mechanisms.	Knowledge	1
10	What is copied straight line mechanism	Knowledge	1
11	What is the use of pantograph?	Knowledge	1
12	Sketch the Harts mechanism.	Knowledge	1
13	Sketch the Peaucellier mechanism.	Comprehension	1
14	Sketch the Roberts mechanism.	Knowledge	1
15	Sketch the Scott Russell mechanism.	Comprehension	1
16	Sketch the grass hoper mechanism.	Knowledge	1
17	Sketch the Tchebecheffs mechanism.	Knowledge	1
18	Sketch the Watt mechanism.	Knowledge	1
19	Give the ratios of links for Tchebecheffs mechanism.	Knowledge	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
20	Give the ratios of links for Grasshopper mechanism.	Knowledge	1
PART B -LONG ANSWER QUESTIONS			
1	a) What are straight line mechanisms? b) Describe any one mechanism having all turning pairs that generate an exact straight line?	Knowledge, Application	1, 3
2	a) Explain the Peaucellier's straight line mechanism. b) Explain the principle of generation of straight line.	Knowledge, Application	1,3
3	a) What is an approximate straight line mechanism? b) Explain a mechanism which consists of a sliding pair.	Knowledge, Application	1,3
4	a) What is an exact straight line mechanism? b) Explain an exact straight line mechanism?	Knowledge, Application	1,3
5	a) Describe the Watt's parallel mechanism for straight line motion. b) Derive the condition for generating a straight line in Watt's mechanism?	Knowledge, Application	1,3
6	a) What is a Pantograph? What is its use? b) Explain Scot Russel mechanism with a neat sketch, Show that it generates a straight line?	Comprehension, Application	1, 3
7	a) Differentiate between Davi's and Ackerman steering gears. b) In a Davi's steering gear, the distance between the pivots of the front axle is 1 meter and the wheel base is 2.5 meters. Find the inclination of the track arm to the longitudinal axis of the car when it is moving along a straight path?	Comprehension, Application	1, 3
8	a) What is the condition for correct steering? b) Explain the Ackerman's steering gear mechanism.	Knowledge, Application	1,3
9	a) What is a Hooke's joint? What are its applications? b) A Hooke's joint connects two shafts whose axes intersect at 150° . The driving shaft rotates uniformly at 120 rpm. The driven shaft operates against a steady torque of 150NM. And carries a flywheel whose mass is 45 kg, and radius of gyration 150 mm. Find the maximum torque which will be exerted by the driving shaft.	Knowledge, Application	1, 3
10	a) What is a Double Hooke's joint? b) Derive an expression for the ratio of shaft velocities in a Hooke's joint.	Knowledge, Application	1,3
11	Explain Scott Russel mechanism with a neat sketch, Show that it generates a straight line?	Comprehension, Application	1, 3
12	Differentiate between Davi's and Ackerman steering gears.	Comprehension, Application	1, 3
13	In a Davi's steering gear, the distance between the pivots of the front axle is 1 meter and the wheel base is 2.5 meters. Find the inclination of the track arm to the longitudinal axis of the car when it is moving along a straight path?	Knowledge, Application	1,3
14	What is the condition for correct steering?	Knowledge, Application	1,3
15	Explain the Ackerman's steering gear mechanism.	Comprehension, Application	1, 3
16	a) What is a Hooke's joint? What are its applications?	Knowledge, Application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
17	b) A Hooke's joint connects two shafts whose axes intersect at 150° . The driving shaft rotates uniformly at 120 rpm. The driven shaft operates against a steady torque of 150NM. And carries a flywheel whose mass is 45 kg and radius of gyration 150 mm. Find the maximum torque which will be exerted by the driving shaft.	Knowledge, Application	1, 3
18	What is a Double Hooke's joint?	Knowledge, Application	1,3
19	Derive an expression for the ratio of shaft velocities in a Hooke's joint.	Knowledge, Application	1,3
20	Explain the Davis's steering gear mechanism.	Knowledge, Application	1,3
UNIT-IV CAMS			
PART A -SHORT ANSWER QUESTIONS			
1	Define cam.	Knowledge	1
2	Define angle of action.	Comprehension	1
3	Explain with the help of displacement diagrams the UARM.	Comprehension	1
4	What are the uses of cams and followers?	Knowledge	1
5	What is a tangent cam	Knowledge	1
6	Define follower	Knowledge	1
7	Classify the cams	Comprehension	1
8	Classify the follower types	Comprehension	1
9	A Define angle of dwell in cams.	Knowledge	1
10	Define pressure angle in cams.	Knowledge	1
11	What is meant by angle of ascend?	Knowledge	1
12	What is meant by angle of descend?	Knowledge	1
13	What is the application of cam?	Comprehension	1
