Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY , BANGALORE-90

COURSE PLAN

Academic Year 2018-19

Program:	B E – CIVIL ENGINEERING
Semester :	3
Course Code:	18CV33
Course Title:	FLUID MECHANICS
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	60
Course Plan Author:	YASHASWINI R V

Academic Evaluation and Monitoring Cell

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Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	CV
Semester:	3	Academic Year:	2019
Course Title:	FLUID MECHANICS	Course Code:	18CV33
Credit / L-T-P:	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	60 Marks
CIA Marks:	40 Marks	Assignment	1 / Module
Course Plan Author:	YASHASWINI R V	Sign ..	Dt:
Checked By:	MOHAN K T	Sign ..	Dt:
CO Targets	CIA Target : 85 %	SEE Target:	70 %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory & problems). Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet. Numerical problems Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers(theory & problems). Introduction to Mechanical and electronic pressure measuring devices.	10	Fluid, Fluid properties	L2, L3
2	Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates. Numerical Problems. Introduction. Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle. Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equi potential lines. Numerical problems on Stream function and velocity potential. Introduction to flow net.	10	Fluid Statics, Fluid Kinamatics	L2, L3, L4
3	Introduction. Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation. Problems on applications of Bernoulli's equation (with and without losses). Vortex motion; forced vortex, free vortex, problems Momentum equation problems on pipe bends. Introduction. Venturimeter, Orificemeter, Pitot tube. Numerical Problems	10	Fluid Dynamics, Bernoulli's Principle	L2,L3,L4
4	Introduction, classification, flow through orifice, hydraulic coefficients, Numerical problems. Mouthpiece, classification,	10	Fluid flow, Bernoulli's	L2,L4

	Borda's Mouthpiece Introduction. Classification, discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Numerical problems. Ventilation of weirs, submerged weirs.		Principle	
5	Introduction. Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Numerical problems. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method, Numerical problems. Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes. Problems	10	Pipe Losses, Fluid Pressure	L2,L3,L4
-	**Total**	**50**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).
1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	-	-
	Text books		In Lib / In Dept
1,2,3,4, 5	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi		In Lib
1,2,3,4, 5	R.K. Bansal, "A Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi		In dept
1,2,3,4, 5	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Del		Not Available
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	-	-
1,2,3,4, 5	Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008(Ed)		In Lib
1,2,3,4, 5	K Subramanya, "Fluid Mechanics and Hydraulic Machines",Tata McGraw Hill Publishing Co. Ltd.		In Lib
1,2,3,4, 5	J. F. Douglas, J. M. Gasoriek, John Swaffield, Lynne Jack, "Fluid Mechanics", Pearson, Fifth Edition		Not Available
C	**Concept Videos or Simulation for Understanding**	-	-
C1			
C2			
C3			
C4			
C5			
C6			
C7			
C8			
C9			
C10			
D	**Software Tools for Design**	-	-

E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	17CV23	Elements of Civil Engineering & engineering Mechanics	Components of Forces, Mechanics Centroid, Moment of Inertia	2	-	Understand L2

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Fluid Properties, Pressure Measuring Devices	Higher Study	-	Understand L2
2	Fluid Statics, Kinamatics	Higher Study	-	Understand L2
3	Bernoulie's Principle, Dynamics,	Higher Study		Understand L2
5				
-				
-				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	18CV33.1	Student Should be able to understand fluid and its properties.	5	Fluid	Lecture	Slip Test	L3 Applying
1	18CV33.2	Student Should be able to understand fluid flow by applying pressure at a point.	5	Fluid properties	Lecture/ Tutorial	Assignment	L3 Applying

2	18CV33.3	Student Should be able to compute and solve problems on fluid at rest by applying the knowledge of Hydrostatics.	3	Fluid Statics	Lecture	Assignment	L4 Analyzing
2	18CV33.4	Student Should be able to apply principles of mathematics to represent kinamatic concepts related to fluid flow.	7	Fluid Kinamatics	Lecture	Slip Test	L4 Analyzing
3	18CV33.5	Student Should be able to analyze Bernoulli's principles for real fluids by applying fundamental law of fluid mechanics.	5	Fluid Dynamics	Lecture	Slip test	L4 Analyzing
3	18CV33.6	Student Should be able to attain discharge in closed condutes using flow measuring devices by applying Bernoulli's principles.	5	Bernoulli's Principles	Lecture/ Tutorial	Assignment	L4 Analyzing
4	18CV33.7	Student Should be able to attain discharge in orifice and mouth pieces by applying Bernoulli's principles.	5	Bernoulli's Principles	Lecture/ Tutorial	Assignment	L4 Analyzing
4	18CV33.8	Student Should be able to attain discharge over notches and weirs by applying Bernoulli's principles.	5	Bernoulli's Principles	Lecture/ Tutorial	Assignment	L4 Analyzing
5	18CV33.9	Student Should be able to compute major and minor losses in pipe lines due to pipe fittings.	5	Pipe Losses	Lecture	Assignment	L4 Analyzing
5	18CV33.10	Student Should be able to compute pressure variation of fluid in pipe lines by applying water hammer.	5	Fluid Pressure	Lecture	Assignment	L4 Analyzing
-	-	**Total**	**50**	-	-	-	-

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Understanding fluid properties.	CO1	L3
1	Use fluid properties to find out pressure variation in a fluid.	CO2	L3
2	Apply hydro static characteristics to study fluid at rest.	CO3	L4
2	Use mathematical concepts to study kinamatic properties of fluid flow.	CO4	L4
3	Apply laws of fluid to draw Bernoulli's principles.	CO5	L4
3	Apply Bernoulli's principle to find disharge in pipe lines.	CO6	L4
4	Apply Bernoulli's principle to find disharge in tanks.	CO7	L4
4	Apply Bernoulli's principle to find disharge over notches and weirs.	CO8	L4
5	To evaluate losses in pipelines.	CO9	L4
5	To find pressure due to closing and opening of valves in pipe lines.	CO10	L4

