

**B. E. Semester: IV**  
**Automobile Engineering**  
**Subject Name: FLUID MECHANICS (AE406)**

**Course Objective:**

- To present a problem oriented in depth knowledge of FLUID MECHANICS
- To address the underlying concepts and methods behind FLUID MECHANICS

**Teaching / Examination Scheme:**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
AE406	<b>FLUID MECHANICS</b>	3	0	2	5	4	3	70	30	20	30	150

**Detailed Syllabus:**

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.
4. Buoyant force, stability of submerged body and floating body. Meta centre & meta centric height - analytical and experimental determination with problems.
5. **Kinematics of fluid flow :** Description of fluid flow- Lagrangian 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.
6. **Vortex Flow :** Forced Vortex flow , Free Vortex Flow, Equation of Motion for Vortex Flow, Equation of Forced Vortex Flow, Equation of Free Vortex Flow.
7. **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.

8. **Viscous Flow** : Flow between two parallel fixed plates, Couette flow, viscous flow through pipes, Hagen - Poiseuille's equation friction factor, Moody diagram, Darcy Weibach equation,.
9. **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.
10. **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, Mach angle. Stagnation properties. Pitot tube with compressibility correction factor.
11. **Flow Measurement** : Measurement of flow with venturimeter ,orifice-meter, nozzle, bendmeter, notches. Practical and term work will be based on above syllabus.

#### Lesson Planning:

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1 <sup>st</sup> , 2 <sup>ed</sup> , 3 <sup>ed</sup>	Unit 1	20 % .	1,2,3
2	4 <sup>th</sup> , 5 <sup>th</sup> , 6 <sup>th</sup>	Unit 2	20 %	4,5
3	7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup>	Unit 3	20 %	6,7
4	10 <sup>th</sup> , 11 <sup>th</sup> , 12 <sup>th</sup>	Unit 4	20 %	8,9
5	13 <sup>th</sup> , 14 <sup>th</sup> , 15 <sup>th</sup>	Unit 5	20 %	10,11

#### Instructional Method & Pedagogy:

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- 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.
- 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.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Experiments shall be performed in the laboratory related to course contents. Suggested list of experiment is given below.
  1. Determination of the Coefficient of discharge of given Orifice and Venturi meter.

2. Calculation of the rate of flow using Rota meter.
3. Determination of friction factor of given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
5. Conducting experiments and drawing the characteristic curves of reciprocating pump.
6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel.
8. Conducting experiments and drawing the characteristics curves of Francis turbine.
9. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
10. Drag estimation on models of automobiles of different shapes.

**Students Learning Outcomes:**

- The student can identify different areas of FLUID MECHANICS
- Can find the applications of all the areas in day to day life.

**Recommended Study Materials:**

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 and Hydraulic Machines-R.S.Khurmi , S.Chand & Co.
4. Fluid Mechanics by R.K.Rajput, S.Chand & Co.