14	What is meant by angle of action?	Knowledge	1
15	What is dwell?	Comprehension	1
16	What are the classifications of followers according to the path of motion?	Knowledge	1
17	What is the motion of the follower?	Knowledge	1
18	What are the necessary elements of a cam mechanism?	Knowledge	1
19	Write the formula for maximum velocity.	Knowledge	1
20	What are the classifications of follower according to the motion of the follower?	Knowledge	1
PART B -LONG ANSWER QUESTIONS			
1	a) Define a cam and mention the types? b) What are the various motions possible with cam and follower?	Knowledge, Application	1, 3
2	a) Define a follower and mention the types? b) Draw and explain the displacement and velocity diagrams for uniform velocity motion.	Knowledge, Application	1,3
3	a) Define the following terms as applied to cams with neat sketch: i) Base circle ii) pitch circle iii) pressure angle. b) Draw the profile of a cam with oscillating roller follower for the following motion: Follower to move outwards through an angular displacement of 20° during 120° of cam rotation, follower to dwell for 50° , follower to return to its initial position during 90° of cam rotation	Knowledge, Application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	with UARM, follower to dwell for the remaining period.		
4	a) Write short notes on cams and followers. b) Draw a cam to raise a valve through a distance of 50 mm in 1/3 of revolution with SHM, keep it fully raised through 1/12 of revolution and lower it with harmonic motion in 1/6 of revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20 mm and the minimum radius of the cam is 25 mm. The axis of the valve rod passes through the axis of the cam shaft.	Knowledge, Application	1,3
5	a) Draw and explain the displacement and velocity diagrams for Simple Harmonic motion. b) Lay out the profile of a cam so that the follower is to move outwards through 30 mm during 160° of cam rotation with Uniform velocity and dwell for 30° of cam rotation followed by returning to initial position with Uniform acceleration and retardation during 110° of cam rotation and dwell for the remaining period. The base circle diameter of cam is 28 mm and the follower is a knife edge follower. The axis of the follower is offset by 6 mm.	Knowledge, Application	1,3
6	a) Define angle of action, angle of dwell and pressure angle in cams. b) Lay out the profile of a cam so that the follower is to move outwards through 30 mm during 180° of cam rotation with SHM and dwell for 20° of cam rotation followed by returning to initial position with Uniform velocity during 160° of cam rotation. The base circle diameter of cam is 28 mm and the roller diameter is 8 mm. The axis of the follower is offset by 6 mm.	Comprehension, Application	1, 3
7	a) Explain with the help of displacement, velocity and acceleration diagrams the UARM. b) A cam operating a knife edge follower has the following data: Follower moves outward through 40 mm during 60° of cam rotation with uniform velocity, follower dwells for the next 45°, follower returns to its original position during next 90° with Uniform velocity and dwells for the remaining period. Draw the cam profile.	Comprehension, Application	1, 3
8	a) What are the uses of cams and followers? b) A radial translating flat faced follower has a lift of 30 mm. The rise takes place with SHM during 180° of cam rotation. The return also takes place with SHM during the next 180° of cam rotation. Assume anti clockwise rotation of the cam. Draw the cam profile and determine the maximum velocity and acceleration values when the follower rises and the cam rotates at 50 rpm.	Knowledge, Application	1, 3
9	a) Why a roller follower is preferred to a knife edge follower? b) Derive expressions for displacement, velocity and acceleration for a tangent cam operating a radial translating roller follower when the contact is on circular nose.	Knowledge, Application	1,3
10	a) What is a tangent cam? b) Derive an expression for the tangent cam when the follower is contacting the convex flanks.	Knowledge, application	1,3
11	A cam is to give the following motion to a knife edged follower: (a) Outstroke during 60° of cam rotation (b) Dwell for the next 45° of cam rotation (c) Return stroke during next 90° of cam rotation and (d) Dwell for the remaining of cam rotation The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the	Comprehension, Application	1, 3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	cam when (a) the axis of the follower passes through the axis of the cam shaft, and (b) the axis of the follower is offset by 20 mm from the axis of the cam shaft.		
