MEC 2205: FLUID MECHANICS II

Hours per semester				Weighted total mark	Weighted exam mark	Weighted continuous assessment mark	Credit unit
LH	PH	TH	CH				CU
45	30	75	60	100	60	40	4

Course description

This course introduces the behaviour of ideal fluids and later on the flow of fluid past a solid boundary. It covers the effect of such flow on surfaces whereby the principle of lifting surfaces is demonstrated, and later on the effect on lift once the flow is lost. The course also covers the analysis of flow in open channels (i.e. surface of the stream is open to the atmosphere) looking at both uniform and non-uniform scenarios. Flow in which the density of the fluid change from one point to another is also analyzed in this course together with various types of turbo-machines that are used to modify the energy of the stream.

Course objectives

The aim of this course is to guide the students' understanding of the principles of fluid motion past a solid boundary and the associated effects, operation, design and analysis of hydraulic structures such as open channels, and various fluid machines such as pumps and turbines that are used either to add energy to a fluid or to transform fluid energy into other forms

Learning Outcome

- At the end of this course, the student will be able to:

60%

- Establish a profile of fluid that flows past a solid boundary and later on identify at

which point on the surface the flow is lost. This will help the student in the design of surfaces that depend for their functioning on the principle of flow past a solid boundary; such as airfoils and Hydrofoils.

- Apply the basic principles of fluid motion in the design and analysis of lifting surfaces and turbo-machinery.

- Differentiate between various types of machines and principle of their operations, which are a used to increase energy of a fluid stream or subtract energy from the fluid stream to be converted into other forms of energy.

Course Content

Kinematics of fluids **(8Hours)**

- Stream function
- Velocity potential
- Circulation

Boundary layer and wakes **(8Hours)**

- Laminar Boundary Layer on a flat plate
- Turbulent Boundary Layer on a flat plate
- Effects of Pressure gradient

Free surface flow **(16 Hours)**

- Definitions
- Energy equation and the energy gradient
- Determination of Flow

Turbo machinery **(8 Hours)**

- Classification of fluid Machines
- Performance characteristics
- Losses and efficiencies
- Cavitations

Variable density flow **(5 Hours)**

Laboratories **(30 Hours)**

- Flow characteristics
- Pump characteristics

Delivery Methods:

- The course will be taught by using lectures, tutorials, practical sessions involving hands-on project work and laboratories.

Assessment Methods:

- Course work (assignments and tests) and final examination and their relative contributions to final grade are shown as follows:

Requirement	**Percentage contribution**
Course work	40%
Final examination	60%
Total	**100%**

References

- J.R.D Francis, ***Fluid Mechanics for Engineering Students, 4th Edition.*** Edward Arnold (Publishers) Ltd. ISBN 0 7131 33325
- Bernard Massey, ***Mechanics of Fluids, 7th Edition.*** Stanley Thornes Publishers. ISBN 0 7487 40430
- John F. Douglas, Janusz M. Gasiorek, John A. Swaffield, Lynne B. Jack, ***Fluid Mechanics, 5 Edition.*** Pearson Prentice Hall, ISBN 0-13-129293-5
- J. F. Douglas, ***Solving Problems in Fluid Mechanics,*** Volume 1, **3rd Edition** ISBN 0- 582-30556-X