Ramgarhia Polytechnic College, Phagwara

Civil Engineering Department

Head of Department:	Er. Gurcharan Singh
Name of the Faculty:	Er. Rahul verma
Discipline:	Civil Engineering Department
Semester:	3rd
Subject:	Fluid Mechanics
Lesson Plan Duration:	16 Weeks

RATIONALE

Subject of Fluid Mechanics is a basic engineering subject and helps in solving fluid flow problems in the field of Civil Engineering. The subject deals with basic concepts and principles in hydrostatics, hydro kinematics

and hydrodynamics and their application in solving fluid -mechanics problems.

Learning Outcomes

After undergoing the subject, students will be able to:

- Interpret the different terms related to fluids.
- Calculate the pressure exerted by fluids on the walls of containers.
- Calculate discharge through pipes, irrigation channels, water supply pipe lines.
- Use different flow measurement devices like venturimeter, mouthpiece, notches, weir, orificemeter
- Calculate size of the pipe for carrying a particular discharge.
- Prepare the details like dimensions, slope of the irrigation, canals and water courses
- Differentiate between different type of water pumps used in the field.
- Measure the loss of head in pipes and channels

PO ⇨ / CO ⇩	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓			✓			✓
CO2		✓			✓		✓
CO3		✓			✓		
CO4		✓		✓		✓	✓
CO5	✓					✓	
CO6		✓	✓		✓		✓

CO7							
CO8							
CO9							

Syllabus

Units	Details	Hours
1.	Introduction 1.1 Fluids: Real and ideal fluids 1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics	(1 hrs)
2.	2. Properties of Fluids (definition only) 2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility.	(3 hrs)
3.	3. Hydrostatic Pressure 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications. 3.2 Total pressure, resultant pressure, and centre of pressure. 3.3 Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems)	(8 hrs)

4.	4. Measurement of Pressure 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure. 4.2 Piezometer, simple manometer and differential manometer, Bourden gauge and dead weight pressure gauge	(5 hrs)
5.	Fundamentals of Fluid Flow 5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow 5.2 Discharge and continuity equation (flow equation) {No derivation} 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy 5.4 Bernoulli's theorem; statement and description (without proof of theorem)	(6hrs)
6.	6. Flow Measurements (brief description with simple numerical problems) 6.1 Venturimeter and mouthpiece 6.2 Pitot tube 6.3 Orifices and mouthpieces 6.4 Current meters 6.5 Notches and weirs (simple numerical problems)	(06 hrs)
7.	7. Flow through Pipes 7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment 7.2 Critical velocity and velocity distributions in a pipe for laminar flow 7.3 Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula) 7.4 Hydraulic gradient line and total energy line 7.5 Pipes in series and parallel 7.6 Water hammer phenomenon and its effects (only definition and description)	(08 hrs)

8	8. Flow through open channels: 8.1 Definition of an open channel, uniform flow and non-uniform flow 8.2 Discharge through channels using i) Chezy's formula (no derivation) ii) Manning's formula (no derivation) 8.3 Most economical channel sections (no derivation) i) Rectangular ii) Trapezoidal 8.4 Head loss in open channel due to friction	(9hrs)
9	Hydraulic Pumps Hydraulic pump, reciprocating pump, centrifugal pumps (No numerical and derivations) (may be demonstrated with the help of working models) Note: Visit to Hydraulic research station is must to explain the various concepts	(2 hrs)

Reference Books:

1. Jagdish Lal, "Fluid Mechanics and Hyraulics" Delhi Metropolitan Book Co. Pvt Ltd.
2. Modi, PN, and Seth, SM; "Hydraulics and Fluid Mechanics", Delhi Standard Publishers Distributors.
3. Khurmi RS, "Hydraulics and Hydraulics Machines", Delhi S Chand and Co.
4. Poonia MP and Jakhar OP, “Laboratory Manual for Fluid Mechanics”; Standard Publishers Distributors, Delhi 4. Likhi SK., Laboratory Manual in Hydraulics, Delhi Wiley Eastern.
5. Birinder Singh , “Fluid Mechanics”, Kaption Publishing, New Delhi.
6. Sarao A.S., “Fluid Mechanics”, Tech. India Publication, New Delhi

Delivery/Instructional Methodologies

Sr.No.	Description
1.	Chalk and Talk
2.	PowerPoint Presentation

Assessment Methodologies

Sr. No.	Description	Type
1.	Student Assignment	Direct
2.	Test	Direct
3.	Board Examination	Direct
4.	Student Feedback	Direct

