SARVAJANIK UNIVERSITY
SarvajanikCollege of Engineering and Technology
Bachelor of Technology
Civil Engineering

B.Tech.II Semester III

Subject Name: Fundamentals of Fluid Mechanics **Subject Code:** BTCL13303
Type of course: PCC III
Prerequisite: System of units, Laws of motion, Basic idea of force, Concept of centroid & Moment of Inertia
Rationale: 1. To develop a basic understanding about the properties of fluids, their behaviour under static and dynamic conditions.
2. To enable the students to apply the basic principles of Fluid Mechanics to solve real life problems

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
4	0	2	5	60	25	15	30	20	

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Module 1: Basic Concepts and Definitions** Distinction between a fluid and solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.	06	10 %
2.	**Module 2: Fluid Statics** Fluid Pressure: Pressure at a point, Pascal's law, and pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.	08	15 %
3.	**Module 3 : Fluid Kinematics** Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational	12	20 %

	and rotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three - dimensional continuity equations in Cartesian coordinates		
4.	**Module 4 : Fluid Dynamics** Surface and body forces; Equations of motion, Euler's equation; Bernoulli's equation, derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.	10	20 %
5.	**Module 5 : Flow through Pipes** Major and minor losses, laws of friction, hydraulic gradient line and total energy line, flow through pipes, equivalent pipes and branching of pipes, pipe networks by Hardy Cross method Viscous flow-Couette flow, Hagen-Poiseuille equation-flow between parallel plates.	12	15 %
6.	**Module 6 : Dimensional Analysis and Similitude** Fundamental dimensions-Physical Quantity and Dimensions-Dimensional Homogeneity- Non Dimensional parameters, Theorem dimensional analysis, Choice of variables, Determination of Dimensionless parameters. Model Similitude-Physical models- geometric-kinematic and dynamic similarity	06	10%
7.	**Module 7: Boundary Layer** Definition of boundary layers, Laminar and turbulent boundary layers, Displacement, momentum and energy thickness, Momentum integral equation, Applications.	06	10 %

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	20	20	10	10

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

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

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Fluid Mechanics and Machinery	C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli	Oxford University Press 0195699637, 9780195699630	2010	1st
2	Hydraulics and Fluid Mechanics	P M Modi and S M Seth	Standard Book House ISBN-13: 9788189401269	2019	22nd
3	Theory and Applications of Fluid Mechanics	K. Subramanya	Tata McGraw Hill ISBN: 9789353163426, 9353163420	2018	2nd
4	Fluid Mechanics with Engineering Applications	R.L. Daugherty, J.B. Franzini and E.J.Finnemore	McGraw-Hill Education (ISE Editions) ISBN-13 : 978-0071142144	1997	9th
5	Fluid Mechanics	A.K. Jain	Khanna Publishers 978-81-7409-194-9	1998	12th
6	Fluid Mechanics and Hydraulic Machines	R.K.Bansal	Laxmi Publications ISBN – 13 : 978-8131808153	2018	9th

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Demonstrate the difference between solid and fluid, its properties and behavior in static conditions. (R, U – Cognitive Level)	20
CO-2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.(U,A – Cognitive Level)	30
CO-3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.(R, A – Cognitive Level)	20
CO-4	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.(R, A – Cognitive Level)	15
CO-5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface. (R, U – Cognitive Level)	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	2	1	1	1	1	1	2	1	2	1	2	3	2	1
CO-2	3	2	1	1	1	1	1	2	1	2	1	2	3	2	1
CO-3	3	2	3	2	1	1	1	2	1	2	1	2	3	3	2
CO-4	3	3	3	2	1	1	1	3	1	2	1	3	3	3	3
CO-5	3	3	3	2	1	1	1	3	1	2	1	3	3	3	3
Rationale *	15	12	11	8	5	5	5	12	5	10	5	12	15	13	10

Rationale*: All CO's are compatible and matching to be derived POs to several extents.The principles of fluid mechanics will help to develop a basic understanding about the properties of fluids, their behaviour under static and dynamic conditions.

List of Practicals:

1. Measurement of viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of jets
9. Flow Visualisation -Ideal Flow
10. Velocity Distribution in Open channel flow

Major Equipment:

1. Viscometer
2. Piezometers, Manometers, pressure gauges
3. Floating body
4. Reynolds experimental setup
5. Hydraulic bench with modular attachments for various experiments

List of Open Source Software:

1. Water gems
2. Open FOAM