INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**MECHANISM AND MACHINE DESIGN**
Course Code	:	**AAE523**
Program	:	**B. Tech**
Semester	:	**V**
Branch	:	**Aeronautical Engineering**
Section	:	**A&B**
Academic Year	:	**2019– 2020**
Course Faculty	:	**Mr. M Vijay Kumar, Assistant Professor**

COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand the basic principles of kinematics and the related terminology of machines
II	Discriminate mobility; enumerate links and joints in the mechanisms.
III	Formulate the concept of analysis of different mechanisms
IV	Develop the working of various straight line mechanisms, gears, gear trains, steering gear mechanisms, cams and a Hooke's joint
V	Analyze a mechanism for displacement, velocity and acceleration of links in machine

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		UNIT – I				
1	Define machine?	An apparatus using mechanical power and having several parts, each with a definite function and together performing a particular task	Remember	CO 1	CLO1	AAE523.01
2	What is mechanism?	A system of parts working together in a machine; a piece of machinery	Remember	CO 1	CLO1	AAE523.01
3	Describe machine design?	Machine design is defined as the use of imagination, scientific principles and engineering techniques to create a machine or structure economically, in order to satisfy the requirements of a customer. Machine design is the first step involved in creation of a machine.	Understand	CO 1	CLO1	AAE523.01

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4	What is mechanics?	It is that branch of scientific analysis which deals with motion, time and force.	Remember	CO 1	CLO1	AAE523.01
5	Define the term Kinematics?	Kinematics is the study of motion, without considering the forces which produce that motion. Kinematics of machines deals with the study of the relative motion of machine parts.	Remember	CO 1	CLO1	AAE523.01
6	What is a Dynamics?	Dynamics of machines involves the study of forces acting on the machine parts and the motions resulting from these forces.	Understand	CO 1	CLO1	AAE523.01
7	Define plane motion?	A body has plane motion, if all its points move in planes which are parallel to some reference plane.	Understand	CO 1	CLO2	AAE523.02
8	What is translation?	A body has translation if it moves so that all straight lines in the body move to parallel positions. Rectilinear translation is a motion wherein all points of the body move in straight lie paths	Understand	CO 1	CLO2	AAE523.02
9	Define Binary link.	Link which is connected to other links at two points.	Remember	CO 1	CLO2	AAE523.02
10	Define ternary link.	Link which is connected to other links at three points	Understand	CO 1	CLO2	AAE523.02
11	Define quaternary link.	Link which is connected to other links at four points	Remember	CO 1	CLO2	AAE523.02
12	What is the use of Hook's joint?	Hook's joins is used to connect two nonparallel but intersecting shafts.	Understand	CO 1	CLO2	AAE523.02
13	What is resistant body?	A resistant body is that which does not suffer appreciable distortion or change in physical form by forces acting on it. Some flexible bodies like belts, ropes and chains etc. may be treated as resistant bodies.	Remember	CO 1	CLO2	AAE523.02
14	Define Kinematic link.	Each part of machine which moves relative to other is called kinematic link or element. A link or an element may consist of a number of parts connected in such a way that they form one unit and have no relative motion with each other.	Remember	CO 1	CLO3	AAE523.03
15	Name of types of links.	Rigid link, Flexible link, Fluid link	Understand	CO 1	CLO3	AAE523.03
16	What is flexible link?	A flexible link is that which, while transmitting motion, is partly deformed in such a manner that transmission of motion is not affected. Such a link transmits motion in one direction only (push or pull). Examples are belts, ropes, springs, chains etc.	Remember	CO 1	CLO3	AAE523.03
17	What is frame?	It is a structure which supports the moving parts of a machine	Remember	CO 1	CLO3	AAE523.03
18	Describe lower pair?	If the joint by which two members are connected has surface contact, the pair is known as lower pair. Eg. pin joints, shaft rotating in bush, slider in slider crank mechanism.	Remember	CO 1	CLO3	AAE523.03