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
	N/A	N/A	N/A

Topics beyond syllabus/advanced topics

Units	Details	Hours
N/A	N/A	N/A

Web Source References

Sr. No.	URL
1.	https://nptel.ac.in/

Lesson Plan

Week	Theory		Practical	
	Lecture Day		Practical Day	
1st	1st	Introduction 1.1 Fluids: Real and ideal fluids 1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics	1.	To verify Bernoullis Theorem
	2nd	Properties of Fluids (definition only) Mass density, specific weight, specific gravity, viscosity		
	3rd	Surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility		
2nd	4th	Vapour pressure and compressibility	2.	To find out venturimeter coefficient
	5th	Hydrostatic Pressure: Pressure, intensity of pressure, pressure head,		
	6th	Pascal's law and its applications		
3rd	7th	Total pressure, resultant pressure, and centre of pressure	3	To determine coefficient of velocity (Cv), Coefficient of discharge (Cd) Coefficient of contraction (Cc) of
	8th	Total pressure and centre of pressure on horizontal, vertical		

		and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems		an orifice and verify the relation between them.
	9th	Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems		
4th	10th	Total pressure, resultant pressure, and centre of pressure	4	To perform Reynold's experiement
	11th	Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems		
	12th	Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular,		

		triangular, trapezoidal shapes and circular. (No derivation - Simple Numerical Problems		
5th	13th	Measurement of Pressure	5	To verify loss of head in pipe flow due to (a) Sudden enlargement b) Sudden contraction c) Sudden bend
	14th	Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.		
	15th	Piezometer, simple manometer		
6th	16th	Differential manometer	6	Demonstration of use of current meter and pitot tube
	17th	Bourden gauge and dead weight pressure gauge		
	18th	Fundamentals of Fluid Flow		
7th	19th	Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow	7	To determine coefficient of discharge of a rectangular notch/triangular notch.
	20th	Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow		
	21st	Discharge and continuity equation (flow equation) {No derivation		
8th	22nd	Types of hydraulic energy: Potential energy, kinetic	8	To perform Reynold's experiement

		energy, pressure energy		
	23rd	Bernoulli's theorem; statement and description (without proof of theorem)		
	24th	Flow Measurements (brief description with simple numerical problems)		
9th	25th	Venturimeter and mouthpiece	9	To verify loss of head in pipe flow due to (a) Sudden enlargement b) Sudden contraction c) Sudden bend
	26th	Current meters		
	27th	Orifices and mouthpieces		
10th	28th	Pitot tube	10	Demonstration of use of current meter and pitot tube
	29th	Notches and weirs (simple numerical problems)		
	30th	Flow through Pipes		
11th	31st	Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment	11	To find out venturimeter coefficient
	32nd	Critical velocity and velocity distributions in a pipe for laminar flow		
	33rd	Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance,		

		exit, obstruction and change of direction (No derivation of formula)		
12th	34th	Hydraulic gradient line and total energy line	12	To verify loss of head in pipe flow due to (a) Sudden enlargement b) Sudden contraction c) Sudden bend
	35th	Water hammer phenomenon and its effects (only definition and description.		
	36th	Pipes in series and parallel		
13th	37th	Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula)	13	To verify loss of head in pipe flow due to (a) Sudden enlargement b) Sudden contraction c) Sudden bend
	38th	Flow through open channels:		
	39th	Definition of an open channel, uniform flow and non-uniform flow		
14th	40th	Discharge through channels using i) Chezy's formula (no derivation	14	To verify Bernoullis Theorem
	41st	ii) Manning's formula (no derivation)		
	42nd	Most economical channel sections (no derivation) i) Rectangular ii) Trapezoidal		
15th	43rd	Head loss in open channel due to friction	15	To verify loss of head in pipe flow

	44th	Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula)		due to (a) Sudden enlargement b) Sudden contraction c) Sudden bend
	45th	Most economical channel sections (no derivation) i) Rectangular ii) Trapezoidal		
16th	46th	Head loss in open channel due to friction	16 .	VIVA
	47th	Hydraulic Pumps Hydraulic pump, reciprocating pump		
	48th	Centrifugal pumps (No numericals and derivations) (may be demonstrated with the help of working models		

NBA has defined the following seven POs for an Engineering diploma graduate:

i) **Basic and Discipline specific knowledge**: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

ii) **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.

iii**)** **Design/ development of solutions**: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

iv) **Engineering Tools, Experimentation and Testing**: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

v) **Engineering practices for society, sustainability and environment**: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

vi) **Project Management**: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

vii) **Life-long learning**: Ability to analyze individual needs and engage in updating in the context of technological changes.

Program Specific Outcomes (PSOs)

PSOs are a statement that describes what students are expected to know and be able to do in a specialized area of discipline upon graduation from a program. Program may specify 2-4 program specific outcomes, if required.

These are the statements, which are specific to the particular 11 program. They are beyond POs. Program Curriculum and other activities during the program must help in the achievement of PSOs along with POs.