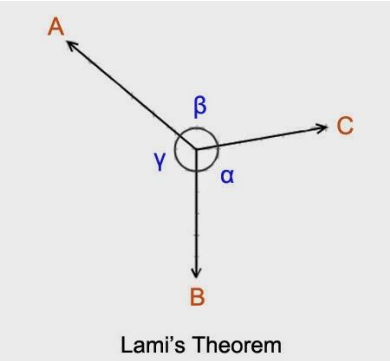
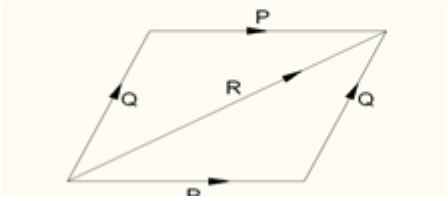
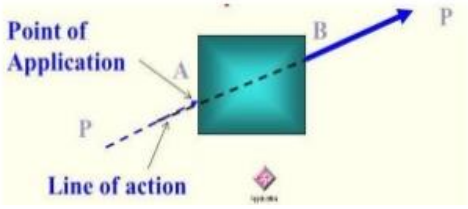
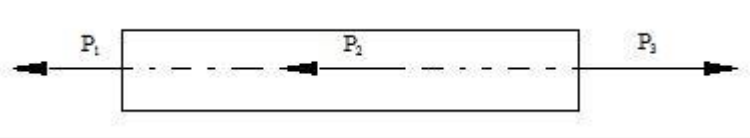
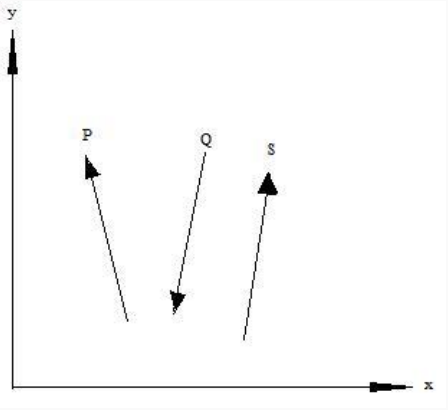
GE 8292- ENGINEERING MECHANICS

S.No	Part-A
1	State parallel axis 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. $I_{xy} = \bar{I}_{xy} + \bar{x}\bar{y}A$
2	State perpendicular axis theorem. Moment of inertia of an area about an axis perpendicular to its plane at any point is equal to the sum of moments of inertia about any two mutually perpendicular axes about the same point in plane of the area. It is also known as polar moment of inertia. $I_{zz} = I_{xx} + I_{yy}$
3	When will the product of inertia of a lamina become zero? When the x axis, the y axis, or both are an axis of symmetry, the product of inertia is zero. I_{xy}=o
4	Locate the centroid a semicircular lamina of radius 2m. CENTROID OF SEMI-CIRCLE FORMULA: $\bar{X}$= d/2 $\bar{Y}$= 4R/3π
5	Differentiate between center of gravity and centroid ❖ The centre of figures which have only area but no mass is known as Centroid. ❖ Centre of gravity is a point where the entire mass or weight of the body is assumed to be concentrated.
6	What do you understand by mass moment of inertia? Mass Moment of Inertia (Moment of Inertia) - I - is a measure of an object's resistance to change in rotation direction. Moment of Inertia has the same relationship to angular acceleration as mass has to linear acceleration. • Moment of Inertia of a body depends on the distribution of mass in the body with respect to the axis of rotation For a point mass the Moment of Inertia is the mass times the square of perpendicular distance to the rotation reference axis and can be expressed as I = m r2 (1) where I = moment of inertia (kg m^2) m = mass (kg)

7	What is the radius of gyration of a circle of diameter "d " about its diameter. The Radius of Gyration is the distance from the rotation axis where a concentrated point mass equals the Moment of Inertia of the actual body. The Radius of Gyration for a body can be expressed as $$I_x = k_x^{\,2} A$$ $$k_x = \sqrt{\frac{I_x}{A}}$$
8	Compare and contrast moment and second moment about an axis. **The second moment of area**, also known as moment of inertia of plane area, or second area moment, is a geometrical property of an area which reflects how its points are distributed with regard to an arbitrary axis. $$I = \int r^2 dA$$
9	State Lami‟s theorem with a neat sketch? Lami's theorem states that if three forces acting at a point are in equilibrium, each force is proportional to the sine of the angle between the other two forces. Consider three forces A, B, C acting on a particle or rigid body making angles α, β and γ with each other.  Lami's Theorem $$\frac{A}{\sin\alpha} = \frac{B}{\sin\beta} = \frac{C}{\sin\gamma}$$
10	State the Parallelogram law of forces? If two forces acting at a point be represented in magnitude and direction by the two sides of a parallelogram. Then the diagonal represents the resultant of the forces both in magnitude and direction.  $$R = \sqrt{(P^2 + Q^2 + 2PQ\cos\alpha)}$$

	The direction of the resultant is $\alpha = \tan^{-1}\left[\frac{Q \sin\theta}{P + Q\cos\theta}\right]$
11	State the triangular law of forces? **Triangular Law of Forces** **Triangular Law of forces is useful to find the resultant of two non zero forces, acting simultaneously** **Statement:** **If two vectors are represented in magnitude and direction by the two sides of a triangle taken in order, the third side of the triangle represents their resultant in magnitude and direction in reverse order.**
12	Define principle of transmissibility. **Principle of Transmissibility of Forces** • Any force acting at a point can be replaced by the same magnitude of force at some other point on the same line of action in the same direction. • Does not change the condition of motion of the body. 
13	Distinguish the following system of forces with a suitable sketch. a) Coplanar b) Collinear. **Coplanar Force System** When the lines of action of a set of forces lie in a single plane is called coplanar force system. **Collinear Force System** When the lines of action of all the forces of a system act along the same line, this force system is called collinear force system.

	 **Non-Coplanar Force System** When the line of action of all the forces do not lie in one plane, is called Non-coplanar force system  **Concurrent Force System** The forces when extended pass through a single point and the point is called point of concurrency. The lines of actions of all forces meet at the point of concurrency. Concurrent forces may or may not be coplanar.
14	Discuss about the necessary and sufficient condition for static equilibrium of a particle in 2-D. • There are two conditions that must be met for an object to be in equilibrium. • The first condition is that the net force on the object must be zero for the object to be in equilibrium. • If net force is zero, then net force along any direction is zero.