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19	What is higher pair?	If the contact between the pairing elements takes place at a point or along a line, such as in a ball bearing or between two gear teeth in contact, it is Known as a higher pair.	Remember	CO 1	CLO3	AAE523.03
20	What is sliding pair?	It is constituted by two elements so connected that one is constrained to have a sliding motion relative to the other. DOF = 1	Understand	CO 1	CLO4	AAE523.04
21	Define turning pair.	When connections of the two elements are such that only a constrained motion of rotation of one element with respect to the other is possible, the pair constitutes a turning pair. DOF = 1	Understand	CO 1	CLO4	AAE523.04
22	Define spherical pair.	A spherical pair will have surface contact and three degrees of freedom. Eg. Ball and socket joint. DOF = 3	Remember	CO 1	CLO4	AAE523.04
23	Define Helical pair.	Helical pair or screw pair. When the nature of contact between the elements of a pair is such that one element can turn about the other by screw threads, it is known as screw pair. Eg. Nut and bolt. DOF = 1	Remember	CO 1	CLO4	AAE523.04
24	What is pantograph?	An instrument for copying a plan or drawing on a different scale by a system of hinged and jointed rods	Understand	CO 1	CLO4	AAE523.04
25	What is the use of pantograph?	Pantographs are used for reducing or enlarging drawings and maps. They are also used for guiding cutting tools or torches to fabricate complicated shapes.	Remember	CO 1	CLO4	AAE523.04
UNIT – II						
1	Describe velocity?	It is the rate of change of displacement.	Remember	CO 2	CLO5	AAE523.05
2	What is Acceleration?	It is the rate of change of velocity	Remember	CO 2	CLO5	AAE523.05
3	Define is Absolute motion?	The motion of body in relative to another body which is at rest or to a fixed point located on this body.	Understand	CO 2	CLO5	AAE523.05
4	What is Relative motion?	The motion of body in relative to another moved body.	Remember	CO 2	CLO5	AAE523.05
5	Describe the concept of velocity analysis?	As dynamic forces are a function of acceleration and acceleration is a function of velocities, study of velocity and acceleration will be useful in the design of mechanism of a machine. The mechanism will be represented by a line diagram which is known as configuration diagram. The analysis can be carried out both by graphical method as well as analytical method.	Remember	CO 2	CLO5	AAE523.05
6	What is velocity formula?	V = dx/dt	Remember	CO 2	CLO5	AAE523.05
7	Define turning pair.	When connections of the two elements are such that only a constrained motion of rotation of one element with respect to the other is possible.	Understand	CO 2	CLO6	AAE523.06

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8	What is linear velocity formula?	V = rω	Remember	CO 2	CLO6	AAE523.06
9	Explain the term' angular velocity?	Angular velocity is Rate of change of angular displacement	Remember	CO 2	CLO6	AAE523.06
10	What is the relation between linear and angular velocity?	V = rω	Understand	CO 2	CLO6	AAE523.06
11	List the points of velocity analysis by using graphical method.	Draw the configuration design to a suitable scale. Locate all fixed point in a mechanism as a common point in velocity diagram. Choose a suitable scale for the vector diagram velocity. The velocity vector of each rotating link is perpendicular to the link. Velocity of each link in mechanism has both magnitude and direction. Start from a point whose magnitude and direction is known. The points of the velocity diagram are indicated by small letters.	Remember	CO 2	CLO6	AAE523.06
12	What are the components of Coriolis Acceleration?	It has been seen that the acceleration of a body may have two components. Centripetal acceleration and tangential acceleration.	Understand	CO 2	CLO7	AAE523.07
13	Define Slider-crank mechanism	Slider-crank mechanism, arrangement of mechanical parts designed to convert straight-line motion to rotary motion, as in a reciprocating piston engine, or to convert rotary motion to straight-line motion, as in a reciprocating piston pump.	Understand	CO 2	CLO7	AAE523.07
14	Describe toggle mechanisms.	Toggle mechanisms are used, where large resistances are to be overcome through short distances. Here, effort applied will be small but acts over large distance.	Remember	CO 2	CLO7	AAE523.07
15	What is toggle mechanism?	A mechanism utilized to apply heavy pressure from a small applied force, such as in a jaw breaker and other machinery.	Understand	CO 2	CLO7	AAE523.07
16	Define four-bar mechanism	A four-bar linkage, also called a four-bar, is the simplest movable closed-chain linkage. It consists of four bodies, called bars or links, connected in a loop by four joints.	Remember	CO 2	CLO8	AAE523.08
17	Robert's mechanism is what type of mechanism?	It is an approximate straight line motion mechanism.	Understand	CO 2	CLO8	AAE523.08
18	What is An intermittent-motion mechanism?	An intermittent-motion mechanism is a linkage which converts continuous motion into intermittent motion	Remember	CO 2	CLO8	AAE523.08
19	Define sliding	Able to move smoothly along a surface	Understand	CO 2	CLO8	AAE523.08
20	What is the use of Ratchets?	Ratchets are used to transform motion of rotation or translation into intermittent rotation or translation.	Remember	CO 2	CLO8	AAE523.08

