CVE 303 – Fluid Mechanics

COURSE PARTICULARS

Course Code: CVE 303
Course Title: Fluid Mechanics
No. of Units: 3
Course Duration: Two hours of Lectures and three hours of practicals per week for 15 weeks.
Status: Compulsory Course
Course Email Address: okolics 2002@gmail.com
Course Webpage: http://www.cve futa.edu.ng/courseschedule.php?coursecode=CVE303

Prerequisite: Age 204

Dr. C.S. Okoli
Dept. of Civil Engineering The Federal University of Technology, Akure, Nigeria.
Phone: +2348034277819
Email: okolics 2002 @gmail.com

COURSE DESCRIPTION

This course provides some basic principles of fluid mechanics. Fluid mechanics may be defined as the study of behaviour of fluids under the influence, of forces. These forces are stresses and velocities that occur in a Newtonian and non Newtonian fluid in motion or at rest. The course is thought under two broad topics Viz; fluid statics and fluid dynamics. Fluid statics is the study of forces which keeps fluids in static equilibrium while fluid dynamics deals with the motion of fluids and forces which keep them in motion. Fluid dynamics can be subdivided into hydrodynamics and gas dynamics. Hydrodynamics is the study of fluid flows where there are no density changes. The flow of liquids falls into this category mainly but it also includes the flow of gases at low speeds. A subdivision of hydrodynamics is called hydraulics, which is the study of flow where density changes occur such as high speed gases flow through conduits or over solid surfaces. Aerodynamics is the study of gas flow which combines both low speed and high speed flows. The course will consist of theory and laboratory practical experiments. It is believed that the course will cover both B.Eng and Bsc degree levels for most universities in the field of fluid mechanics. It could also serve as an introductory course for masters degree programme in fluid engineering for most universities all over the world.

COURSE OBJECTIVES

The objectives of this course are to:

- Introduce the student to basic and advanced theory of fluid mechanics
- Introduce the student to the development of interest in the study of fluid mechanics and its application in engineering practice.
- Demonstrate to the students the behaviours of various laws of fluid statics and fluid dynamics in nature and their units of measurements.

Upon successful completion of this course, the student will be able to:*(Knowledge based)*

- Explain the theory of Fluid Mechanics
- Apply the basic principles to engineering practice
- Undertake design and modelling activities in the areas of fluid mechanics and hydraulics.

GRADING SYSTEM FOR THE COURSE

The course will be graded as follows

Assignments, tests and laboratory experiments	40%
Final Examination	60%
TOTAL	**100%**

GENERAL INSTRUCTIONS

Attendance: The student is required to attend all lectures and participate in all laboratory practical classes to conduct experiment.

READING LIST

J.A. FOX Engineering fluid mechanics

F.O. Douglas Introduction to fluid mechanics

COURSE OUTLINE

Week	Topic	Remarks
1	Fluid statics, definitions; of pressure concept direction, pressure head pressure variation with depth, pressure variation in incompressible and compressible fluid pressure transmission pressure measurements	The aim is to introduce the student to definitions and basic concept of fluid properties.
2	Forces on submerged surfaces horizontal plane surface vertical surface, inclined surface curved surface, Buoyancy.	The student is introduces to resolution of forces on submerged and semi submerge surface and how to compute them.
3	Stability of gloating bodies, partially immersed Bodies, Totally immersed bodies.	The student is taught on how to obtain the various position of floating bodies
4	Fluid Dynamics, motion of liquid masses. Acceleration of horizontal particles. vertical acceleration, Acceleration in three dimensions, Rotational motion and circular motion.	The student is introduced to variables influencing the motion of liquid masses.
5	Free vortex motion, Forced vortex motion	The student should have knowledge of different force vortex motion.
6	Fluid flow visualization, Lagrangian, viewpoint, Eurerian viewpoint, streamline, Types of flows, Rate of flows Average fluid velocity Accelerations, Pressure variations in pipes	The student should be able to visualize various fluid motion.
7	The control volume equation definition of the control volume equation and rate of change of extensive properties, Derivation of control volume equation. Derivation of continuity equation from first principles.	The student should be able to derive from first principle control volume and continuity equations.
8	Differential form of the continuity equation. Momentum Equation derivation of momentum equation, Applications of momentum equation, Normal impact on flat surfaces and oblique impact on curved surfaces.	The mathematical ability of the student should be demonstrated by the derivation of differential form of momentum equations and their application.
9	Impact of Jets on straight objects on curved objects Forces on moving objects. Forces in Bends and Reducers, Force, developed by a propeller, Jet propulsion engine. Rocket motion and space travel.	Impact of Jets, forces on bends and reducers, are should be taught to the student

10	Moment momentum equation, Flow through pump impellers, Flow through garden sprinkler, and flow through bend. Energy equation. Derivation of energy equation. Application to pipe flow- Adaptation of energy equations Application to pipe flow and pressure vessels.	Derivation of moment of momentum equation and flow through pumps and propellers is taught to the student including its application
11	Dimensional Analysis, Techniques of dimensional analysis, Buckingham π theorem, interpretation of dimensionless numbers, Applications of similarity theory. Viscous flow, Laminar flow, flow between two parallel places, theory of lubrication boundary theory Drag and lift mechanism.	The student should be able to develop a good analytical and mathematical skill at the end of the course
12	Experiments. The following experiment will be conducted during the course. 1. Determination of meta-centric height and centre of gravity 2. Verification of Bernoulli's theorem 3. Determination of coefficient of discharge for a given venture meter	All students must participate in laboratory practical experiments
13	Experiments 4. Determination of C_C C_v, C_d for flow through orifices. 5. Calibration of a rectangular notch 6. calibration of a vertical notch	All students must participate in laboratory practical experiments
14	Revision	All students should take part in revision classes