B.E Semester: 4 Mechanical Engineering
Subject Name: Fluid Mechanics (MA406-N)

A. Course Objective:
• To present a problem oriented in depth knowledge of Fluid Mechanics
• To address the underlying concepts and methods behind Fluid Mechanics

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus:

Unit No.	Details
1	Properties of fluid: Introduction, classification of fluids, ideal and real, Newtonian and non-Newtonian etc. Physical properties such as viscosity, compressibility, capillarity, surface tension with application and numerical problems, vapour pressure, study of viscometers- Capillary tube type, rotating cylinder, falling sphere, Saybolt/ Redwood viscometer.
2	Dimensional analysis: Fundamental dimensions, dimensional homogeneity, Rayleigh's method and Buckingham's' method. Dimension less numbers and their significance. Hydraulic similitude, Type of models, Problems related to Reynolds number and Froude number.
3	Fluid Statics : Pressure at a point, centre of pressure on plane and curved surface, pressure measurement with manometers - simple, inclined, U-tube, inverted U-tube, single column manometer, micro manometer- single & differential with numerical problems. Buoyant force, stability of submerged body and floating body. Meta centre & meta centric height -analytical and experimental determination with problems.
4	Kinematics of fluid flow: Description of fluid flow- Langrangian method, Eulerian method, Stream line , path line, streak line, stream tube, classification of flow-steady and unsteady, uniform and non-uniform. One, two and three dimensional flow definition, laminar & turbulent flow. Continuity equation for 3-dimensional flow Cartesian Co-ordinates.

5	Fluid Dynamics & Viscous Flow: Fluid Dynamics: Euler's equation along stream tube and in Cartesian CO-ordinates. Bernoulli's equation in one dimension flow and problems. Water hammer and its effects. Measurement of flow with venturimeter & orifice-meter, nozzle, bendmeter, notches. Viscous Flow : Flow between two parallel fixed plates, Couette flow, viscous flow through pipes, Hagen - Poiseullis' equation friction factor, Moody diagram, Darcy Weichbach equation
6	Laminar and turbulent boundary layer flows: Description of boundary layer, Boundary layer parameters, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Prandtl's boundary layer equation.
7	Compressible Fluid Flow: Thermodynamic concept, Equations governing compressible flow, Equation of state, Continuity equation, Euler's equation, Momentum equation, speed of sound wave, Mach number, classification of flow based on Mach number, Mach cone and Mach angle. Stagnation properties. Pitot tube with compressibility correction factor

Total hours (Theory):48
Total hours (Practical):32
Total hours:80

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1st ,2nd ,3rd	Unit 1	20%	1,2
2	4th .5th ,6th	Unit 2	20%	3
3	7th , 8th ,9th	Unit 3	20%	4
4	10th . 11th . 12th	Unit 4	20%	5
5	13th , 14th ,15th ,16th	Unit 5	20%	6,7

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Suggested list of experiment is given below

F. List of Practical:

1	To study fluid properties
2	To study about Buoyancy and Floatation
3	To determine the metacentric height of a floating body
4	To verify Bernoulli's theorem
5	To determine the friction factor for pipes of different sizes.
6	To calibrate different flow measuring devices (Venturimeter , Orifice meter ,Rota meter) and find their co-efficient of performance
7	To determine the different regimes of flow by Reynolds' experiment
8	To measure the flow using different notches
9	To calibrate Pitot tube
10	To determine kinematic viscosity of a given fluid using Red Wood viscometer
11	To determine the kinematic viscosity of liquid using flow cup viscometer
12	To determine the losses in pipe lines due to sudden enlargement, contraction of bends and elbow.

G. Students Learning Outcomes:

1	Understand the basic concept of fluid mechanics
2	Understand statics, dynamics and various approaches to fluid mechanics.
3	Understand concepts of Fluid Dynamics, Viscous Flow and learn about various flow measuring devices.
4	Correlate fundamentals of fluid mechanics with various mechanical systems
5	Understand basics of compressible flow

H. List of Open Source Software/learning website:

1. http://nptel.ac.in/
2. www.learnerstv.com
3. http://www.mne.psu.edu/cimbala/Learning/Fluid/fluid.htm
4. http://www.efluids.com/efluids/pages/edu_tools.htm

I. Text Books & Reference Books:

1	Fluid Mechanics And Fluid Power Engineering-D.S.Kumar,S K Kataria Publishers, N. Delhi
2	Fluid Mechanics & Hydraulic Machines - R.K.Bansal, Laxmi Publication
3	Fluid Mechanics: Basic Concepts & Principles-Shiv Kumar, Ane Books Pvt. Ltd.
4	Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co
5	Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
6	Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.