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	CO	PO	-	'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'	-
1	CO1	PO1		The basics of fluid mechanics form the basis of the knowledge of a Civil Engineer to encounter any problem in the field of Water resources engineering	L2
1	CO2	PO1		The basic knowledge of fluid and mathematics have been applied to find pressure in different fluids using manometers.	L3
1	CO2	PO2		The student develops the ability to solve the problems on the various pressure measuring devices.	L2
2	CO3	PO1		The basics of fluid statics form the basis of the knowledge of a Civil Engineer to encounter any problem in the field of Water resources engineering	L2
2	CO3	PO2		Identify, formulate analyse engineering problems reaching substantiated conclusions using mathematics and engineering sciences to find impact of body on fluid at rest.	L3
2	CO3	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to solve problems in lock gates.	L2
2	CO4	PO1		The Civil Engineer needs to understand how to analyse a flow without having to consider the forces causing the motion.	L1
2	CO4	PO2		Identify, formulate analyse engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences to compute the body in motion without impact of forces.	L3
3	CO5	PO1		The Civil Engineer needs to understand how to analyse a fluid flow with considering the forces causing the motion.	L1
3	CO5	PO2		Identify, formulate analyse engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences to compute the body in motion with impact of forces.	L3
3	CO5	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of fluid dynamics to solve problems in pipelines.	L2
3	CO6	PO1		The simple methods that have been used to determine the discharge and velocity of flow without using any electronic equipment, helps build the logic of a Civil Engineer	L3
3	CO6	PO2		The logic of the simple instruments like the venturimeter, orificemeter and pitot tube can inspire the students to design similar simple devices using the basic concepts of fluid flow.	L2
3	CO6	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of fluid dynamics to solve problems in pipelines.	L3
4	CO7	PO1		The simple methods that have been used to determine the discharge and velocity of flow without using any electronic equipment, helps build the logic of a Civil Engineer	L1
4	CO7	PO2		The logic of the simple instruments like the orifices and mouthpieces can inspire the students to design similar simple devices using the basic concepts of fluid flow.	L3
4	CO7	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of fluid dynamics to solve problems in openings in tanks.	L1
4	CO8	PO1		The simple methods that have been used to determine the discharge and velocity of flow without using any electronic equipment, helps build	L3

				the logic of a Civil Engineer	
4	CO8	PO2		The logic of the simple instruments like the notches & weirs can inspire the students to design similar simple devices using the basic concepts of fluid flow.	L2
4	CO8	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of fluid dynamics to solve problems in Notches and weires.	L2
5	CO9	PO1		The mechanics behind pipe flow and the energy losses associated with it provides a fundamental engineering knowledge to the student	L3
5	CO9	PO2		Analysis of flow through pipes is a promising problem solving area in Civil Engineering	L3
5	CO9	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of fluid dynamics to solve problems in major and minor losses in pipes.	L2
5	CO10	PO1		The mechanics behind watter hammer and the energy losses associated with it provides a fundamental engineering knowledge to the student	L1
5	CO10	PO2		Analysis of pressure in pipes causing water hammer is a promising problem solving area in Civil Engineering	L1
5	CO10	PO4		Use knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information of pressure.	L2

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes															-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	18CV33.1	Student Should be able to understand fluid and its properties.	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L3
1	18CV33.2	Student Should be able to understand fluid flow by applying pressure at a point.	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	L3
2	18CV33.3	Student Should be able to compute and solve problems on fluid at rest by applying the knowledge of Hydrostatics.	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-	L4
2	18CV33.4	Student Should be able to apply principles of mathematics to represent kinamatic concepts related to fluid flow.	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	L4
3	18CV33.5	Student Should be able to analyze Bernoulli's principles for real fluids by applying fundamental law of fluid mechanics.	1	3	-	2	-	-	-	-	-	-	-	-	-	-	-	L4
3	18CV33.6	Student Should be able to attain discharge in closed condutes using flow measuring devices by applying Bernoulli's principles.	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-	L4
4	18CV33.7	Student Should be able to attain discharge in orifice and mouth pieces by applying Bernoulli's principles.	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	L4
4	18CV33.8	Student Should be able to attain discharge over notches and weirs by applying Bernoulli's	3	2	-	2	-	-	-	-	-	-	-	-	-	-	-	L4

		principles.															
5	18CV33.9	Student Should be able to compute major and minor losses in pipe lines due to pipe fittings.	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-	L4
5	18CV33.10	Student Should be able to compute pressure variation of fluid in pipe lines by applying water hammer.	1	1	-	2	-	-	-	-	-	-	-	-	-	-	-	L4
-	**18CV33**	**Average attainment (1, 2, or 3)**	**2.6**	**2.5**		**2.4**									-	-	-	**-**
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	-				

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Fluids & Their Properties Fluid Pressure and Its Measurements	10	2	-	-	1	1	2	CO1, CO2	L2, L3
2	Hydrostatic forces on Surfaces, Fundamentals of fluid flow	10	2	-	-	1	1	2	CO3, CO4	L2, L3, L4
3	Fluid Dynamics, Applications	10	-	2	-	1	1	2	CO5, CO6	L2, L3, L4
4	Orifice and Mouthpiece, Notches and Weirs	10	-	2	-	1	1	2	CO7, C08	L3, L4
5	Flow through Pipes, Surge Analysis in Pipes	10	-	-	4	1	1	2	CO9, CO10	L2, L3, L4
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1, CO2, CO3, CO4	L2, l3, l4
3, 4	CIA Exam – 2	30	CO5, CO6, CO7, Co8	L2, L3, L4
5	CIA Exam – 3	30	CO9, CO10	L2, L3, L4
1, 2	Assignment - 1	05	CO1, CO2, CO3, CO4	L2, l3, l4
3, 4	Assignment - 2	05	CO5, CO6, CO7, CO8	L2, L3, L4
5	Assignment - 3	05	CO9, CO10	L2, L3, L4
1, 2	Seminar - 1	05	CO1, CO2, CO3, CO4	L2, l3, l4
3, 4	Seminar - 2	05	CO5, CO6,CO7,CO8	L2, L3, L4
5	Seminar - 3	05	CO9, CO10	L2, L3, L4
1, 2	Other Activities – define – Slip test		CO1 to Co10	L2, L3, L4 . ..
	Final CIA Marks	**40**	**-**	**-**

D1. TEACHING PLAN - 1

Module - 1

Title:		Appr Time:	12 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Understand fluid and its properties.	CO1	L3
2	Understand fluid flow by applying pressure at a point.	CO2	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Concept of fluid	CO1	L2
2	Systems of units	CO1	L2
3	Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity, Surface tension	CO1	L2
4	Fluid as a continuum	CO1	L2
5	Newton's law of viscosity	CO1	L2
6	Numerical problems	CO1	L3
7	Capillary rise in a vertical tube and between two plane surfaces	CO1	L2
8	Numerical problems	CO1	L3
9	Vapor pressure of liquid	CO1	L2
10	Compressibility and bulk modulus	CO1	L2
11	Pressure inside a water droplet, pressure inside a soap bubble and liquid jet	CO1	L2
12	Numerical problems	CO1	L3
13	Pressure at a point	CO2	L2
14	Pascal's law	CO2	L3
15	Variation of pressure with depth	CO2	L3
16	Types of pressure	CO2	L2
17	Measurement of pressure using simple, differential & inclined manometers	CO2	L3
18	Numerical problems	CO2	L3
19	Introduction to Mechanical and electronic pressure measuring devices	CO2	L2
c	**Application Areas**	**CO**	**Level**
1	Understanding fluid properties.	CO1	L3
2	Use fluid properties to find out pressure variation in a fluid.	CO2	L3
d	**Review Questions**	-	-
1	Define fluid. Distinguish between liquids and gases. (Dec2013,Jan 2014)	CO1	L2
2	Define the following fluid properties with units: i) Mass Density	CO1	L2

