COURSE CODE:	*MCE 202*
COURSE TITLE:	*Engineering Mechanics II*
NUMBER OF UNITS:	*2 Units*
COURSE DURATION:	*Two hours per week*

COURSE DETAILS:

Course Coordinator:	**Engr. Adekunle, N .Olatunde** B.Sc, M.Sc.
Email:	noadekonle@yahoo.com
Office Location:	**Room 4 PG School**
Other Lecturers:	**None**

COURSE CONTENT:

Kinematics and kinetics of particles. Work ,energy ,power, momentum, and impulse. Kinematics and kinetics of rigid body in plane motion. Analysis of elementary dynamics systems-dynamics system elements: mechanical, electrical, fluid and thermal .Newton,s law of motion, D'Alembert's principle and Lagrange equations. Particle dynamics in non –inertia frame of reference.

COURSE REQUIREMENTS:

This is a compulsory course for all students in engineering. In view of this, students in the college of engineering are strongly advised to attend classes regularly and have a minimum of 75% attendance to be eligible to write the final examination.

READING LIST:

1. A Textbook of Engineering Mechanics by R.S khurmi, S.CHAND.

2. Engineering Mechanics by

3. Engineering Mechanics by

LECTURE NOTES

NEWTON'S LAW OF MOTION

Newton's law of motion describe what happens to a body when forces are acting on it.

Dynamics: is the branch of mechanics concerned with the forces that change or produce the motion of bodies.

A car accelerates from rest to 10 mph as a result of force. The engine supplies force through a series of shafts and gears to the tires that pushes backward on the road. Then, the road in turn exerts a force on the car to push it forward.

It is the force that enable us to accelerate the car.

Also, forces respectable for all motions i.e. starting and stopping.

Newton's 1st law of motion

States that a body at rest, will remain at rest and a body in motion at a constant velocity will continue in motion at that constant velocity, unless acted on by some unbalanced external force.

Force push, pull, drag etc.

Description of the 1st law

i)   A book placed on a desk remain in that position

ii)   A body moving with constant velocity (speed) on a level road.

Inertia- the resistance of a body to a change in its motion or state of motion

1st law –an inertia coordinate system i.e. a coordinate system in which objects experiencing no unbalanced forces remain at rest or continue in uniform motion. Also, an inertia coordinate system is called an inertia reference system.

Newton's 1st law is applied in an inertia coordinate system.

Newton's 2nd law of motion –relate all forces causes acceleration of a body but that acceleration is directly proportional to that force, and in the direction of that force .

Newton's 3rd law of motion –two bodies A and B and if body A exerts a force on body B, then body B will exerts an equal but opposite force on body A. To every action there is equal and opposite reaction $F_{AB} = -F_{BA}$.

Definition of mass,

Weight,

Momentum,

Force (types of force),

Nature of the force,

Inertia Rigid Body

Simple : Application of Newton's 2nd law

Determination of the velocity of a body in motion given the force

applied

- Determination of the force acting on a moving vehicle
- Effect of retarding force on moving mechanical system

Quantitative description of force and motion of a lift mechanism

D'Alemberts principle

Simple : Application of Newton's 2nd law

Determination of the velocity of a body in motion given the force

applied

Determination of the force acting on a moving vehicle

Effect of retarding force on moving mechanical system

Simple : Application of Newton's 2nd law

Determination of the velocity of a body in motion given the force

applied

Determination of the force acting on a moving vehicle

Effect of retarding force on moving mechanical system

Quantitative description of force and motion of a lift mechanism

WORK ENERGY AND POWER

Definition for work

Mathematic expression for finding work done

Different expression to find work done considering

The direction of force applied and distance moved in the direction of force.

How to obtain work done from force – displacement graph

Standard unit of work done

Definition of Energy and units

Types of Energy

(i) Mechanical Energy   =   P.E and K.E

(ii) Electrical Energy   Solar Energy

(iii) Sound Energy

(iv) Atomic Energy

(v) Heat Energy

Quantitative description of mechanical Energy

Simple illustration of K.E

Simple illustration of P.E

Momentum and collision

Meaning of momentum = mass x velocity

Law of conservation of momentum

Momentum of the bodies before collision =Momentum of bodies after collision

Linear momentum with specific examples

Case 1 Body A moving towards a stationary body B

Case 2. Body A moving towards another body B moving in the same direction

Case 3 Body A moving towards another body B moving in opposite direction

Angular momentum with specific examples

Types of Collisions

Direct impact

Indirect (obligue) impact

Impulse

LECTURE FOUR

Kinematic of particles

Brief introduction to kinematic of particle

Basic definitions of critical terms

Scalar : a quantity with magnitude only e.g speed, distance ,energy ,density and mass.

vector : quantity with magnitude and direction : velocity, displacement, acceleration and momentum

Rectilinear motion: motion along a straight line

Case 1 Rectilinear motion : a particle moving along a straight line.

1.Determination of instantaneous velocity of particle

2.Determination of Average Acceleration

3.Determination of Instantaneous Acceleration of particle

 Differential equation for rectilinear motion

Relationship between displacement, velocity and constant acceleration

   Graphical representation

Derivation of equation of motion

1. Constant acceleration , a =constant

2. Acceleration as a function of time , a = f(t)

3. Acceleration as Acceleration as a function

of displacement , a = f(s)

4 . Acceleration as a function of velocity, a = f(v)

     Rectangular coordinate system

Position vector in rectangular coordinate system

How to obtain velocity from given position vector

How to obtain acceleration from given position vector

Circular motion of particle

Determination of Angular velocity

Determination of Angular Acceleration

Determination of Normal Acceleration   using formula

Determination   of Tangential Acceleration of particle

Application using specific engineering tools

Plane Motion

Rectilinear – Curvilinear

Equations of circular motion with constant angular acceleration

Comparison between linear equations of motion with circular motion

LECTURE FIVE

KINEMATICS OF PARTICLES

Brief introduction to kinematics of particles

Force mass and acceleration

Rectilinear motion

General equation of surface

Vector representation of acceleration

Determination of magnitude acceleration

Vector representation of force

CURVILINEAR MOTION

coordinates system.

Typical Application in Relation to Engineering

   (i)   Work Energy-equation

(ii)   Application of impulse and momentum formulae

Relative motion equation

Rectangular coordinate system Fx, Fy,

Normal and Tangential Coordinate Fn, Ft

Polar Coordinates system.

CURVILINEAR MOTION

Coordinates system.

Typical Application in Relation to Engineering

(i)   Work Energy-equation

(ii)   Application of impulse and momentum formulae

Relative motion equation

Rectangular coordinate system Fx, Fy,

Normal and Tangential Coordinate Fn, Ft