

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

IN THE NAME OF ALLAH
THE MOST BENEFICENT
THE MOST MERCIFUL



إِسْلَامٌ وَسَلَامٌ عَلَيْكَ يَا رَسُولَ اللَّهِ
وَعَلَى أَلِيكَ صَلَاحٌ كَمَا حَدَّثَ اللَّهُ

MTH304 MCQ's File & Summary (Definitions)

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Mth304 lecture 1 to 22 - Read-only

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$$\frac{\cos^2 A}{P} + \frac{\cos^2 B}{Q} + \frac{\cos^2 C}{R} = 0 \quad \text{(dividing by } 2PQR \text{)}$$

EXERCISE 1

Multiple Choice Questions (MCQs)

Four options are given in each of the following questions, fill the circle in front of that choice which you think is correct. Cutting or filling two more circles is not allowed:

The quantity of matter in a body is called its
(a) acceleration (b) velocity ☒ (c) mass (d) tension

A body of negligible small dimensions is termed as
(a) heavy body (b) small body ☒ (c) particle (d) none of these

The concept of a particle is an ideal one and represents a geometrical
shape which possesses mass.
(a) ellipse (b) triangle (c) circle ☒ (d) point

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A body may be regarded as an aggregate of
(a) ellipses (b) triangles (c) circles (d) ☒ particles

A body is said to be a rigid body if the distance between any two of particles _____ by any means.
(a) changes (b) ☒ remains unchanged (c) remains variable (d) none of these

A body is said to be a rigid body if it _____ its shape in any way.
(a) changes (b) ☒ does not change (c) changes rapidly (d) none of these

A body is said to be in motion if it _____ its position with respect to surroundings in the course of time.
(a) does not change (b) ☒ changes (c) never changes (d) none of these

A body is said to be at rest if it _____ its position with respect to surroundings in the course of time.
(a) ☒ does not change (b) changes (c) rapidly changes (d) none of these

Rest and motion of a body are _____ concepts.
(a) absolute (b) not relative (c) ☒ relative (d) none of these

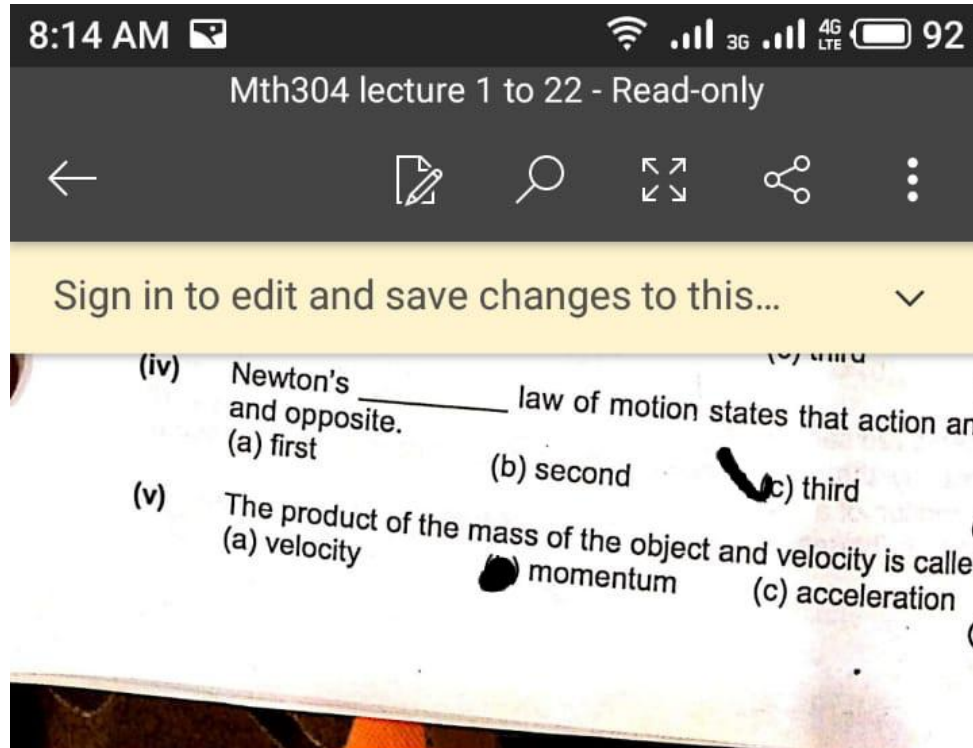
The physical quantity which changes or tends to change the state of rest or motion of a body is called
(a) ☒ force (b) acceleration (c) velocity (d) none of these

The line passing through the point of application in the direction of the force is called the _____ of action of force.
(a) ☒ line of action (b) line of force (c) line of direction (d) none of these