	ii) Specific Gravity iii) Dynamic Viscosity iv) Vapour Pressure v) Capillarity(Dec 2011, July 2013, July2014, 2015)		
3	Write units of (i) Surface tension (ii) Dynamic viscosity (iii) Power (iv) Momentum and (v) Pressure (July 2013,Jan 2014)	CO1	L2
4	Define and mention units of (i) Kinematic viscosity (ii) Density (July 2013, Jan 2014, Jan 2015)	CO1	L2
5	Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet (Dec 13, Jan 2015)	CO1	L2
6	State and prove Newton's law of viscosity(Jan 2015)	CO1	L2
7	Illustrate capillary rise and drop with appropriate sketches clearly indicating the fluids involved in each case. (July 2013,July 2015)	CO1	L2
8	Define capillarity and derive an expression for capillary rise. (Jan 2015)	CO1	L2
9	Derive an expression for capillary rise and capillary fall with sketches.	CO1	L2
10	Distinguish between Ideal & real fluids, ii) Surface tension and capillarity	CO1	L2
11	Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet. (Jan-2014)	CO1	L2
12	Give reasons for the following: I) Viscosity of the fluid decreases with increase in temperature. ii) Shape of water droplet is spherical. iii) Capillary rise occurs when glass tube is immersed in water. iv) Specific gravity is dimensionless.	CO1	L2
13	A thin plate is placed between two flat surfaces 'h' cm apart such that the viscosity of the liquids on the top and bottom of the plate are $\mu 1$ and $\mu 2$ respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of the thin plate is minimum. Assume 'h' to be very small. (July 2013)	CO1	L3
14	A plate having an area of 0.6 m^2 is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.36 m/s. There is a cushion of fluid 1.8mm thick between the plane and the plate. Find the viscosity of the fluid, if the weight of the plate is 280N. (Dec 2011)	CO1	L3
15	A 150 mm diameter vertical cylinder rotates concentrically with inside another cylinder of diameter 151.mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque 12 N-m is required to rotate the inner cylinder with at 100rpm. Determine the viscosity of the fluid. (Dec2013,July 2014)	CO1	L3
16	Two large surfaces are 2.5 cm apart. This space is filled with an oil of viscosity 0.80 Ns/m^2. Find the force required to drag a thin plate of area 0.5 m^2 between the two surfaces at a i) When the plate is equidistant from the surfaces ii) When the plate is at 1 cm from one of the surfaces. (Jan13)	CO1	L3
17	The space, between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m^3/s requires a force of 98.1 N. Determine i) the dynamic viscosity of the oil in poise and ii) the kinematic viscosity of the oil in stokes if the specific gravity of oil is 0.95. (Jan 2015)	CO1	L3
18	A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 100 mm. If the thickness of the oil film is 1.4 mm and the dynamic viscosity of the oil is 0.7 $N\text{-}S/m^2$. Determine. i) Torque required to over come friction in bearing. ii) Power utilized in overcoming viscous resistance. Assume a linear velocity profile. (June-2012)	CO1	L3
19	A 50mm diameter and 0.10m long cylindrical body slides vertically down in a 52mm diameter cylindrical tube. The space between the cylindrical body and tube wall is filled with oil of viscosity 1.9 $N\text{-}s/m^2$. Determine its velocity of fall if its weight is 16N. (July 2013, July 2015)	CO1	L3
20	Two fixed parallel plates are 2.5cm apart. The space between the surfaces is filled with oil of viscosity 0.8 $N\text{-}s/m^2$. A flat thin late of 0.5m^2 area moves	CO1	L3

	through the oil at a velocity of 0.6m/s. Calculate the drag force when, (i) Plate is equidistant from both the planes (ii) Plate is at a distance of 1cm from one of the plane surface (July 2013, July 2015)		
21	A 150mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 N-m is required to rotate the inner cylinder at 100rpm. Determine the viscosity of the fluid.(July-2014)	CO1	L3
22	A cylinder of 120mm diameter rotates concentrically inside a fixed cylinder of diameter 125mm. Both the cylinders are 300mm long. Find the viscosity of the liquid that fills the space between the cylinders if a torque of 0.9 N—m required to maintaining speed of 60 rpm. (Dec 2013)	CO1	L3
23	An open tank contains water up to a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity. i) At the interface of the two liquids and ii) At the bottom of the tank. (July 2014)	CO1	L3
24	Two large surfaces are 2.5 cm apart. This space is filled with an oil of viscosity 0.80 Ns/m². Find the force required to drag a thin plate of area 0.5 m² between the two surfaces at a speed of 0.6 m/s. i) When the plate is equidistant from the surfaces ii) When the plate is at 1 cm from one of the surfaces(Jan-2013)	CO1	L3
25	The space, between two square flat part plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 metre per sec requires a force of 98.1N to maintain the spew. Determine i) The dynamic viscosity of the oil in poise and ii) the kinematic viscosity of the oil in stokes if the specific gravity of oil is 0.95. (Jan-2015)	CO1	L3
26	The space between two square flat plates of 800mm side is filled with an oil film of 20mm thickness. Lower plate is stationary and upper plate moves at a speed of 3 2m/s when 50N force is applied. Calculate: I) Shear stress ii) Dynamic viscosity of oil in poise iii) Kinematic viscosity of oil if G = 0.90.	CO1	L3
27	Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in, i) water and ii) mercury. The temperature of the liquid is 20˚C and the values of the surface tension of water and mercury at 20˚C in contact with air are 0.0736 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130˚. Take density of water at 20˚C as equal 7 kg/m³. (Jan 2015)	CO1	L3
28	Calculate he capillary rise in a glass tube of 2.5mm when immersed in mercury. The temperature of the liquid is 20ºC and the value of surface tension of mercury at 20ºC in contact with air is 0.5 N/m. the contact angle for mercury - = 135º (July 2013)	CO1	L3
29	A glass tube 2.5 mm in diameter contains mercury column with air above it. If a =0.50 N/m,What will be the capillary depression? Take Angle = 135˚. (Jan-2013)	CO1	L3
30	Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in, i) water and ii) mercury. The temperature of the liquid is 20˚C and the values of the surface tension of water and mercury at 20˚C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130˚. Take density of water at 20˚C as equal to 7 kg/ma.(Jan-2015)	CO1	L3
31	State and prove Pascal's law.(July-2014)	CO2	L2
32	Explain the different types of pressure. Give the relationship between them. Indicate these pressures by means of a sketch.(Jan-2013)	CO2	L2
33	With the help of a neat sketch define the terms: Absolute, gauge and vacuum pressure. Bring out the relationship between absolute and gauge pressure. (June-2012)	CO2	L2
34	Differentiate between : i) Absolute and gauge pressure	CO2	L2