		UNIT – III				
1	What is Instantaneous center?	The instant center of rotation, also called instantaneous velocity center, or also instantaneous center or instant center, is the point fixed to a body undergoing planar movement that has zero velocity at a particular instant of time.	Remember	CO 3	CLO9	AAE523.09
2	What is the formula for I-center?	n(n-1)/2	Understand	CO 3	CLO9	AAE523.09
3	What is the full form of I-center?	Instantaneous center	Remember	CO 3	CLO9	AAE523.09
4	Define centroid	The centre of mass of a geometric object of uniform density	Understand	CO 3	CLO9	AAE523.09
5	Define angular velocity	The rate of change of angular position of a rotating body.	Understand	CO 3	CLO9	AAE523.09
6	What is the formula for Angular velocity	Angular velocity = (final angle) - (initial angle) / time = change in position/time.	Remember	CO 3	CLO9	AAE523.09
7	Define Gyroscope	A device consisting of a wheel or disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction.	Remember	CO 3	CLO10	AAE523.10
8	What are the types of Gyroscope?	Rotary (classical) gyroscopes. Vibrating Structure Gyroscope. Optical Gyroscopes.	Remember	CO 3	CLO10	AAE523.10
9	What is the working principle of Gyroscope	Gyroscope works on the principle that Angular momentum changes in the direction of Torque. A gyroscope is a spinning wheel or disc in which the axis of rotation is free to assume any orientation by it.	Remember	CO 3	CLO10	AAE523.10
10	Define static force	A static force refers to a constant force applied to a stationary object. A static force is too weak to move an object because it is being countered by equally strong opposite forces	Remember	CO 3	CLO10	AAE523.10
11	Define Dynamic force	In physics dynamic force can be closely described as amount of acceleration/velocity, needed to move an object. Dynamic force is the process by which the energy from an action increases or decreases	Remember	CO 3	CLO10	AAE523.10
12	Define precession	The slow movement of the axis of a spinning body around another axis due to a torque (such as gravitational influence) acting to change the direction of the first axis. It is seen in the circle slowly traced out by the pole of a spinning gyroscope	Understand	CO 3	CLO10	AAE523.10
13	Define Plane Motion	Plane Motion is the motion of a rigid body such that all its points move parallel to some fixed plane	Understand	CO 3	CLO10	AAE523.10
14	What is Constrained motion?	Constrained motion results when an object is forced to move in a restricted way. For example, it may have to move along a curved track, to slide on a table that may accelerate upwards, to stay in contact with an accelerating wedge, etc	Understand	CO 3	CLO11	AAE523.11

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15	Define free gyro	In a free gyro, output signals are produced by the gimbals' angular displacements that correspond to components of the angular displacement of the base. ii. A gyro not provided with an erection system (i.e., a gyro free to move about its axes).	Understand	CO 3	CLO11	AAE523.11
16	Define rate gyro	A rate gyro is a type of gyroscope, which rather than indicating direction, indicates the rate of change of angle with time. If a gyro has only one gimbal ring, with consequently only one plane of freedom, it can be adapted for use as a rate gyro to measure a rate of angular movement	Remember	CO 3	CLO11	AAE523.11
17	What is meant by accelerometer	An accelerometer is an electromechanical device used to measure acceleration forces. Such forces may be static, like the continuous force of gravity or, as is the case with many mobile devices, dynamic to sense movement or vibrations. Acceleration is the measurement of the change in velocity, or speed divided by time	Remember	CO 3	CLO11	AAE523.11
18	Explain the term sensor in a gyroscope	A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena.	Remember	CO 3	CLO12	AAE523.12
19	What is stability?	The quality, state, or degree of being stable: such as. a: the strength to stand or endure : firmness. b : the property of a body that causes it when disturbed from a condition of equilibrium or steady motion to develop forces or moments that restore the original condition	Remember	CO 3	CLO12	AAE523.12
20	Explain types of stability	1) Longitudinal stability 2) Lateral stability	Understand	CO 3	CLO12	AAE523.12
		UNIT - IV				
1	What is cam?	A cam is a mechanical device used to transmit motion to a follower by direct contact. The driver is called the cam and the driven member is called the follower. In a cam follower pair, the cam	Understand	CO 4	CLO13	AAE523.13
2	What is Disk or plate cam?	The disk (or plate) cam has an irregular contour to impart a specific motion to the follower. The follower moves in a plane perpendicular to the axis of rotation of the camshaft and is held in contact with the cam by springs or gravity.	Remember	CO 4	CLO13	AAE523.13
3	What is cylindrical cam?	The cylindrical cam has a groove cut along its cylindrical surface. The roller follows the groove, and the follower moves in a plane parallel to the axis of rotation of the cylinder.	Understand	CO 4	CLO13	AAE523.13

