



CVM
UNIVERSITY

Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Mechanical Engineering)

Semester: IV

Course Code: 202090401

Course Title: Fluid Mechanics

Course Group: Professional Core Course IV

Course Objectives: The course is designed to give a very broad idea of fluid, fluid types, properties of fluid, fluid statics and dynamics and basic governing equations.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Fluids and Their Properties: Fluid and continuum, Shear stress in a moving fluid, molecular structure of material, Physical properties of fluids	02
2	Pressures and Head: Types of Pressure, Pascal's law, variation of pressure vertically in a fluid under gravity, equality of pressure at the same level in a static fluid, general equation for the variation of pressure due to gravity from a point to point in a static fluid, pressure and head, the hydrostatic paradox, Manometers, Pressure measurements using Elastic Pressure Transducers, Force Balance Pressure gauge, Electrical Pressure Transducers	06
3	Fluid Statics: Introduction, Action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure, resultant force and center of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy.	07



4	Fluid Kinematics: Description of Fluid flow, Classification of fluid flows, Stream line, path lines and streak lines, acceleration of a fluid particle, discharge and mean velocity, continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system. Rotational and ir-rotational flow, circulation and vorticity, streamlines and the stream functions, velocity potential and potential flow, relation between stream function and velocity potential; flow nets, stream function and velocity potential for uniform flow, vortex flow.	07
5	Fluid Dynamics (Momentum and energy Principle): Momentum and fluid flow, Momentum equation for 2-D and 3-D flow along a stream line, momentum correction factor, Euler's equation of motion along a stream line, Mechanical energy of a flowing fluid – Bernoulli's theorem, kinetic energy correction factor, pitot tube, determination of volumetric flow rate via pitot tube, changes of pressure in tapering pipe, principle of venturimeter, pipe orifices, theory of small orifices discharging to atmosphere, theory of large orifices, Rotameter, elementary theory of notches and weirs, flow in a curved path	07
6	Dimensional Analysis and Similarities: Dimension reasoning, dimensional homogeneity and its application, dimensional analysis using Rayleigh's method, Buckingham π -theorem, significance of dimensionless numbers, use of dimensionless numbers in experimental investigation, Geometric similarity, Dynamic similarity, Kinematic similarity, model testing-Model laws, Undistorted and Distorted models.	05
7	Viscous Flow: Flow regimes and Reynolds number, Reynolds experiment, Navier-Stokes equation of motion, Relationship between shear stress and pressure gradient, Laminar uni-directional flow between stationary parallel plates and parallel plates having relative motion, laminar flow in circular pipe- Hagen Poiseuille formula, Dashpot mechanism, Viscous resistance in a bush bearing, collar bearing and foot step bearing	04
8	Turbulent Flow & Compressible Flow: Turbulent Flow: Expression for coefficient of friction - Darcy Weishbach Equation, Moody diagram resistance of smooth and rough pipes shear stress and velocity distribution in turbulent flow through pipes. Compressible Flow: Basic equations for one dimensional compression, Pressure wave propagation, sound velocity in fluid, Mach number, Stagnation properties	04
9	Flow through pipes: Major energy losses, Minor energy losses, Hydraulic gradient and total energy lines, Pipes in series and parallel, Equivalent pipes, Siphon, power transmission through pipe, Flow through nozzle at end of pipe, Water hammer in pipes	03

List of Practicals / Tutorials:

1	To understand pressure measurement procedure and related instruments/devices.
2	To determine metacentric height of floating body.
3	Verification of Bernoulli's theorem.
4	To measure the velocity of flow using Pitot tube.
5	To determine the Coefficient of discharge through different flow meters.



6	To determine the Coefficient of discharge through open channel flow over a Notch.
7	To determine the different types of flow Patterns by Reynolds's experiment.
8	To determine the Friction factor for the different pipes.
9	To determine the loss coefficients for different pipe fittings.
10	To determine the viscosity of fluid by viscometer

Reference Books:

1	Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
2	Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd.
3	Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.
4	Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.
5	Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
6	Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria & Sons

Supplementary learning Material:

1	NPTEL Resources
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Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Industrial/ Field visits

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						R: Remembering; U: Understanding; A: Applying; N: Analyzing; E: Evaluating; C: Creating
R	U	A	N	E	C	
25%	25%	20%	25%	5%	0%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the basic concept of fluid mechanics.	25
CO-2	Get acquainted with statics, dynamics and various approaches to fluid mechanics.	25
CO-3	Examine and understand fundamentals of flow through pipes.	20



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CO-4	Understand and evaluate basics of viscous flow, turbulent flow and compressible flow.	30
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Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025