	ii) Simple manometer and differential manometer and iii). Piezometer and pressure gauges.		
35	Derive equation for hydrostatic law of pressure variation.	CO2	L2
36	What is manometer? Distinguish between U tube differential manometer and inverted U-tube differential manometer.(Jan-2014)	CO2	L2
37	Briefly explain with sketches differential and simple manometers.	CO2	L2
38	List out the characteristics of Manometric liquids. Give any two examples for manometric liquids.(June-2012)	CO2	L2
39	Distinguish between simple manometer and differential manometer, with the help of sketches.(Jan-2013)	CO2	L2
40	With neat sketch, explain Bourdon's pressure gauge.(July-2014)	CO2	L2
41	Petrol of specific gravity 0.8 flows up through a vertical pipe. A and B are the two points in the pipe, B being 0.3 m higher than A. Connections are led from A and B to a U tube manometer containing mercury. If the pressure difference between A and B is 18 KPa, find the reading of differential manometer.(Jan-2013)	CO2	L3
42	If mercury barometer reads 700mm and Bourdon gauge at a point in a flow system reads 500 kN/m2, what is the absolute pressure at the point?(July-2013)	CO2	L3
43	An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cms. When an oil (S = 0.8) is used as a gauge fluid, the vertical height of the water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cms. Determine the difference of pressure between the pipes. Pipe B is lying below the pipe A.(June-2012)	CO2	L3
44	A single column manometer is connected to a pipe containing oil of specific gravity 0.8. The ratio of reservoir area to the limb is 100. The liquid level in the reservoir is 300 mm below the centre of the pipe containing oil and level of liquid in the right liquid limb is 500 mm above the liquid level in the reservoir. Determine the pressure of liquid in the pipe. The liquid in the reservoir and right limb is mercury with its sp.gr. as 13.6.	CO2	L3
45	A simple U — tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the pipe is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury (S = 13.6) level in the two limbs is 200mm and height of oil in the left limb from the centre of the pipe is 150mm below.(July-2015)	CO2	L3
46	U-tube manometer is used to measure the pressure of oil specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100mm below the level of mercury (specific gravity = 13.6) in the right limb. If the difference of mercury levels in the right limb and left limb is 160mm. Determine the absolute pressure of the oil in the pipe.(Dec-2011)	CO2	L3
47	A differential manometer is connected at the two points A and B of two pipes. The centre of pipe A is 3 m above centre of pipe B. Pipe A contains liquid of sp.gr. 1.5 while pipe B contains a liquid of sp.gr. 0.9. The maiometric liquid mercury is 5 m below the centre of pipe A. The pressure at A and B are 1 Kgf/cm and 1.8 Kgf/cm2 respectively. Find the difference in mercury level in the differential manometer.(Jan-2015)	CO2	L3
48	A simple U — tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the pipe is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury (S = 13.6) level in the two limbs is 200mm and height of oil in the left limb from the centre of the pipe is 150mm below.	CO2	L3
49	An U-tube differential manometer connects two pipes A and B. Pipe A contains CC/4(G = 1.59) under 130kN/m2 gauge pressure. Pipe B contains oil (G = 0.82) under 200kN/m2 gauge pressure. Pipe A is 2.5m above pipe B. The manometer contains mercury. Calculate the difference in mercury levels. Draw	CO2	L3

	neat sketch. The level of mercury connected to pipe A is in level with center of pipe B.		
50	The left leg of a U-tube mercury manometer is connected to a pipe line carrying water, the level of mercury in the leg being 0.6m below the centre of pipe line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in right leg contains benzene of sp.gr 0.88 to height of 0.3m. Find the pressure head and intensity in the pipe.	CO2	L3
51	A vertical isosceles triangular gate with its vertex up has a base width of 2m and a height of 1.5m. If the vertex of the gate is lm below the free water surface, find the total pressure force and the position of the centre of pressure on one side of the plate y water = 9.79kN/m .	CO2	L3
52	Prove that for a plate kept horizontal in a liquid will have its centroid coinciding with centre of pressure.	CO2	L3
53	With a illustrative sketch, What is the pressure corresponding to 25cm column of kerosene of relative density 0.8? What is the equivalent head of mercury corresponding to this pressure? water = 9 .79kN/m^3.(July-2015)	CO2	L3
54	A 90N rectangular solid block slides down a 30° inclined plane. The plane is lubricated by a 3mm thick film of oil of relative density 0.9 and viscosity 0.8 pa.s. If the contact area is 0.3m^2 estimate the terminal velocity of the block. (July-2015)	CO2	L3
55	What considerations govern the diameter of glass tube to be used in a manometer?	CO2	L3
56	What are the common liquids used in manometer? What conditions should it satisfy before you choose a manometric liquid?	CO2	L3
57	If the relative density of fluid is 1.59, calculate its Mass density, Specific weight and Specific volume.	CO2	L3
58	Determine the diameter of a droplet of water in mm. If the pressure inside is to be greater than outside pressure by 130N/mm^2.	CO2	L3
59	Determine the pressure at the bottom of sea 1.0km deep if density of sea water is 1030kg/m^3	CO2	L3
60	How are fluids classified based on property of viscosity? Explain with examples for each types.	CO1	L3
61	A liquid has a specific gravity of 0.72. Find its density and specific weight. Find also the weight per liter of liquid.	CO1	L3
62	Explain the working principles of electronic pressure gauge. List the types of electronic pressure gauge. Explain any one type.	CO2	L3
63	Define the following. Also mention their units (i) Specific weight (ii) Relative density (iii) Specific volume (iv) Mass density.	CO1	L3
64	Two vertical parallel plates distance 't' apart are partially submerged in liquid of specific weight 'w' and surface tension. Show that capillary rise is given by h where 0 is angle made by surface tension force with vertical.	CO1	L3
65	An oil of viscosity 5 poise is used for lubrication between a shaft ad sleeves. The diameter of shaft is 0.5m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100mm the thickness of oil film is 1mm	CO1	L3
66	What is U-tube differential manometer? Obtain an expression for difference of,pressure between two pipes at different levels.	CO2	L3
e	**Experiences**	-	-
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Module – 2