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4	Define translating cam.	The translating cam is a contoured or grooved plate sliding on a guiding surface(s). The follower may oscillate or reciprocate .The contour or the shape of the groove is determined by the specified motion of the follower.	Remember	CO 4	CLO13	AAE523.13
5	List types of followers.	Knife edge follower Roller follower Flat faced follower Spherical follower	Remember	CO 4	CLO13	AAE523.13
6	Define Cam Profile.	The contour of the working surface of the cam.	Understand	CO 4	CLO14	AAE523.14
7	Define Tracer point.	The point at the knife edge of a follower, or the center of a roller, or the center of a spherical face.	Remember	CO 4	CLO14	AAE523.14
8	What is Pitch Curve?	The path of the tracer point.	Understand	CO 4	CLO14	AAE523.14
9	What is base circle?	The smallest circle drawn, tangential to the cam profile, with its center on the axis of the camshaft. The size of the base circle determines the size of the cam.	Remember	CO 4	CLO14	AAE523.14
10	What is Prime Circle?	The smallest circle drawn, tangential to the pitch curve, with its center on the axis of the camshaft.	Remember	CO 4	CLO14	AAE523.14
11	What is Pressure Angle?	The angle between the normal to the pitch curve and the direction of motion of the follower at the point of contact.	Remember	CO 4	CLO15	AAE523.15
12	What is a standard follower motion?	Uniform velocity. Modified uniform velocity. Uniform acceleration and acceleration. Simple harmonic motion. Cycloidal motion.	Remember	CO 4	CLO15	AAE523.15
13	Explain displacement diagram.	In a cam follower system, the motion of the follower is very important. Its displacement can be plotted against the angular displacement θ of the cam and it is called as the displacement diagram. The displacement of the follower is plotted along the y-axis and angular displacement θ of the cam is plotted along x-axis.	Understand	CO 4	CLO15	AAE523.15
14	What is cam joint?	A connection between two links that is formed by general surfaces in contact is called a cam-joint.	Remember	CO 4	CLO15	AAE523.15
15	What is cam follower mechanism?	A cam-follower mechanism has a two degree of freedom cam joint that connects the input and output links. The relative shape of the cam and follower define the displacement function of the mechanism.	Remember	CO 4	CLO15	AAE523.15
16	Define degrees of freedom	In physics, the degree of freedom (DOF) of a mechanical system is the number of independent parameters that define its configuration. It is the number of parameters that determine the state of a physical system and is important to the analysis of systems of bodies in mechanical engineering etc	Understand	CO 4	CLO16	AAE523.16

