Course code	Course Name	L-T-P - Credits	Year of Introduction
ME212	FLUID MECHANICS	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

- To establish fundamental knowledge of basic fluid mechanics and address specific topics relevant to simple applications involving fluids
- To familiarize students with the relevance of fluid dynamics to many engineering systems

Syllabus

Fluid Properties, Kinematics of fluid flow, Fluid Statics, Dynamics of fluid flow, Flow through pipes, Concept of Boundary Layer, Dimensional Analysis and Hydraulic similitude

Expected outcome

At the end of the course students will

i. Become conversant with the concepts of flow measurements and flow through pipes
ii. Be able to apply the momentum and energy equations to fluid flow problems.
iii. Be able to evaluate head loss in pipes and conduits.
iv. Be able to use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity

Text Books:

1. Balachandran.P, Engineering Fluid Mechanics, PHI,2012
2. A S Saleem, Fluid Mechanics, Fathima Books,2016

References:

1. Bansal R. K., A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2005
2. Cengel, Fluid Mechanics, McGraw Hill Education India 2014
3. Fox R. W. and A. T. McDonald, Introduction to Fluid dynamics, 5/e, John Wiley and Sons, 2009.
4. Joseph Karz, Introductory Fluid Mechanics, Cambridge University press,2010
5. Modi P. N. and S. M. Seth, Hydraulics & Fluid Mechanics, S.B.H Publishers, New Delhi, 2002 . Streeter V. L., E. B. Wylie and K. W. Bedford, Fluid Mechanics, Tata McGraw Hill, Delhi, 2010.
6. Shames I. H, Mechanics of Fluids, McGraw Hill, 1992.
7. White F.M., Fluid Mechanics, 6/e, Tata McGraw Hill, 2008

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction: Fluids and continuum, Physical properties of fluids, density, specific weight, vapour pressure, Newton's law of viscosity. Ideal and real fluids, Newtonian and non-Newtonian fluids. Fluid Statics- Pressure-density-height relationship, manometers, pressure on plane and curved surfaces, center of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to uniform accelerations, measurement of pressure	8	15%
II	Kinematics of fluid flow: Eulerian and Lagrangian approaches, classification of fluid flow, 1-D, 2-D and 3-D flow, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational	8	15%

	flows, stream lines, path lines, streak lines, stream tubes, velocity and acceleration in fluid, circulation and vorticity, stream function and potential function, Laplace equation, equipotential lines flow nets, uses and limitations		
FIRST INTERNAL EXAMINATION			
III	Dynamics of Fluid flow: Fluid Dynamics: Energies in flowing fluid, head, pressure, dynamic, static and total head, Control volume analysis of mass, momentum and energy, Equations of fluid dynamics: Differential equations of mass, energy and momentum (Euler's equation), Navier-Stokes equations (without proof) in rectangular and cylindrical co-ordinates, Bernoulli's equation and its applications: Venturi and Orifice meters, Notches and Weirs (description only for notches and weirs). Hydraulic coefficients,	9	15%
IV	Pipe Flow: Viscous flow: Reynolds experiment, significance of Reynolds number, critical Reynolds number, shear stress and velocity distribution in a pipe, law of fluid friction, head loss due to friction, Hagen Poiseuille equation. Turbulent flow: Darcy- Weisbach equation, Chezy's equation Moody's chart, Major and minor energy losses, hydraulic gradient and total energy line, flow through long pipes, pipes in series, pipes in parallel, equivalent pipe, siphon, transmission of power through pipes, efficiency of transmission, Water hammer, Cavitation.	10	15%
SECOND INTERNAL EXAMINATION			
V	Concept of Boundary Layer : Growth of boundary layer over a flat plate and definition of boundary layer thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layers, laminar sub layer, velocity profile, Von-Karman momentum integral equations for the boundary layers, calculation of drag, separation of boundary and methods of control.	10	20%
VI	Dimensional Analysis and Hydraulic similitude: Dimensional analysis, Buckingham's theorem, important dimensional numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. Froude, Reynold, Weber, Cauchy and Mach laws- Applications and limitations of model testing, simple problems only	10	20%
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100, Exam duration: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.