Title:		Appr Time:	7 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Compute and solve problems on fluid at rest by applying the knowledge of Hydrostatics.	CO3	L4
2	Student Should be able to apply principles of mathematics to represent kinamatic concepts related to fluid flow.	CO4	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
20	Total pressure	CO3	L3
21	Centre of pressure	CO3	L3
22	Total pressure on horizontal plane surface	CO3	L3
23	Total pressure on vertical plane surface	CO3	L3
24	Total pressure on inclined plane surface	CO3	L3
25	Total pressure on curved surfaces	CO3	L3
26	Water pressure on gravity dams	CO3	L3
27	Lock gates	CO3	L3
28	Numerical Problems	CO3	L4
29	Methods of describing fluid motion	CO4	L3
30	Velocity and Total acceleration of a fluid particle	CO4	L3
31	Types of fluid flow, Description of flow pattern.	CO4	L3
32	Basic principles of fluid flow	CO4	L3
33	three-dimensional continuity equation in Cartesian coordinate system.	CO4	L3
34	Derivation for Rotational and irroational motion	CO4	L3
35	Potential function, stream function, orthogonality of streamlines and equipotential lines.	CO4	L3
36	Numerical problems on Stream function and velocity potential.	CO4	L4
37	Introduction to flow net.	CO4	L3
c	**Application Areas**	**CO**	**Level**
1			
2			
d	**Review Questions**	-	-
67	Define the following terms: ii) Centre of pressure. i) Total pressure(Dec-2011)	CO3	L3
68	Derive an expression for the depth of centre of pressure from the free surface of liquid of an inclined plane surface submerged in the liquid.(Dec-2011)	CO3	L3
69	Circular opening 2.5m diameter, in a vertical side of tank is closed by a disc of 2.5m diameter which can rotate about a horizontal diameter. Determine The force on the disc. i)The torque required to maintain the disc in equilibrium in vertical position when the head of water above the horizontal diameter is 3.5.(Dec-2011)	CO3	L4
70	Derive an expression for total pressure on one side of an inclined plane and show that the centre of pressure lies lower than its centroid.(June-2012)	CO3	L3
71	A rectangular gate 5mx3m is placed under water such that the 3m edges are parallel to the free surface. The top and bottom edges are 4.0 m and 8.0 m below the water surface respectively. Determine the total pressure and the position of the centre of pressure on the gate.(June-2012)	CO3	L4
72	Derive an expression fro total pressure and centre of pressure for an inclined plane surface immersed in a liquid of specific weight.(Jan-2013)	CO3	L3
73	Prove that for a plate submerged in horizontal position in water the centre of pressure is same as centroid of the plate.	CO3	L3
74	Derive the three-dimensional continuity equation in the Cartesian coordinates.(Dec-2011)	CO3	L3
75	The velocity potential function for a two-dimensional flow is 4 = x(2y-1). At a	CO3	L4

	point P(4, 5), determine i) the velocity at that point ii) the value of stream function.(Dec-2011)		
76	hat do you mean by equipotential line and line of constant stream function? Show that the stream lines and equipotential lines meet orthogonally.(June-2012)	CO4	L2
77	A rectangular plate 2m wide and 3m depth is immersed in water such that its ends are at depths of 1.5 m and 3m respectively. Determine the total pressure acting on the plate and locate centre of pressure.(Jan-2013)	CO4	L4
78	Prove that for a plate submerged in horizontal position in water the centre of pressure is same as centroid of the plate.(July-2013)	CO3	L3
79	Derive the continuity equation in Cartesian coordinates for steady, incompressible, three dimensional flows.(Jan-2013)	CO4	L3
80	The velocity components in a two dimensional flow fields is given by u = y3 /3 + 2x - x2y,v = xy2 - 2y - x /3. Show that these functions represent the conditions for an irrotational flow. Obtain an expression for stream function(Jan-2013)	CO4	L4
81	In a flow the velocity vector is given by V = 3x i +4y j — 7z k . Determine the equation of the stream line passing a point M(1,4,5). (July-2013)	CO4	L4
82	The velocity potential 4) for a two dimensional flow is given by (x2 — y2) + 3xy. Calculate: i) the stream function vIr and ii) the flow rate passing between the stream lines through (1,1) and (1, 2).(July-2013)	CO4	L4
83	Derive the expressions for total pressure and centre of pressure on a vertical plate submerged in a static liquid.(Jan-2014)	CO3	L3
84	Explain the procedure of finding hydrostatic force on a curved surface.	CO3	L4
85	A circular plate 2.5 m diameter is immersed in water, its greatest and least depth below the free surface being 3 m and 1 m respectively. Find i) the total pressure on one face of the plate and ii) the position of centre of pressure.(Jan-2014)	CO3	L4
86	Define the terms velocity potential function, stream function and establish the relation between them.(Jan-2014)	CO3	L4
87	A stream function is given by y = 2x 2 — 2y2 . Determine the velocity and velocity potential function at (1, 2).(Jan-2014)	CO4	L4
88	Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical form of 4 m diameter, when the gate is placed on the dam in such a way that water is just going to spill. Take the length of the gate as 8 m.	CO4	L4
89	Show that streamlines and equipotential lines form a set of perpendicular lines.	CO4	L3
90	A circular plane surface 4m in diameter is immersed in water such that the top and bottom edges are 1.5 and 4m below the water surface. Find the total pressure and the position of centre of pressure with respect to the water surface.	CO4	L4
91	Define the terms : Stream line, Streak line , Flow net and Stagnation point. (04 Marks)	CO3	L3
92	Check whether the velocity components U = 3x ,V = 2z + 3x2 and W = -3z + 2t, satisfy the continuity equation.	CO4	
93	With Usual notation, derive expression for the force exerted on a submerged inclined plane surface by the static fluid and locate the position of centre of pressure. Also prove that the total pressure exerted by a static liquid on an inclined plane submerged surface is the same as the force exerted on a vertical plane surface as long as the depth of centre of gravity of the surface is unaltered.	CO4	L3
94	A square pipe whose two edges parallel to the ground surface is of edge dimension 1.5 m. It carries oil of specific gravity 0.9 under pressure (measured at the centre) 250 kN/m2. Find the force exerted by the oil on the gate valve at the end of the pipe and also find the position of the centre of pressure.	CO4	L4
e	**Experiences**	-	-
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E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	18CV33	Sem:	III	Marks:	30	Time:	75 minutes
Course:	Fluid Mechanics						

-	-	**Note: Answer any 3 questions, each carry equal marks.**	**Marks**	**CO**	**Level**
1	a	Define the following fluid properties with units: i) Mass Density ii) Specific Gravity iii) Dynamic Viscosity iv) Vapour Pressure v) Capillarity	10	CO1	L2
	b	A 150 mm diameter vertical cylinder rotates concentrically with inside another cylinder of diameter 151.mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque 12 N-m is required to rotate the inner cylinder with at 100rpm. Determine the viscosity of the fluid.	10	CO1	L3
2	a	State and prove Pascal's law.	10	CO2	L2
	b	The left leg of a U-tube mercury manometer is connected to a pipe line carrying water, the level of mercury in the leg being 0.6m below the centre of pipe line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in right leg contains benzene of sp.gr 0.88 to height of 0.3m. Find the pressure head and intensity in the pipe.	10	CO2	L3
3	a	Derive an expression fro total pressure and centre of pressure for an inclined plane surface immersed in a liquid of specific weight.	10	CO3	L3
	b	A rectangular gate 5mx3m is placed under water such that the 3m edges are parallel to the free surface. The top and bottom edges are 4.0 m and 8.0 m below the water surface respectively. Determine the total pressure and the position of the centre of pressure on the gate.	10	CO3	L4
4	a	Derive the continuity equation in Cartesian coordinates for steady, incompressible, three dimensional flows.	10	CO4	L3
	b	The velocity components in a two dimensional flow fields is given by u = y3 /3 + 2x - x2y,v = xy2 - 2y - x /3. Show that these functions represent the conditions for an irrotational flow. Obtain an expression for stream function.	10	CO4	L4