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17	What is the condition of perfect steering?	The condition for perfect steering is that all the four wheels must turn about the same instantaneous centre. While negotiating a curve, the inner wheel makes a larger turning angle θ than the angle φ subtended by the axis	Understand	CO 4	CLO16	AAE523.16
18	Define uniform velocity	A body is said to have uniform velocity if it covers equal distance in equal intervals of time in a particular direction, however the time intervals may be small. This means that if a body is traveling at a constant speed along a straight line (i.e, a particular direction) then it said to have uniform velocity.	Understand	CO 4	CLO16	AAE523.16
19	Define SHM	The harmonic motion of constant amplitude in which the acceleration is proportional and oppositely directed to the displacement of the body from a position of equilibrium: the projection on any diameter of a point in uniform motion around a circle.	Remember	CO 4	CLO16	AAE523.16
20	What is rigid body	a rigid body (also known as rigid object is a solid body in which deformation is zero or so small it can be neglected. The distance between any two given points on a rigid body remains constant in time regardless of external forces exerted on it. A rigid body is usually considered as a continuous distribution of mass.	Remember	CO 4	CLO16	AAE523.16
		UNIT - V				
1	What is gear train?	A gear train is two or more gear working together by meshing their teeth and turning each other in a system to generate power and speed. It reduces speed and increases torque. To create large gear ratio, gears are connected together to form gear trains. They often consist of multiple gears in the train.	Remember	CO 5	CLO17	AAE523.17
2	What is module?	It is the ratio of the pitch circle diameter to the number of teeth. Module =D/T	Remember	CO 5	CLO17	AAE523.17
3	What is the ideal diameter of gear?	Pitch circle diameter	Remember	CO 5	CLO17	AAE523.17
4	What is Reverted Gear train?	The driver and driven axes lies on the same line. These are used in speed reducers, clocks and machine tools.	Remember	CO 5	CLO17	AAE523.17
5	What is Epicyclic gear train?	Epicyclic means one gear revolving upon and around another. The design involves planet and sun gears as one orbits the other like a planet around the sun.	Understand	CO 5	CLO17	AAE523.17
6	What is dedendum circle?	It is the circle drawn through the bottom of the teeth and is concentric with the pitch circle. Dedendum circle is also called root circle.	Remember	CO 5	CLO17	AAE523.17
7	What is dedendum?	It is the radial distance from the pitch circle to the bottom of the tooth. Its standard value is 1.157m	Remember	CO 5	CLO18	AAE523.18

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8	What is Backlash?	It is the amount by which the width of a tooth space exceeds the thickness of the engaging tooth on the pitch circles.	Remember	CO 5	CLO18	AAE523.18
10	Define gear nomenclature.	It is the surface of the top of the tooth	Remember	CO 5	CLO18	AAE523.18
11	Define face width.	It is the length of the tooth parallel to the gear axis	Understand	CO 5	CLO18	AAE523.18
12	Define face.	It is the tooth surface between the pitch circle and the top land.	Remember	CO 5	CLO18	AAE523.18
13	Define flank.	It is the tooth surface between the pitch circle and the bottom land.	Remember	CO 5	CLO18	AAE523.18
14	Define bottom land.	It is the surface of the bottom tooth between adjacent fillets.	Remember	CO 5	CLO18	AAE523.18
15	What is fillet?	It is the curved portion of the tooth flank at the root circle.	Remember	CO 5	CLO19	AAE523.19
16	Define total depth.	It is the radial distance between the addendum circle and the dedendum circle of a gear. It is equal to the sum of addendum and the dedendum of Gear. It is also represented as Whole depth.	Remember	CO 5	CLO19	AAE523.19
18	Define pitch point	It is the point of tangency of the two pitch circles or a pitch circle and a pitch line. It lies on the line of centers	Understand	CO 5	CLO19	AAE523.19
19	Define pressure angle	The pressure angle exists between the tooth profile and a radial line to its pitch point. In involute teeth, it is defined as the angle formed by the radial line and the line tangent to the profile at the pitch point.	Understand	CO 5	CLO19	AAE523.19
20	Define gear ratio	The ratio of the number of teeth on gear to that on the pinion is known as a gear ratio. Gear Ratio= T/t.	Understand	CO 5	CLO19	AAE523.19
21	What is law of gearing?	It states that the common normal at the point of contact always passes through pitch point	Remember	CO 5	CLO19	AAE523.19
22	Name forms of gear teeth	i) Involute teeth. ii) Cycloidal teeth.	Understand	CO 5	CLO20	AAE523.20
23	which relation is used to obtain minimum number of teeth in order to avoid interference with wheel	Minimum number of teeth $= 2\,A_w / [\ \sqrt{(1+ 3\,\sin^2 \Phi)}\ ] – 1$ where A_w = addendum coefficient of wheel	Remember	CO 5	CLO20	AAE523.20
24	What is arc of contact?	It is the path traced by a point on the pitch circle from the beginning to the end of engagement of a given pair of teeth.	Remember	CO 5	CLO20	AAE523.20

Signature of the Faculty   **HOD, AE**