12	Draw the profile of a cam operating a Knife-edged follower from the following data: (a) Follower to move outward through 40 mm during 60° of a cam rotation; (b) Follower to dwell for the next 45° (c) Follower to return its original position during next 90° (d) Follower to dwell for the rest of cam rotation. The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the cam is 50mm. If the cam rotates at 300 r.p.m., determine the maximum velocity and acceleration of the follower during the outward stroke and return stroke.	Knowledge, Application	1,3
13	A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife-edged follower the motion as described below: (a) To move outwards through 40 mm during 100° rotation of the cam; (b) to dwell for next 80° (c) To return to its starting position during next 90 ° and (d) To dwell for the rest period of revolution. Draw the profile of the cam (i) When the line of stroke of the follower passes through the centre of the cam shaft and (ii) When the line of stroke of the follower is to take place with Uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m.	Knowledge, Application	1,3
14	Draw the profile of a cam operating a roller reciprocating follower and with the following data: Minimum radius of cam =25 mm; lift=30mm; Roller diameter= 15mm. The cam lifts the follower for 120° with SHM, followed by a dwell period of 30°. Then the follower lowers down during 150° of cam rotation with uniform acceleration and retardation followed by a dwell period. If the cam rotates at a uniform speed of 150 RPM. Calculate the maximum velocity and acceleration of follower during the descent period.	Comprehension, Application	1, 3
15	It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat mushroom contact surface: (i) Follower to have a stroke of 20 mm during 120° of cam rotation, (ii) Follower to dwell for 30° of cam rotation, (iii) Follower to return to its initial position during 120° of cam rotation, (iv) Follower to dwell for remaining 90° of cam rotation. The minimum radius of the cam is 25 mm. The out stroke of the follower is performed with SHM and return stroke with equal uniform acceleration and retardation.	Knowledge, Application	1,3
16	A tangent cam to drive a roller follower through a total lift of 12.5 mm for a cam rotation of 75°.The cam speed is 600 rpm . The distance between cam centre and follower centre at full lift is 45 mm and the roller is 20 mm in diameter. Find the cam proportions and plot	Knowledge, Application	1, 3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	displacement, velocity and acceleration for one full cycle.		
