



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)  
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.



## MUST KNOW CONCEPTS

MKC

Mechanical

2021-22

Course Code & Course Name : 19GES28 & Engineering Mechanics

Year/Sem/Sec : II/III

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
<b>Unit-I : Basics and Statics of Particles</b>				
1.	Engineering Mechanics	---	It is the science that describes and predicts the effect of forces on objects either at rest or in motion.	
2.	Classification of Mechanics	---	Mechanics of solids, Mechanics of fluids.	
3.	Statics	---	It is the study of distribution and effect of forces on rigid bodies which are at rest and remain at rest.	
4.	Dynamics	---	It is study of motion of rigid bodies and their correlation with the forces causing them.	
5.	Kinematics	---	It is the study of motion of bodies without any reference to the forces causing motion of forces produced as a result of the motion.	
6.	Kinetics	---	It is the study of the relationship between the forces and the resulting motion.	
7.	Rigid body	---	It represents the definite amount of matter, the parts of which are fixed in position relative to another. i.e. A rigid body is a body that does not deform	
8.	Particle	---	A body whose dimensions are negligible when compared with the distances or the length involved in the discussion of its motion is called a particle.	
9.	Basic Concepts of Engineering Mechanics	---	Space, Time , Mass, Force	
10.	Space	---	It is used to fix the position of a point in relation to a reference point known as Origin	
11.	Time	---	It is used to measure the sequence of	

			events.	
12.	Mass	---	It is used to measure of inertia or resistance to change its state of a body	
13.	Force	---	It is essential because it changes or tends to change the state of rest or uniform motion of body.	
14.	Characteristics of force	---	Magnitude, Direction and point of application (line of action)	
15.	Force System	---	Coplanar (Plane), Non-coplanar( Space)	---
16.	Coplanar	---	Collinear, Concurrent, Parallel, Non-Concurrent, Non-Parallel	---
17.	Non-coplanar	---	Concurrent, Parallel, Non-Concurrent, Non-Parallel	---
18.	Coplanar forces	---	Lines of action of all forces lie on the same plane	---
19.	Non-coplanar forces	---	Lines of action of all forces that do not lie on the same plane	---
20.	Collinear	---	Lines of action of all the forces act along the same line	---
21.	Concurrent forces	---	Lines of action of all forces act along the same line	---
22.	Parallel forces	---	Lines of action of all forces that are parallel to each other.	---
23.	Fundamental principles	---	Newton's three laws of motion, Newton's law of gravitation, Parallelogram law, Principle of Transmissibility.	---
24.	System of units	---	Centimeter-Gram-Second System (CGS), Foot-Pound-Second System (FPS), Meter-Kilogram-Second System (MKS), International system of units (SI)	---
25.	Force	F	It is defined as the force which gives an acceleration of $1 \text{ m/s}^2$ to a mass of 1 kg in the direction of force. $1 \text{ N} = 1 \text{ kg} \times 1 \text{ m/s}^2$ .	N

### Unit-II : Equilibrium of Rigid Bodies

26.	Equilibrium of a particle		A body is said to be in equilibrium, when the resultant of the force system acting on it is zero.	
27.	Equilibrant		Equal in magnitude of the resultant but opposite in direction	
28.	Equations of		$R = 0; \Sigma F_x = 0; \Sigma F_y = 0; R = \text{resultant.}$	

	equilibrium			
29.	Free body		It is the body is isolated from all other members which are connected to this body	
30.	Free body Diagram		It is a sketch of the isolated body which shows all external forces on the body and the reactions exerted on it by removed elements.	
31.	Equilibrium of Two Force Body		A body when subjected to only two forces and is in equilibrium is known as two force body. The two forces must be collinear, must have same magnitude but opposite in direction.	
32.	Equilibrium of Three Force Body		When a body is subjected to only three forces and is in equilibrium, they must form a closed triangle when we apply the polygon law of forces.	
33.	Moment of a Force	M	The Moment of a force is a measure of its tendency to cause a body to rotate about a specific point or axis. Moment = $Fd$ ; F= Force; d= perpendicular distance	Nm
34.	Varignon's Theorem		This is used to determine the moment of the resultant of several concurrent forces. It states, the moment about a given point 'O' of the resultant of several concurrent forces is equal to the sum of the moments of various forces about the same point 'O'.	
35.	Moment of a Couple		The two forces of the same magnitude, parallel lines of action and opposite sense are said to form a couple	Nm
36.	Equations of equilibrium of rigid bodies		$\Sigma F_x = 0$ ; $\Sigma F_y = 0$ ; $\Sigma M = 0$ .	
37.	Example for Vector		Velocity, Acceleration	
38.	Scalar Example		Mass, Weight	
39.	Support Reaction		Developed by a support prevents translation of a body in a given direction	
40.	Couple	---	Two forces same in magnitude but opposite in direction	
41.	Momentum	---	Product of mass and velocity	
42.	Types of couple	---	Clock wise and anti clock wise	
43.	$\Sigma H$	---	Algebraic sum of all Horizontal forces	

