AEN 1208Engineering Mechanics II
Course Code:
Course Level: Level 1
Course Credit: 4 CU
Instructor: Mr. Thomas Makumbi, BSc. Agric. Eng (Mak)
Teaching Assistant

Brief Course Description

This course introduces students to the basic principles of dynamics and their application to particles and bodies. It covers topics such as the fundamentals of dynamics, Particle kinematics and kinetics, Mass moments of inertia, Kinetics of systems of particles, Kinematics and Kinetics of a rigid body in plane motion and Three Dimensional dynamics of a rigid body.

Course Objective

- Students will acquire knowledge of relating dynamic principles of mechanics to engineering applications through the development of capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

- To equip students with the ability to visualize physical configuration in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures. This ability to visualize is so vital to problem formulation through the construction of a meaningful mathematical model.

Course Outline

Lecture	Topic	Content	Methods	Tools/ equipment
1.	Fundamentals of Dynamics	Space, time , rigid body , particle, force, mass, vector and scalar quantities, units, Newton's laws of motion	Interactive lecture (2hrs)	Chalk/ Blackboard and LCD
2.	Fundamentals of Dynamics	Newton's law of gravitation, Kepler's laws of planetary motion, dimensions and gravitation	Interactive lecture (2hrs)	Chalk/ Blackboard and LCD
3	Tutorial 1	Examples on fundamentals of dynamics	Interactive lecture (2hrs)	Chalk/ Blackboard and LCD
4.	Kinematics of a particle	Rectilinear motion and Plane curvilinear motion	Lecture (2hrs)	Chalk/ Blackboard and LCD
5.	Kinematics of a particle	Rectangular coordinates(x-y), Normal and	Lecture (2hrs)	Chalk/ Blackboard and LCD

		tangential coordinates(n-t), Polar coordinates(r-θ)		
6.	Kinematics of a particle	Relative motion and Constrained motion of connected particles	Lecture (2hrs)	Chalk/ Blackboard and LCD
7.	Tutorial 2	Examples on kinematics of particles	Interactive lecture (2hrs)	Chalk/ Blackboard and LCD
8.	Kinetics of particles	Force-mass-acceleration (Newton's second law).	Lecture (2hrs)	Chalk/ Blackboard and LCD
9.	Kinetics of particles	Work and energy principles (Gravitational potential energy, Elastic potential energy, Conservative force fields).	Lecture (2hrs)	Chalk/ Blackboard and LCD
10.	Kinetics of particles	Impulse and momentum (linear and angular momentum, and impact)	Lecture (2hrs)	Chalk/ Blackboard and LCD
11.	Kinetics of particles	Central force motion and Conic sections.	Lecture (2hrs)	Chalk/ Blackboard and LCD
12.	Tutorial 3	Examples on kinetics of a particle	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
13.	Mass moments of inertia	Circular cylindrical shell, half cylindrical shell, circular cylinder, semi cylinder and rectangular parallelepiped	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
14.	Mass moments of inertia	Spherical shell, hemispherical shell, sphere, hemisphere and uniform slender	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD

		rod		
15.	Mass moments of inertia	Quarter circular rod, elliptical cylinder, conical shell, half conical shell and right circular cone	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
16.	Mass moments of inertia	Half cone, semiellipsoid, elliptic paraboloid, rectangular tetrahedron and half torus	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
17.	Tutorial 4	Examples on mass moments of inertia	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
18	Test 1	Fundamentals of dynamics, kinetics and kinematics of a particle and mass moments of inertia	Written exam (2 hrs)	Chalk/ black board and stationary
19.	Kinetics of systems of particles	Generalized Newton's second law, Work and energy.	Lecture (2hrs)	Chalk/ Blackboard and LCD
20.	Kinetics of systems of particles	Impulse and momentum, Conservation of energy and momentum	Lecture (2hrs)	Chalk/ Blackboard and LCD
21.	Tutorial 5	Examples on kinetics of systems of particles	Interactive Lecture (2hrs)	Chalk/ Blackboard and LCD
22.	Plane kinematics of Rigid bodies	Plane motion (translation, fixed axis rotation, general plane motion), Rotation	Lecture (2hrs)	Chalk/ Blackboard and LCD
23.	Plane kinematics of Rigid bodies	Absolute motion and Relative velocity	Lecture (2hrs)	Chalk/ Blackboard and LCD
24.	Plane kinematics of Rigid bodies	Instantaneous center of zero velocity and Relative acceleration	Lecture (2hrs)	Chalk/ Blackboard and LCD
25.	Tutorial 6	Examples on plane	Interactive lecture	Chalk/ Blackboard

		kinematics of rigid bodies	(2 hrs)	and LCD
26.	Plane kinetics of Rigid bodies	Force-mass-acceleration (general equations of motion, translation, fixed axis rotation, general plane motion).	Lecture (2hrs)	Chalk/ Blackboard and LCD
27.	Plane kinetics of Rigid bodies	Work-energy relations (work of forces and couples, kinetic energy, potential energy and work-energy equation).	Lecture (2hrs)	Chalk/ Blackboard and LCD
28.	Plane kinetics of Rigid bodies	Impulse and momentum (linear and angular momentum, interconnected rigid bodies, conservation of momentum, impact of rigid bodies).	Lecture (2hrs)	Chalk/ Blackboard and LCD
29.	Tutorial 7	Examples on plane kinetics of rigid bodies	Interactive lecture (2 hrs)	Chalk/ Blackboard and LCD
30.	Introduction to 3 dimensional dynamics of a rigid body	Kinematics (translation, fixed axis rotation, parallel plane motion, rotation about a fixed point, general motion).	Lecture (2hrs)	Chalk/ Blackboard and LCD
31.	Introduction to 3 dimensional dynamics of a rigid body	Kinetics (angular momentum, momentum and energy equations of motion, parallel plane motion).	Lecture (2hrs)	Chalk/ Blackboard and LCD
32.	Test 2	Kinetics of systems of particles,	Written exam (2 hrs)	Chalk/ black board and stationary

		Kinematics and Kinetics of a rigid body in plane motion and introduction to 3-dimensional dynamics of a rigid body		

Assessment:

- Assignments (10%)
- 2 tests (30%)
- Final university examination (60%)

References

i. Meriam J.L and Kraige L.G (2003). "Engineering Mechanics (Dynamics). Fifth Edition". John Wiley and Sons Inc.

ii. Hibbeler R.C (2006). "Engineering Mechanics (Dynamics). Eleventh edition". Prentice Hall International, London, UK.

iii. Beer et.al. (2003). "Vector Mechanics for Engineers". McGraw Hill Publishing Co. Ltd

Other Resources

- Computer laboratory connected to internet
- Gatsby motor vehicle garage
- University library
- Faculty and department book banks
- Mechanical workshop
- Solid Edge and unigraphics laboratory