Line of action

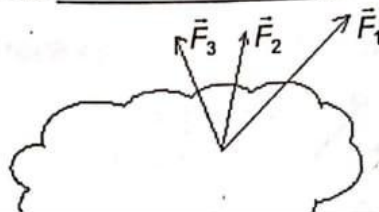
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- (vi) If a particle of mass m is moving with a velocity $\vec{v}$, then its linear momentum is
(a) $m\vec{a}$ (b) $m^2\vec{a}$ (c) $m^2\vec{v}$ (d) $m\vec{v}$
- (vii) Mathematical form of Newton's second law of motion is $\vec{F} =$
(a) $m\vec{a}$ (b) $m^2\vec{a}$ (c) $m^2\vec{v}$ (d) $m\vec{v}$
- (viii) The forces passing through a single point are called _____
(a) parallel (b) concurrent (c) non-concurrent (d) none of these
- (ix) The forces lying in the same plane are called _____ forces.
(a) non-coplanar (b) coplanar (c) skew (d) none of these
- (x) Forces $\vec{F}_1, \vec{F}_2$ and $\vec{F}_3$ are _____ forces.

coplanar

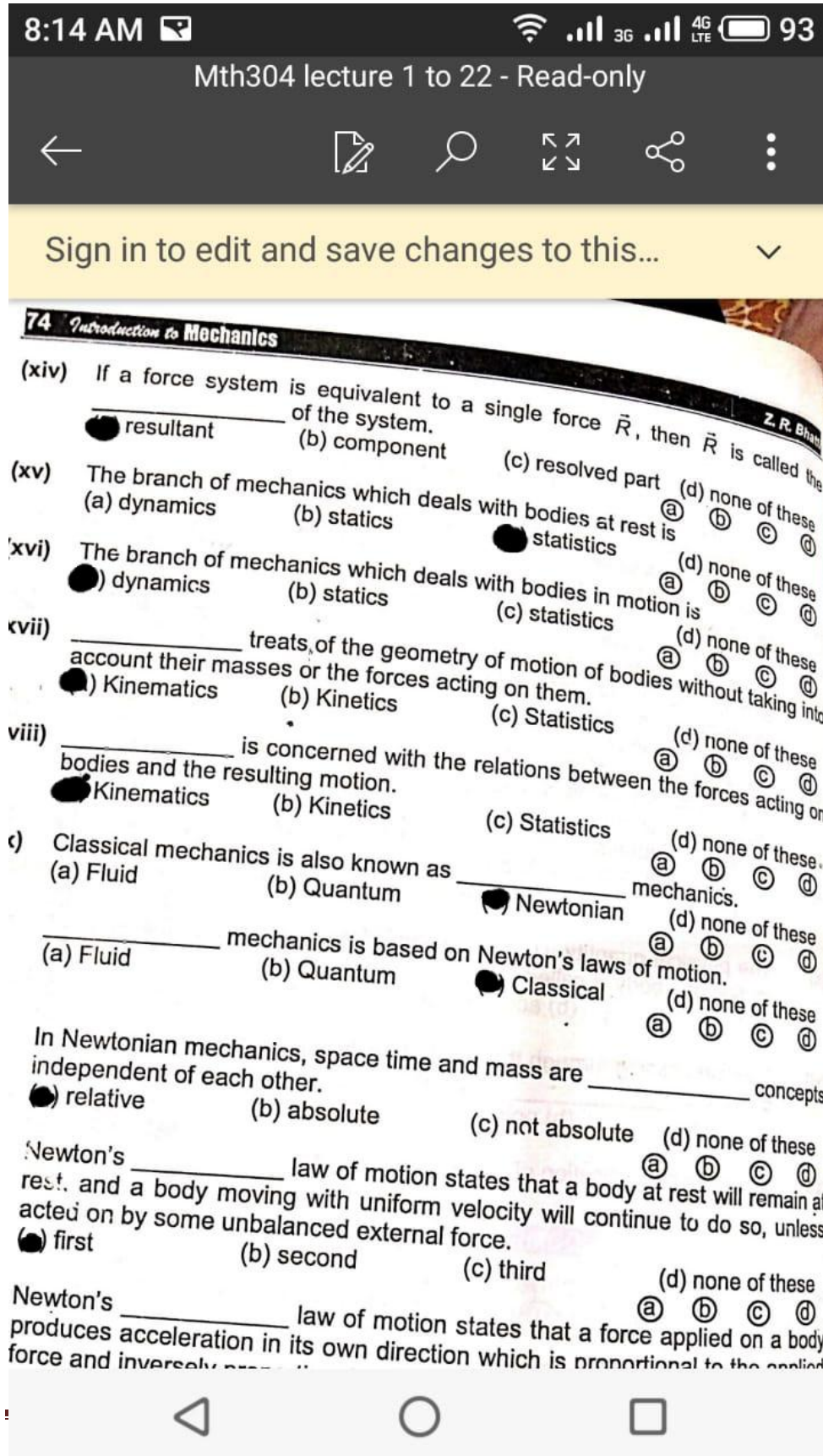


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- (a) $\tan^{-1}\left(\frac{P}{Q}\right)$ (b) $\tan^{-1}\left(\frac{Q \sin \alpha}{P + Q \cos \alpha}\right)$
 (c) $\tan^{-1}\left(\frac{P \sin \alpha}{Q + P \cos \alpha}\right)$ (d) $\tan^{-1}\left(\frac{Q}{P}\right)$
- (v) If two forces $\vec{P}$ and $\vec{Q}$ act at an angle α , then the angle of their resultant with $\vec{Q}$ is (a) (b) (c) (d)
 (a) $\tan^{-1}\left(\frac{P}{Q}\right)$ (b) $\tan^{-1}\left(\frac{Q \sin \alpha}{P + Q \cos \alpha}\right)$
 (c) $\tan^{-1}\left(\frac{P \sin \alpha}{Q + P \cos \alpha}\right)$ (d) $\tan^{-1}\left(\frac{Q}{P}\right)$
- (vi) The resultant of two forces of equal magnitude will _____ the angle between them. (a) (b) (c) (d)
 (a) not bisect (b) trisect (c) bisect (d) none of these
- (vii) Two forces of magnitudes 7 and 4 units act at an angle 60° , the angle of their resultant with the force of magnitude 7 is (a) (b) (c) (d)
 (a) $\tan^{-1}\left(\frac{2\sqrt{3}}{9}\right)$ (b) $\tan^{-1}\left(\frac{7\sqrt{3}}{15}\right)$ (c) $\tan^{-1}\left(\frac{7}{4}\right)$ (d) none of these
- (viii) Two forces of magnitudes 7 and 4 units act at an angle 60° , the angle of their resultant with the force of magnitude 4 is (a) (b) (c) (d)