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18CV33	Sem:	III	Marks:	5/10	Time:	
Course:	Fluid Mechanics						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT15CV053	Define fluid. Distinguish between liquids and gases. (Dec2013,Jan 2014)	4	CO1	L2
2	1KT16CV020	Define the following fluid properties with units:	10	CO1	L2

		i) Mass Density ii) Specific Gravity iii) Dynamic Viscosity iv) Vapour Pressure v) Capillarity(Dec 2011, July 2013, July2014, 2015)			
3	1KT16CV026	Write units of (i) Surface tension (ii) Dynamic viscosity (iii) Power (iv) Momentum and (v) Pressure (July 2013,Jan 2014)	10	CO1	L2
4	1KT16CV028	Define and mention units of (i) Kinematic viscosity (ii) Density (July 2013, Jan 2014, Jan 2015)	10	CO1	L2
5	1KT16CV035	Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet (Dec 13, Jan 2015)	04	CO1	L2
6	1KT16CV038	State and prove Newton's law of viscosity(Jan 2015)	05	CO1	L2
7	1KT16CV039	Illustrate capillary rise and drop with appropriate sketches clearly indicating the fluids involved in each case. (July 2013,July 2015)	05	CO1	L2
8	1KT16CV042	Define capillarity and derive an expression for capillary rise. (Jan 2015)	05	CO1	L2
9	1KT16CV047	Derive an expression for capillary rise and capillary fall with sketches.	05	CO1	L2
10	1KT16CV048	Distinguish between Ideal & real fluids, ii) Surface tension and capillarity	04	CO1	L2
11	1KT16CV055	Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet. (Jan-2014)	04	CO1	L2
12	1KT16CV060	Give reasons for the following: I) Viscosity of the fluid decreases with increase in temperature. ii) Shape of water droplet is spherical. iii) Capillary rise occurs when glass tube is immersed in water. iv) Specific gravity is dimensionless.	08	CO1	L2
13	1KT16CV077	A thin plate is placed between two flat surfaces 'h' cm apart such that the viscosity of the liquids on the top and bottom of the plate are μ1 and μ2 respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of the thin plate is minimum. Assume 'h' to be very small. (July 2013)	10	CO1	L3
14	1KT16CV082	A plate having an area of 0.6 m^2 is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.36 m/s. There is a cushion of fluid 1.8mm thick between the plane and the plate. Find the viscosity of the fluid, if the weight of the plate is 280N. (Dec 2011)	10	CO1	L3
15	1KT16CV088	A 150 mm diameter vertical cylinder rotates concentrically with inside another cylinder of diameter 151.mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque 12 N-m is required to rotate the inner cylinder with at 100rpm. Determine the viscosity of the fluid. (Dec2013,July 2014)	10	CO1	L3
16	1KT16CV094	Two large surfaces are 2.5 cm apart. This space is filled with an oil of viscosity 0.80 Ns/m^2. Find the force required to drag a thin plate of area 0.5 m^2 between the two surfaces at a i) When the plate is equidistant from the surfaces ii) When the plate is at 1 cm from one of the surfaces. (Jan13)	10	CO1	L3
17	1KT16CV098	The space, between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m^3/s requires a force of 98.1 N. Determine i) the dynamic viscosity of the oil in poise and ii) the kinematic viscosity of the oil in stokes if the specific gravity of oil is 0.95. (Jan 2015)	10	CO1	L3
18	1KT16CV102	A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 100 mm. If the thickness of the oil film is 1.4 mm and the	10	CO1	L3

		dynamic viscosity of the oil is 0.7 N-S/m². Determine. i) Torque required to over come friction in bearing. ii) Power utilized in overcoming viscous resistance. Assume a linear velocity profile. (June-2012)			
19	1KT17CV007	A 50mm diameter and 0.10m long cylindrical body slides vertically down in a 52mm diameter cylindrical tube. The space between the cylindrical body and tube wall is filled with oil of viscosity 1.9 N-s/m². Determine its velocity of fall if its weight is 16N. (July 2013, July 2015)	10	CO1	L3
20	1KT17CV008	Two fixed parallel plates are 2.5cm apart. The space between the surfaces is filled with oil of viscosity 0.8 N-s/m². A flat thin late of 0.5m² area moves through the oil at a velocity of 0.6m/s. Calculate the drag force when, (i) Plate is equidistant from both the planes (ii) Plate is at a distance of 1cm from one of the plane surface (July 2013, July 2015)	10	CO1	L3
21	1KT17CV010	A 150mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 N-m is required to rotate the inner cylinder at 100rpm. Determine the viscosity of the fluid.(July-2014)	10	CO1	L3
22	1KT17CV011	A cylinder of 120mm diameter rotates concentrically inside a fixed cylinder of diameter 125mm. Both the cylinders are 300mm long. Find the viscosity of the liquid that fills the space between the cylinders if a torque of 0.9 N—m required to maintaining speed of 60 rpm. (Dec 2013)	10	CO1	L3
23	1KT17CV012	An open tank contains water up to a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity. i) At the interface of the two liquids and ii) At the bottom of the tank. (July 2014)	10	CO1	L3
24	1KT17CV013	Two large surfaces are 2.5 cm apart. This space is filled with an oil of viscosity 0.80 Ns/m². Find the force required to drag a thin plate of area 0.5 m² between the two surfaces at a speed of 0.6 m/s. i) When the plate is equidistant from the surfaces ii) When the plate is at 1 cm from one of the surfaces(Jan-2013)	10	CO1	L3
25	1KT17CV015	The space, between two square flat part plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 metre per sec requires a force of 98.1N to maintain the spew. Determine i) The dynamic viscosity of the oil in poise and ii) the kinematic viscosity of the oil in stokes if the specific gravity of oil is 0.95.(Jan-2015)	10	CO1	L3
26	1KT17CV017	The space between two square flat plates of 800mm side is filled with an oil film of 20mm thickness. Lower plate is stationary and upper plate moves at a speed of 3 2m/s when 50N force is applied. Calculate: I) Shear stress ii) Dynamic viscosity of oil in poise iii) Kinematic viscosity of oil if G = 0.90.	10	CO1	L3
27	1KT17CV019	Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in, i) water and ii) mercury. The temperature of the liquid is 20˚C and the values of the surface tension of water and mercury at 20˚C in contact with air are 0.0736 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130˚. Take density of water at 20˚C as equal 7 kg/m³. (Jan 2015)	10	CO1	L3
28	1KT17CV020	Calculate he capillary rise in a glass tube of 2.5mm when	10	CO1	L3