17	Construct a tangent cam and mention the important terminologies on it. Also derive the expression for displacement, velocity, acceleration of a reciprocating roller follower when the roller has contact with the nose.	Knowledge, Application	1,3
18	Layout the profile of a cam operating a roller reciprocating follower for the following data. Lift of follower = 30mm; Angle during the follower rise period = 120°; angle during the follower after rise = 30°; angle during the follower return period = 150°. Angle during which follower dwell after return = 60°; minimum radius of cam = 25mm; Roller diameter = 10mm. The motion of follower is uniform acceleration and deceleration during the rise and return period.	Knowledge, Application	1,3
19	Design a cam to raise a valve with simple harmonic motion through 15mm in 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.	Knowledge, Application	1,3
20	a) Classify with neat sketches the cam follower according to their shape, location and motion. State also their advantages, if any, with respect to other followers b). Sketch neatly the displacement, velocity and acceleration curves of a SHM motion of Follower. Why is it superior over other motion curves?	Knowledge, Application	1,3
UNIT-V HIGHER PAIR			
PART A -SHORT ANSWER QUESTIONS			
1	Explain spur gears?	Knowledge	1
2	Describe cycloidal gears?	Comprehension	1
3	Explain the method of eliminating interference in gears.	Comprehension	1
4	What is a gear train and list its types?	Knowledge	1
5	What is a Differential?	Knowledge	1
6	Explain helical gears.	Knowledge	1
7	Classify bevel gears?	Comprehension	1
8	What is interference?	Comprehension	1
9	Mention the involute profiles of gears?	Knowledge	1
10	Define pressure angle of gears.	Knowledge	1
11	Define addendum and dedendum.	Knowledge	1
12	Define circular pitch.	Knowledge	1
13	Define path of contact.	Comprehension	1
14	Define Length of path of contact.	Knowledge	1
15	State the law of gearing.	Comprehension	1
16	Define angle of approach.	Knowledge	1
17	Define contact ratio.	Knowledge	1
18	Define helix angle (α).	Knowledge	1

S. No	Question	Blooms Taxonomy Level	Course Outcome
19	Define gear ratio.	Knowledge	1
20	Define epicyclic gear train.	Knowledge	1
PART B -LONG ANSWER QUESTIONS			
1	a) Explain spur, helical and bevel gears? b) Derive an expression for the length of path of contact.	Knowledge, Application	1, 3
2	a) Explain the terms module, pressure angle and addendum in gears. b) Two mating gears have 29 and 40 involute teeth of module 10 mm and 20° pressure angle. If the addendum on each wheel is such that the path of contact is maximum and interference is just avoided, find the addendum for each gear wheel, path of contact, arc of contact and contact ratio.	Knowledge, Application	1,3
3	a) Make a comparison of cycloidal and involute profiles of gears? b) A pair of 20° pressure angle gears in mesh have the following data: Speed of pinion = 400 rpm, Number of teeth on pinion = 24, number of teeth on gear = 28. Determine the addendum of the gears if the path of approach and recess is half the maximum value.	Comprehension, Application	1, 3
4	a) Explain the method of eliminating interference in gears. b) A pair of gears having 40 and 20 teeth respectively are rotating in mesh. The speed of the smaller is 2000 rpm. Determine the velocity of sliding at the point of engagement, at the pitch point and at the point of disengagement. Assume that the gear teeth are 20° involute, addendum is 5 mm and module is 5 mm.	Comprehension, Application	1, 3
5	a) Derive an expression for the length of arc of contact. b) The pitch circle diameter of the smaller of the two gears which mesh externally and have involute teeth is 100 mm. The number of teeth is 16 and 32. The pressure angle is 20° . The addendum is 0.32 of the circular pitch. Find the length of path of contact of the pair of teeth.	Knowledge, Application	1,3
6	a) Derive an expression for the minimum number of teeth on pinion to avoid interference. b) The pressure angle of two gears in mesh is 20° and have a module of 10 mm. The number of teeth on pinion are 24 and on gear 60. The addendum of pinion and gear is same and equal to one module. Determine the number of pairs of teeth in contact, the angle of action of pinion and gear, the ratio of sliding to rolling velocity at the beginning of contact, at pitch point and at the end of contact.	Comprehension, application	1,3
7	a) What is a gear train and what are its types? b) The speed ratio of a reverted gear train is 12. The module pitch of gears A and B which are in mesh is 3.125 mm and of gears C and D which are in mesh is 2.5 mm. Calculate the suitable number of teeth for the gears. No gear is to have less than 20 teeth. B-C is a compound gear.	Knowledge, Application	1, 3
8	a) Explain with a neat sketch the sun and planet wheel. b) In an epicyclic gear train, an arm carries two gears 1 and 2 having 40 and 50 teeth respectively. The arm rotates at 160 rpm counter clockwise about the centre of gear 1, which is fixed. Determine the speed of gear 2.	Knowledge, Application	1,3
9	a) What is a Differential? b) An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with two internal wheels. D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to shaft A coaxial with F. If the wheels have the same pitch and the shaft rotates at 800 rpm what is the speed of	Knowledge, application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	the shaft F? Sketch the arrangement.		