44.	$\Sigma V$	---	Algebraic sum of all Horizontal forces	
45.	$\Sigma M$	---	Algebraic sum of moments	
46.	SSB	---	Simply supported beam	
47.	Cantilever beam	---	One end is supported and other end is free	
48.	Truss	---	Fully constrained structure	
49.	Beam	---	A horizontal structural member	
50.	Frame	---	Several members riveted or welded together	

### Unit-III : Properties of Surfaces and Solids

51.	Centre of Gravity	---	The point at which whole weight of the body is assumed to have concentrated is called as centre of gravity	
52.	Centroid	---	The point at which whole area of the body is assumed to have concentrated is called as centre of gravity	
53.	Moment of Inertia	---	It is a quantity that determines the torque needed for a desired angular acceleration about a rotational axis	
54.	Parallel Axes Theorem	---	The moment of inertia about an axes in the plane is the sum of the moment of inertia about a parallel axis passing through centroid and the product of the area and square of the distance between the two parallel axes	
55.	Product of Inertia	---	Product of inertia is the product of a elementary area with the x and y coordinates of its centroid and then integrating it to cover the whole area	
56.	Principal Moment of Inertia	---	The maximum and minimum moment of inertias are called as principal moment of inertia	
57.	Mass Moment of Inertia	---	Mass moment of inertia of a body is the second moment of the mass about an axis. It is the measure of resistance of a body towards angular acceleration.	
58.	Radius of Gyration	---	the distance from the axis of rotation to the point where the entire area may be assumed to be concentrated	
59.	Perpendicular Axis Theorem	---	The moment of inertia of a planar lamina about an axis perpendicular to the plane of the lamina is equal to the	

			sum of the moments of inertia of the lamina about the two axes at right angles to each other, in its own plane intersecting each other at the point where the perpendicular axis passes through it.	
60.	Section modulus	Z	The ratio of moment of inertia of a section about the neutral axis to the distance of the outermost layer from the NA	
61.	Neutral axis		A line or plane through a beam or plate connecting points at which no extension or compression occurs when it is bent.	
62.	Symmetrical section		Sections will be called symmetrical, if a given section is cut around axes such that one portion is the exact image of the other	
63.	Homogenous material		A material of uniform composition throughout that cannot be mechanically separated into different materials.	
64.	Heterogeneous material		A heterogeneous material is one whose individual components can be discerned.	
65.	Moment of resistance		The couple produced by the internal forces in a beam subjected to bending under the maximum permissible stress.	
66.	Isotropy		Uniformity in all directions	
67.	L Section		A typical longitudinal section of a road	
68.	Longitudinal Section		Longitudinal Section pertains to a section done by a plane along the long axis of a structure in contrast to the other term, cross section, which is a section that is cut transversely.	
69.	T Beam		Used in construction, is a load-bearing structure of reinforced concrete, wood or metal, with a T-shaped cross section	
70.	Polar Moment of Inertia		It is a quantity used to describe resistance to torsional deformation (deflection), in cylindrical objects	
71.	Two-dimensional shapes	2D	A 2D shape is a shape with two dimensions, such as width and height; a 3D shape is a shape with three dimensions, such as width, height and depth.	

72.	Torsion		The action of twisting or the state of being twisted, especially of one end of an object relative to the other.	
73.	Centroidal axis		Centroidal axis is any line that will pass through the centroid of the cross section.	
74.	Dead load		Relatively constant over time	
75.	Flitch beam		It is a compound beam used in the construction of houses, decks, and other primarily wood-frame structures.	

