COURSE HANDOUT

FLUID MECHANICS (CE-301)

CE-3RD SEMESTER

ACADEMIC YEAR (2024-25)

Dr Niranjan Singh

Professor

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
CE-301	Fluid Mechanics	Core	4	3	1	0	50	100	150

COURSE OUTCOMES

	At the end of the course the student will be able to:
CO1	Mathematically analyze simple flow situations and get clear thoughts of the concept of continuity.
CO2	Analyze of various flow solutions and various boundary layers of bounding surface.
CO3	Comprehend the momentum equation & dimensional analysis.
CO4	To obtain the velocity/pressure variations and the application of mass and momentum conservation laws for fluid flows.
CO5	Evaluate the flow and performance of pumps and turbines

Section A

Unit 1: *Fluid: Definition of fluid, Newton's law of viscosity, units and dimensions, Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, control volume-application of continuity equation and momentum equation, incompressible flow, Bernoulli's equation and its applications.* **(9 Hrs)**

Unit 2: *Flow of fluid: Exact flow solutions in channels and ducts, couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer - measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.*

(9 Hrs)

Unit 3: *Dimension Analysis: Need for dimensional analysis, methods of dimension analysis, types of similitude dimensionless parameters, application of dimensionless parameters, model analysis.*

(6 Hrs)

SECTION-B

Unit 4: *Pumps: Euler's equation, theory of rotodynamic machines, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles. Centrifugal pumps, working principle, work done by the impeller, performance curves, cavitations in pumps, reciprocating pump, working principle.*

(8 Hrs)

Unit 5: *Turbines:Classification of water turbines, heads and efficiencies, velocity triangles (axial, radial) and mixed flow turbines- Pelton wheel, Francis and Kaplan turbines, working principles , draft tube, specific speed, unit quantities, performance curves for turbines, governing of turbines.*

(8 Hrs)

Textbooks

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Fluid Mechanics and Machinery	C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli,	Oxford University Press	4th (2010)
2.	Fluid Mechanics and Hydraulic Machines	Sukumar Pati	McGraw Hill Education	10th (2020)
3.	Fluid Mechanics	Fox and McDonald	Wiley	8th (2015)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	*Fluid Mechanics Through Problems*	*R.J.Garde*	*New Age Publisher*	*7th (2018)*
2	*Fluid Mechanics*	*D.S.Kumar*	*Katson*	*4th (2012)*

COURSE PLAN	
Unit-I Fluid and its properties	
S.No	**Topics**	**Recommended Books**

S.No	Topics	Recommended Books
1	*Introduction to Fluids*	*Book 1, 2, Ch.1*
2	*Fluid Properties and Units*	*Book 1, 2, Ch.1*
3	*Control Volume and Continuity Equation*	*Book 1, 2, Ch.1*
4	*Momentum Equation and Incompressible Flow*	*Book 1, 2, Ch.1*
5	*Bernoulli's Equation and Applications*	*Book 1, 2, Ch.1*
6	*Fluid Dynamics and Viscosity*	*Book 1, 2, Ch.1*
7	*Compressibility and Surface Tension*	*Book 1, 2, Ch.1*
8	*Applications of Fluid Mechanics*	*Book 1, 2, Ch.1*
9	*Review and Integration*	*Book 1, 2, Ch.1*
Unit-II Flow of fluid		
10	*Exact flow solutions in channels and ducts*	*Book 1, Ch.2*
11	*Couette flow*	*Book 1, Ch.2*
12	*Poiseuille flow*	*Book 1, Ch.2*
13	*Laminar flow through circular conduits*	*Book 1, Ch.1*
14	*Laminar flow through circular annuli*	*Book 1, Ch.2*
15	*Concept of boundary layer*	*Book 2, Ch.2*
16	*Measures of boundary layer thickness*	*Book 2, Ch.2*
17	*Darcy Weisbach equation*	*Book 2, Ch.2*
18	*Friction factor*	*Book 2, Ch.2*
Unit-III : Dimension Analysis and Model analysis		
19	*Need for dimensional analysis*	*Book 2, Ch.3*
20	*Methods of dimension analysis*	*Book 2, Ch.3*
21	*Types of similitude*	*Book 2, Ch.3*
22	*Dimensionless parameters*	*Book 2, Ch.3*
23	*Application of dimensionless parameters*	*Book 2, Ch.3*
24	*Model analysis.*	*Book 2, Ch.3*
Unit-IV Centrifugal and Reciprocating pumps		
25	*Introduction of Pumps: Euler's equation,*	*Book 2, Ch.5*
26	*Theory of rotodynamic machines*	*Book 1, Ch.5*
27	*Centrifugal pumps, working principle*	*Book 1, Ch.5*
28	*Work done by the impeller*	*Book 2, Ch.5*
29	*Performance curves*	*Book 1, Ch.5*
30	*Cavitations in pumps*	*Book 2, Ch.5*
31	*Reciprocating pump*	*Book 1, Ch.5*
32	*Working principle, Slip*	*Book 1, Ch.5*

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	Unit-V Hydraulic Turbines	
33	Introduction to Turbines, classification of water turbines	Book 2, Ch.8
34	Heads and efficiencies	Book 1, Ch.8
35	velocity triangles (axial, radial) and mixed flow turbines	Book 2, Ch.8
36	Pelton wheel- working principles	Book 1, Ch.8
37	Francis and Kaplan turbines	Book 2, Ch.9
38	Draft tube, specific speed, unit quantities	Book 2, Ch.9
39	Performance curves for turbines,	Book 2, Ch
40	Governing of turbines.	Book 2, Ch

ADDITIONAL WEB RESOURCES

1	https://nptel.ac.in/courses/112/105/112105171/
2.	https://drive.google.com/drive/folders/1A3r4lif9nQwO731uKYRymj3n_TH_1vF4?usp=drive_link

GRADING AND ASSESSMENT

- **Sessional Test**: *20 marks*
- **Assignment**: *20 marks*
- **Attendance**: *10 marks*
- **Final Examination**: *100 marks*

COURSE POLICIES

- **Attendance**: *Minimum 75% attendance is mandatory to appear in the final examination of the course.*
- **Academic Integrity**: *MIET's academic integrity policies apply. Plagiarism will not be tolerated.*
- **Late Submissions**: *Assignments and projects must be submitted by the specified timelines.*

FACULTY INFORMATION

- **Office Hours**

  Monday (12:05 PM - 12:55 PM)
  Friday (12:05 PM - 12:55 PM)
  Contact Information
  niranjan.as@mietjammu.in

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