10	In an epicyclic gear train, internal gear A is keyed to the driving shaft and has 30 teeth. Compound wheel CD of 20 and 22 teeth respectively are free to rotate on a pin fixed to the arm P which is rigidly connected to the driven shaft. Internal gear B which has 32 teeth is fixed. If the driving shaft runs at 60 rpm clock wise, determine the speed of the driven shaft.	Knowledge, Application	1,3
11	In a reverted epicyclic train, the arm F carries two wheels A and D and a compound wheel B-C. Wheel A meshes with wheel B and Wheel D meshes with wheel C. The number of teeth on wheel A, D and C are 80, 48, and 72. Find the speed and direction of wheel D, when wheel A is fixed and arm F makes 200 rpm clockwise.	Knowledge, Application	1,3
12	Two mating spur gear with module pitch of 6.5 mm have 19 and 47 teeth of 20° pressure angle and 6.5 mm addendum. Determine the number of pair of teeth and angle turned through by the larger wheel for one pair of teeth in contact. Determine also the sliding velocity at the instant (i) engagement commences (ii) engagement terminates. When the pitch line velocity is 1.2 m/s.	Comprehension, Application	1, 3
13	The number of teeth on each of the two spur gears in mesh is 40. The teeth have 20° involute profile and the module is 6mm. If the arc of contact is 1.75 times the circular pitch. Find the addendum.	Knowledge, Application	1,3
14	Two 20° involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and pinion 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference?	Knowledge, Application	1,3
15	Two mating involute spur gears 20° pressure angle have a gear ratio of 2. The number of teeth on the pinion is 20 and its speed is 250 rpm. The module pitch of the teeth is 12 mm. If the addendum on each wheel wheel recess on each side are half the maximum possible length each, find (1) the addendum for pinion and gear wheel (2) the length of arc of contact (3) the maximum velocity of sliding during approach and recess. Assume pinion to be driver.	Comprehension, Application	1, 3
16	A pair of spur gear with involute teeth is to give a gear ratio of 4:1. The arc of approach is not be less than the circular pitch and the smaller wheel is the driver. The angle of pressure is 14.5 What is the least number of teeth can be used on each wheel? What is the addendum of the wheel in terms of circular pitch?	Knowledge, Application	1,3
17	A pair 20° full depth involute spur gear having 30 and 50 teeth respectively module 4 mm arc in mesh, the smaller gear rotates at 1000 rpm. Determine (a) Sliding velocities at engagement and disengagement of a pair of teeth and (b) Contact ratio.	Knowledge, Application	1, 3
18	In an epicyclic gear train the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C. Wheel F gear with B and D. All the wheels have the same module and the number of teeth are: TC =28 TD=26; TE = TF=18. (1) Sketch the arrangement, (2) Find the number of teeth on A and B, (3) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B, and (4) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clockwise; Find the speed of wheel B.	Knowledge, Application	1,3
19	Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module=6mm, addendum=one module, pressure angle= 20°. The pinion rotates at 90 rpm. Determine (1) the number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, (2) The length of path and	Knowledge, Application	1,3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	arc of contact, (3) the number of pairs of teeth in contact.		
20	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).	Knowledge, Application	1,3

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