		immersed in mercury. The temperature of the liquid is 20ºC and the value of surface tension of mercury at 20ºC in contact with air is 0.5 N/m. the contact angle for mercury ˉ = 135º (July 2013)			
29	1KT17CV021	A glass tube 2.5 mm in diameter contains mercury column with air above it. If a =0.50 N/m,What will be the capillary depression? Take Angle = 135˚. (Jan-2013)	10	CO1	L3
30	1KT17CV023	Calculate the capillary effect in mm in a glass tube of 4 mm diameter, when immersed in, i) water and ii) mercury. The temperature of the liquid is 20˚C and the values of the surface tension of water and mercury at 20˚C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130˚. Take density of water at 20˚C as equal to 7 kg/ma.(Jan-2015)	10	CO1	L3
31	1KT17CV024	State and prove Pascal's law.(July-2014)	10	CO2	L2
32	1KT17CV025	Explain the different types of pressure. Give the relationship between them. Indicate these pressures by means of a sketch.(Jan-2013)	10	CO2	L2
33	1KT17CV026	With the help of a neat sketch define the terms: Absolute, gauge and vacuum pressure. Bring out the relationship between absolute and gauge pressure. (June-2012)	10	CO2	L2
34	1KT17CV028	Differentiate between : i) Absolute and gauge pressure ii) Simple manometer and differential manometer and iii). Piezometer and pressure gauges.	10	CO2	L2
35	1KT17CV029	Derive equation for hydrostatic law of pressure variation.	10	CO2	L2
36	1KT17CV031	What is manometer? Distinguish between U tube differential manometer and inverted U-tube differential manometer.(Jan-2014)	10	CO2	L2
37	1KT17CV032	Briefly explain with sketches differential and simple manometers.	10	CO2	L2
38	1KT17CV033	List out the characteristics of Manometric liquids. Give any two examples for manometric liquids.(June-2012)	10	CO2	L2
39	1KT17CV034	Distinguish between simple manometer and differential manometer, with the help of sketches.(Jan-2013)	10	CO2	L2
40	1KT17CV035	With neat sketch, explain Bourdon's pressure gauge.(July-2014)	06	CO2	L2
41	1KT17CV036	Petrol of specific gravity 0.8 flows up through a vertical pipe. A and B are the two points in the pipe, B being 0.3 m higher than A. Connections are led from A and B to a U tube manometer containing mercury. If the pressure difference between A and B is 18 KPa, find the reading of differential manometer.(Jan-2013)	10	CO2	L3
42	1KT17CV037	If mercury barometer reads 700mm and Bourdon gauge at a point in a flow system reads 500 kN/m2, what is the absolute pressure at the point?(July-2013)	10	CO2	L3
43	1KT17CV038	An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cms. When an oil (S = 0.8) is used as a gauge fluid, the vertical height of the water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cms. Determine the difference of pressure between the pipes. Pipe B is lying below the pipe A.(June-2012)	10	CO2	L3
44	1KT17CV040	A single column manometer is connected to a pipe containing oil of specific gravity 0.8. The ratio of reservoir area to the limb is 100. The liquid level in the reservoir is 300 mm below the centre of the pipe containing oil and level of liquid in the right liquid limb is 500 mm above the liquid level in the reservoir.	10	CO2	L3

		Determine the pressure of liquid in the pipe. The liquid in the reservoir and right limb is mercury with its sp.gr. as 13.6.			
45	1KT17CV041	A simple U — tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the pipe is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury (S = 13.6) level in the two limbs is 200mm and height of oil in the left limb from the centre of the pipe is 150mm below.(July-2015)	10	CO2	L3
46	1KT17CV042	U-tube manometer is used to measure the pressure of oil specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100mm below the level of mercury (specific gravity = 13.6) in the right limb. If the difference of mercury levels in the right limb and left limb is 160mm. Determine the absolute pressure of the oil in the pipe.(Dec-2011)	10	CO2	L3
47	1KT17CV050	A differential manometer is connected at the two points A and B of two pipes. The centre of pipe A is 3 m above centre of pipe B. Pipe A contains liquid of sp.gr. 1.5 while pipe B contains a liquid of sp.gr. 0.9. The maiometric liquid mercury is 5 m below the centre of pipe A. The pressure at A and B are 1 Kgf/cm and 1.8 Kgf/cm2 respectively. Find the difference in mercury level in the differential manometer.(Jan-2015)	10	CO2	L3
48	1KT17CV053	A simple U — tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the pipe is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury (S = 13.6) level in the two limbs is 200mm and height of oil in the left limb from the centre of the pipe is 150mm below.	10	CO2	L3
49	1KT17CV055	An U-tube differential manometer connects two pipes A and B. Pipe A contains CC/4(G = 1.59) under 130kN/m2 gauge pressure. Pipe B contains oil (G = 0.82) under 200kN/m2 gauge pressure. Pipe A is 2.5m above pipe B. The manometer contains mercury. Calculate the difference in mercury levels. Draw neat sketch. The level of mercury connected to pipe A is in level with center of pipe B.	10	CO2	L3
50	1KT17CV412	The left leg of a U-tube mercury manometer is connected to a pipe line carrying water, the level of mercury in the leg being 0.6m below the centre of pipe line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in right leg contains benzene of sp.gr 0.88 to height of 0.3m. Find the pressure head and intensity in the pipe.	10	CO2	L3
51	1KT18CV400	A vertical isosceles triangular gate with its vertex up has a base width of 2m and a height of 1.5m. If the vertex of the gate is lm below the free water surface, find the total pressure force and the position of the centre of pressure on one side of the plate y water = 9.79kN/m .	10	CO2	L3
52	1KT18CV401	Prove that for a plate kept horizontal in a liquid will have its centroid coinciding with centre of pressure.	10	CO2	L3
53	1KT18CV402	With a illustrative sketch, What is the pressure corresponding to 25cm column of kerosene of relative density 0.8? What is the equivalent head of mercury corresponding to this pressure? water = 9 .79kN/m^3.(July-2015)	10	CO2	L3
54	1KT18CV403	A 90N rectangular solid block slides down a 30° inclined plane. The plane is lubricated by a 3mm thick film of oil of	10	CO2	L3

