HYDRAULICS AND HYDRAULIC MACHINERY

IV Semester: CE

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEC08	Core	3	0	0	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Fluid Mechanics

I. COURSE OVERVIEW

This course is intended to introduce basic principles of fluid mechanics. It is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery especially water turbine and water pumps. Now days the principles of fluid mechanics find wide applications in many situations directly or indirectly. The use of fluid machinery, turbines pumps in general and in power stations in getting as accelerated fill up. Thus, there is a great relevance for this course for mechanical technicians. The Mechanical technicians have to deal with large variety of fluids like water, air, steam, ammonia and even plastics. The major emphasis is given for the study of water. However, the principle dealt with in this course will be applicable to all incompressible fluids.

II. COURSE OBJECTIVES

The Students will try to learn:

1. The importance of study of open channel flow, to give brief description on different types of flows and channels and hydraulic design principles of channels.
2. The fundamentals of Uniform and Non-Uniform flow in open channels and importance of specific energy, critical flow and their applications.
3. The gradually varied flow and rapidly varied flow and their equations and computations and the concepts of momentum principles.
4. The working principles, functions and applications of pumps and turbines.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Explain** the differences between lined, unlined canals, and uniform, non – uniform flows for the designing of open channels.	Understand
CO 2	**Summarize** the geometrical properties of the open channels and establish the relationships among them for the designing of the mosteconomical sections.	Understand
CO 3	**Apply** the concept of boundary layer and viscosity theorem toavoid flow separation problems.	Apply
CO 4	**Analyze** the lift and drag forces on different shapes of the objects using various methods applicable for the separation of the boundarylayer.	Analyse
CO 5	**Utilize** the Principal of angular momentum for determining effect of hydrodynamic force of jets.	Apply
CO 6	**Explain** working principle of different types of turbines fordesigning a hydro power plant.	Understand

IV. SYLLABUS:

MODULE – I: OPEN CHANNEL FLOW (09)

Types of flows, types of channels, channel characteristics, velocity distribution, determination of velocity using empherical methods, economical sections, critical flow, critical depth, specific energy, hydraulic jump.

MODULE – II: BOUNDARY LAYER THEORY (09)

Viscous fluid flow – Boundary conditions – Development of boundary layer – Estimation of boundary layer thickness – Displacement thickness, momentum and energy thickness Characteristics of boundary layer along a thin flat plate, Vonkarmon momentum integral equation, laminar and turbulent Boundary layers separation of BL, control of BL, flow around submerged objects.

MODULE – III: IMPACT OF JETS AND HYDRAULIC TURBINES (09)

IMPACT OF JETS: Hydrodynamic force of jets on stationary, moving plates, jet striking centrally and at tip of symmetrical and unsymmetrical vanes, jet striking on series of straight and curved vanes. Velocity triangles at inlet and outlet, principle of angular momentum.

HYDRAULIC TURBINES: Classification of hydraulic turbines, selection of hydraulic turbines, working, design principles of impulse and reaction turbines, draft tube, theory and function efficiency, layout of hydropower plant, types of heads and efficiencies.

MODULE – IV: CENTRIFUGAL PUMPS (09)

Classification of pumps, work done, manometric head, minimum starting speed, losses and efficiency, specific speed, multistage pump, pumps in parallel, performance of pumps, design of centrifugal pumps, NPSH, cavitation in pumps.

MODULE – V: DIMENSIONAL ANALYSIS (09)

Dimensional Analysis, dimensionless numbers, methods of dimensional analysis (Buckingham's π-Theorem). Concept of similitude – model and prototype.

V. TEXT BOOKS

1. Subramanya K. "Open Channel Flow", Tata McGraw Hill Publications, New Delhi, 2008.
2. Modi,Seth, "Fluid Mechanics Hydraulic and Hydraulic Machines", Standard Book House, 2011.
3. Pillai Narayan,Rama KrishnaCR, Universities press,2006.

VI. REFERENCE BOOKS

1. Ojha CSP, Chandramouli P. N., Berndtsson R., "Fluid Mechanics and Machinery", Oxford University Press, 2010.
2. Chow V.T., "Open Channel Hydraulics", Blackburn Press, 2009.
3. Rajput R.K., "A Text Book of Fluid Mechanics", S.Chand Publications, 1998.
4. Franck N. White, "Fluid Mechanics", Tata McGraw Hill Publications, 8thEdition, 2015.

VII. WEB REFERENCES

1. http://nptel.ac.in/courses/112104117/
2. http://nptel.ac.in/courses/105103096/
3. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/machine/ui/TOC.htm

VIII. E-TEXTBOOKS

1. https://drive.google.com/file/d/0B9_2yANiGJ12aWJrSGJZVjlxbHM/view
2. https://books.google.co.in/books?id=mLpf6YjHM5AC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false