 (a) $\tan^{-1}\left(\frac{2\sqrt{3}}{9}\right)$ (b) $\tan^{-1}\left(\frac{7\sqrt{3}}{15}\right)$ (c) $\tan^{-1}\left(\frac{7}{4}\right)$ (d) none of these
- (ix) The magnitude of the resultant of forces $\vec{P}$ and $\vec{Q}$ acting perpendicularly is (a) (b) (c) (d)
 (a) $\sqrt{P^2 - Q^2}$ (b) $P^2 - Q^2$ (c) $P^2 + Q^2$ (d) $\sqrt{P^2 + Q^2}$
- (x) The resultant of two concurrent forces $\lambda \vec{OA}$ and $\mu \vec{OB}$ is _____, where C divides AB such that $AC : CB = \mu : \lambda$. (a) (b) (c) (d)
 (a) $(\lambda + \mu) \vec{OC}$ (b) $(\lambda - \mu) \vec{OC}$ (c) $\lambda \vec{OC}$ (d) $\mu \vec{OC}$
- (xi) Forces P, Q act at a point O and their resultant is R . If any transversal cuts the lines of action of the forces in the points A, B, C respectively, then $\frac{P}{OA} + \frac{Q}{OB} =$ (a) (b) (c) (d)
 (a) $\frac{R^2}{OC}$ (b) $\frac{R}{OC}$ (c) $\frac{OC}{R}$ (d) none of these

MTH304 MCQ's File & Summary (Definitions)



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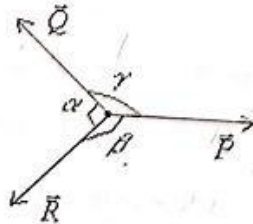
(xii) The necessary and sufficient condition for a particle to be in equilibrium under the action of the forces $\vec{P}_1, \vec{P}_2, \dots, \vec{P}_n$ is that $\vec{P}_1 + \vec{P}_2 + \dots + \vec{P}_n =$

- (a) $\vec{i}$ (b) $\vec{j}$ (c) $\vec{k}$

(xiii) If a particle is in equilibrium under the action of three forces, then the magnitude of each force is proportional to the _____ of the angle between the other two.

- (a) cosine (b) sine (c) cosecant (d) secant

(xiv) If the particle is in equilibrium under the action of forces in the adjoining figure,



then

(a) $\frac{P}{\cot \alpha} = \frac{Q}{\cot \beta} = \frac{R}{\cot \gamma}$

(b) $\frac{P}{\tan \alpha} = \frac{Q}{\tan \beta} = \frac{R}{\tan \gamma}$

(c) $\frac{P}{\cos \alpha} = \frac{Q}{\cos \beta} = \frac{R}{\cos \gamma}$

(d) $\frac{P}{\sin \alpha} = \frac{Q}{\sin \beta} = \frac{R}{\sin \gamma}$

(xv) The tendency of a force to turn a body about a point is called the _____ of that force.