#### Unit-IV : Dynamics of Particles

76.	Displacement		Change in position, that is, where an object is in relation to some reference point. It is measured in metres (m), and its symbol is usually, x, or s or sometimes d	
77.	Angular Displacement		Angular displacement of a body is the angle in radians through which a point revolves around a centre or line has been rotated in a specified sense about a specified axis.	
78.	Velocity		Rate of change of its position with respect to a frame of reference, and is a function of time	
79.	Acceleration		Rate of change of the velocity of an object with respect to time	
80.	Rectilinear motion		A rectilinear motion is a straight-line motion.	
81.	Curvilinear motion		A curvilinear motion is a motion along a curved path.	
82.	Impulse		The impulse of the force is equal to the change of the momentum of the object.	
83.	Momentum		The total momentum before the collision is equal to the total momentum after the collision	
84.	Inertia		A body's tendency to remain at rest or in motion	
85.	Law of Inertia		A body remains at rest or in motion unless acted upon by a force	
86.	Law of acceleration		The acceleration of an object is proportional to the force causing it, is in the same direction as the force and relates to the mass of the object	$m/s^2$
87.	Law of reaction		For every action there is an equal and opposite reaction	
88.	Energy		Energy is the quantitative property that	

			must be transferred to an object in order to perform work on, or to heat, the object	
89.	Kinetic Energy	KE	The energy an object has due its motion.	J
90.	Potential Energy	PE	energy that is stored – or conserved - in an object or substance	J
91.	Work		Work is the energy transferred to or from an object via the application of force along a displacement	
92.	Dynamics		Deals with forces and their relation primarily to the motion but sometimes also to the equilibrium of bodies.	
93.	Statics		The branch of mechanics concerned with bodies at rest and forces in equilibrium.	
94.	D-Alembert Principle		An accelerating rigid body into an equivalent static system by adding the so-called "inertial force" and "inertial torque" or moment	
95.	Angular Velocity		refers to how fast an object rotates or revolves relative to another point	
96.	Angular Acceleration		Angular acceleration refers to the time rate of change of angular velocity.	
97.	Elastic Potential Energy		Energy stored in a compressed or stretched material	
98.	Projectile		Any object thrown by the exertion of a force.	
99.	Projectile Motion		A form of motion experienced by an object or particle that is projected near the Earth's surface and moves along a curved path under the action of gravity only	
100.	Instantaneous Velocity		Velocity of an object in motion at a specific point in time.	

**Unit-V : Friction**

101.	Friction		A force which prevents the motion or movement of the body is called friction or force of friction	
102.	Static Friction		Friction acting on the body when the body is at the state of rest	
103.	Dynamic Friction		Friction acting on the body when body is in motion is called dynamic friction.	
104.	Sliding friction		The sliding friction acts on those bodies, which slide over each other	
105.	Rolling Friction		The rolling friction acts on those bodies	

			which have point contact with each other	
106.	Limiting Friction		The maximum friction (before the movement of body) which can be produced by the surfaces in contact is known as limiting friction	
107.	Co-efficient of Friction		The ratio of limiting friction and normal reaction	
108.	Instantaneous centre of rotation		A point identified with in a body where the velocity is zero.	
109.	Elastic Collision		A collision in which there is no net loss in kinetic energy in the system as a result of the collision	
110.	Ladder		A ladder is an arrangement used for climbing on the walls	
111.	General Plane Motion		When motion of particles and rigid bodies defined in a plane is called plane motion.	
112.	Wedge		It is a piece of metal or wood which is usually of a triangular or trapezoidal in cross-section.	
113.	Rolling Resistance		Force resisting the motion when a body (such as a ball, tire, or wheel) rolls on a surface.	
114.	Rolling resistance in a car		Combination of forces that work against the forward motion	
115.	Cause of rolling resistance		The slippage between the wheel and the surface, which dissipates energy.	
116.	Types of collision		Plastic, Elastic, Inelastic	
117.	Impact of Object Collide		One object to speed up (gain momentum) and the other object to slow down	
118.	Load	P	The combined effect of external forces acting on a body.	N
119.	Elasticity		It is the ability of a body to resist a distorting influence and to return to its original size and shape when that influence or force is removed.	
120.	Resilience		Total strain energy stored in a body.	
121.	Proof resilience		Maximum strain energy stored in a body.	
122.	Modulus of resilience		The proof of resilience per unit volume.	
123.	Ductility		Physical property of a material	



			associated with the ability to be hammered thin or stretched into wire without breaking	
124.	Normal Reaction		The component of contact force normal to the surfaces in contact is called normal reaction	
125.	Normal Force		Force that surfaces exert to prevent solid objects from passing through each other	
<b>Placement Questions</b>				
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