- (a) magnitude (b) direction (c) moment (d) none of these

(xvi) If $\vec{r}$ is the position vector of the point of application A of the force $\vec{F}$ from a fixed point O, then the moment of the force $\vec{F}$ about O is $\vec{M} =$

- (a) $\vec{r} \cdot \vec{F}$ (b) $\vec{r} \times \vec{F}$ (c) $\vec{r} + \vec{F}$ (d) $\vec{r} - \vec{F}$

(xvii) The moment of a force $\vec{F}$ about a point O is _____ to the plane containing O and $\vec{F}$.

- (a) not perpendicular (b) parallel (c) perpendicular (d) none of these

(xviii) The moment of the resultant of concurrent forces about a point is equal to the _____ of moments of the forces about that point.

- (a) difference (b) sum (c) product (d) none of these

(xix) The moment of a force is _____ if the rotation is anticlockwise.

- (a) zero (b) positive (c) negative (d) none of these

SUMMARY

- Space, time and matter are the fundamental concepts.
- Matter which occupies a limited portion of space is called a body.
- The quantity of matter in a body is called its mass.
- A body of negligibly small dimensions is termed a particle.
- A body is said to be a rigid body if the distance between any two particles of the body remains unchanged so that the body does not expand or contract or change its shape in any way.
- Force is defined as a measure of push or pull on an object.
- The point of body where the force acts is called its point of application.
- The line passing through the point of application in the direction of the force is called its line of action.
- A set of forces acting on a particle or rigid body is called a force system.
- Two force systems are said to be equivalent if one system can be replaced by the other system without disturbing the instantaneous state of rest or motion of a body.
- Mechanics deals with the action of forces on bodies which we encounter in nature and technology.
- Branch of mechanics which deals with bodies at rest is known as statics.
- The branch of mechanics which deals with bodies in motion is known as dynamics.
- The branch of dynamics which treats of the geometry of motion of bodies, without taking into account their masses or the forces acting on them is known as kinematics.
- The branch of dynamics which is concerned with the relations between the forces acting on bodies and the resulting motion is known as kinetics.

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- Inertia is a property of matter that resists changes in motion.
- The linear momentum of a particle is the vector $\vec{p} = m\vec{v}$, where m is the mass of the particle and v its velocity relative to a reference system.
- The forces acting on a particle are said to be in equilibrium if these do not change the state of rest or character of motion of the particle. In this case the state of the particle is referred to as an equilibrium state.
- A given force $\vec{R}$ can be replaced by an infinite number of pairs of possible components.
- If the two components of a force are mutually perpendicular, then such components are called the resolved parts of the given force.
- Scalar component of $\vec{R}$ along vector $\vec{u}$ is the dot product $\vec{R} \cdot \vec{u}$.
- Forces whose lines of action intersect at one point are called concurrent forces.
- The resultant of two forces bisects the angle between them if the forces have equal magnitudes.
- The magnitude R of the resultant of two forces $\vec{P}$ and $\vec{Q}$ acting at an angle α is given by $R = \sqrt{P^2 + Q^2 + 2PQ \cos \alpha}$.
- Magnitude of the resultant of the forces P, Q, R acting at a point parallel to the sides of a triangle ABC taken in the same order is $(P^2 + Q^2 + R^2 - 2QR \cos A - 2RP \cos B - 2PQ \cos C)^{\frac{1}{2}}$.
- A particle is in equilibrium if the resultant of all forces acting on the particle is equal to zero.
- If a particle is in equilibrium under the action of three coplanar forces, each force has a magnitude proportional to the sine of the angle between the other two.
- The tendency of a force to turn a body about a point is called the moment of that force.
- The perpendicular distance from the point of rotation to the line of action of the force is known as arm of the force.
- The moment about a point O of the resultant of a system of concurrent forces is equal to the sum of the moments of the various forces about the same point O .
- A couple is defined as two parallel forces with the same magnitude but opposite in direction separated by a perpendicular distance d .
- Any system of coplanar forces acting on a rigid body can be reduced to a single force at all arbitrary point in the plane of the forces together with a couple.
- A system of coplanar forces is in equilibrium if the algebraic sum of the resolved parts of the forces in any two directions is zero and the algebraic sum of the moments about any point is zero.

MTH304 MCQ's File & Summary (Definitions)

- The resultant of a system of coplanar forces is equal to the sum of the moments of the various forces about the same point O .
- A couple is defined as two parallel forces with the same magnitude but opposite in direction separated by a perpendicular distance d .
- Any system of coplanar forces acting on a rigid body can be reduced to a single force at all arbitrary point in the plane of the forces together with a couple.
- A system of coplanar forces is in equilibrium if the algebraic sum of the resolved parts of the forces in any two directions is zero and the algebraic sum of the moments of all the forces about an arbitrary point is zero.