		relative density 0.9 and viscosity 0.8 pa.s. If the contact area is $0.3m^2$ estimate the terminal velocity of the block.(July-2015)			
55	1KT18CV404	What considerations govern the diameter of glass tube to be used in a manometer?	05	CO2	L3
56	1KT18CV405	What are the common liquids used in manometer? What conditions should it satisfy before you choose a manometric liquid?	06	CO2	L3
57	1KT18CV406	If the relative density of fluid is 1.59, calculate its Mass density, Specific weight and Specific volume.	10	CO2	L3
58	1KT18CV407	Determine the diameter of a droplet of water in mm. If the pressure inside is to be greater than outside pressure by $130N/mm^2$.	05	CO2	L3
59	1KT18CV408	Determine the pressure at the bottom of sea 1.0km deep if density of sea water is $1030kg/m^3$	05	CO2	L3
60	1KT18CV409	How are fluids classified based on property of viscosity? Explain with examples for each types.	10	CO1	L3
61	1KT18CV410	A liquid has a specific gravity of 0.72. Find its density and specific weight. Find also the weight per liter of liquid.		CO1	L3
62	1KT18CV411	Explain the working principles of electronic pressure gauge. List the types of electronic pressure gauge. Explain any one type.	05	CO2	L3
63	1KT18CV412	Define the following. Also mention their units (i) Specific weight (ii) Relative density (iii) Specific volume (iv) Mass density.	10	CO1	L3
64	1KT18CV413	Two vertical parallel plates distance 't' apart are partially submerged in liquid of specific weight 'w' and surface tension. Show that capillary rise is given by h where 0 is angle made by surface tension force with vertical.	10	CO1	L3
65	1KT18CV414	An oil of viscosity 5 poise is used for lubrication between a shaft ad sleeves. The diameter of shaft is 0.5m and it rotates at 200 rpm. Calculate the power lost in oil for a sleeve length of 100mm the thickness of oil film is 1mm	10	CO1	L3
66	1KT18CV415	What is U-tube differential manometer? Obtain an expression for difference of,pressure between two pipes at different levels.	10	CO2	L3
67	1KT18CV416	Define the following terms: ii) Centre of pressure. i) Total pressure(Dec-2011)	10	CO3	L3
68	1KT18CV417	Derive an expression for the depth of centre of pressure from the free surface of liquid of an inclined plane surface submerged in the liquid.(Dec-2011)	10	CO3	L3
69	1KT18CV418	Circular opening 2.5m diameter, in a vertical side of tank is closed by a disc of 2.5m diameter which can rotate about a horizontal diameter. Determine The force on the disc. i)The torque required to maintain the disc in equilibrium in vertical position when the head of water above the horizontal diameter is 3.5.(Dec-2011)	10	CO3	L4
70	1KT18CV419	Derive an expression for total pressure on one side of an inclined plane and show that the centre of pressure lies lower than its centroid.(June-2012)	10	CO3	L3
71	1KT18CV420	A rectangular gate 5mx3m is placed under water such that the 3m edges are parallel to the free surface. The top and bottom edges are 4.0 m and 8.0 m below the water surface respectively. Determine the total pressure and the position of the centre of pressure on the gate.(June-2012)	10	CO3	L4
72	1KT18CV421	Derive an expression fro total pressure and centre of pressure for an inclined plane surface immersed in a liquid of specific weight.(Jan-2013)	10	CO3	L3

73	1KT18CV422	Prove that for a plate submerged in horizontal position in water the centre of pressure is same as centroid of the plate.	10	CO3	L3
74	1KT18CV423	Derive the three-dimensional continuity equation in the Cartesian coordinates.(Dec-2011)	10	CO3	L3
75	1KT18CV424	The velocity potential function for a two-dimensional flow is 4 = x(2y-1). At a point P(4, 5), determine i) the velocity at that point ii) the value of stream function.(Dec-2011)	10	CO3	L4
76	1KT18CV425	hat do you mean by equipotential line and line of constant stream function? Show that the stream lines and equipotential lines meet orthogonally.(June-2012)	10	CO4	L2
77	1KT15CV053	A rectangular plate 2m wide and 3m depth is immersed in water such that its ends are at depths of 1.5 m and 3m respectively. Determine the total pressure acting on the plate and locate centre of pressure.(Jan-2013)	10	CO4	L4
78	1KT16CV020	Prove that for a plate submerged in horizontal position in water the centre of pressure is same as centroid of the plate.(July-2013)	10	CO3	L3
79	1KT16CV026	Derive the continuity equation in Cartesian coordinates for steady, incompressible, three dimensional flows.(Jan-2013)	10	CO4	L3
80	1KT16CV028	The velocity components in a two dimensional flow fields is given by u = y3 /3 + 2x - x2y,v = xy2 - 2y - x /3. Show that these functions represent the conditions for an irrotational flow. Obtain an expression for stream function(Jan-2013)	10	CO4	L4
81	1KT16CV035	In a flow the velocity vector is given by V = 3x i +4y j — 7z k . Determine the equation of the stream line passing a point M(1,4,5). (July-2013)	10	CO4	L4
82	1KT16CV038	The velocity potential 4) for a two dimensional flow is given by (x2 — y2) + 3xy. Calculate: i) the stream function vIr and ii) the flow rate passing between the stream lines through (1,1) and (1, 2).(July-2013)	10	CO4	L4
83	1KT16CV039	Derive the expressions for total pressure and centre of pressure on a vertical plate submerged in a static liquid.(Jan-2014)	10	CO3	L3
84	1KT16CV042	Explain the procedure of finding hydrostatic force on a curved surface.	10	CO3	L4
85	1KT16CV047	A circular plate 2.5 m diameter is immersed in water, its greatest and least depth below the free surface being 3 m and 1 m respectively. Find i) the total pressure on one face of the plate and ii) the position of centre of pressure.(Jan-2014)	10	CO3	L4
86	1KT16CV048	Define the terms velocity potential function, stream function and establish the relation between them.(Jan-2014)	10	CO3	L4
87	1KT16CV055	A stream function is given by y = 2x 2 — 2y2 . Determine the velocity and velocity potential function at (1, 2).(Jan-2014)	10	CO4	L4
88	1KT16CV060	Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical form of 4 m diameter, when the gate is placed on the dam in such a way that water is just going to spill. Take the length of the gate as 8 m.	10	CO4	L4
89	1KT16CV077	Show that streamlines and equipotential lines form a set of perpendicular lines.	10	CO4	L3
90	1KT16CV082	A circular plane surface 4m in diameter is immersed in water such that the top and bottom edges are 1.5 and 4m below the water surface. Find the total pressure and the position of centre of pressure with respect to the water surface.	10	CO4	L4

D2. TEACHING PLAN - 2

Module – 3

Title:		Appr Time:	12 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Analyze Bernoulli's principles for real fluids by applying fundamental law of fluid mechanics.	CO5	L2
2	Attain discharge in closed condutes using flow measuring devices by applying Bernoulli's principles.	CO6	L3
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Forces acting on fluid in motion.	CO5	L3
2	Euler's equation of motion along a streamline	CO5	L3
3	Bernoulli's equation	CO5	L3
4	Assumptions and limitations of Bernoulli's equation	CO5	L3
5	Modified Bernoulli's equation	CO5	L3
6	Problems on applications of Bernoulli's equation (with and without losses)	CO5	L3
7	Vortex motion; forced vortex, free vortex problems	CO6	L3
8	Momentum equation	CO6	L4
9	Problems on pipe bends	CO6	L4
10	Venturimeter	CO6	L4
11	Orificemeter	CO6	L4
12	Pitot tube	CO6	L4
13	Numerical Problems	CO6	L4
c	**Application Areas**	**CO**	**Level**
1	Apply laws of fluid to draw Bernoulli's principles.	CO5	L3
2	Apply Bernoulli's principle to find discharge in pipe lines.	CO6	L4
d	**Review Questions**	-	-
1	Derive the Bernoulli's equation from the Euler's equation for a steady flow of fluid and list the assumptions made in it.(Dec-2011)	CO5	L3
2	State the Bernoulli's theorem. Starting from Euler's equation of motion along a stream line, derive the Bernoulli's equation. List the assumptions and limitations.	CO5	L3
3	A 45˚ bend a rectangular air duct of 1 m2 cross sectional area is gradually reduced to 0.5m2 area. Find the magnitude and direction of the force required to hold the duct in position if the velocity of flow at 1m2 section is 10 m/s, and pressure is 30 kN/m2 . Take the specific weight of air as 0.0116 kN/m3. (Dec-2011)	CO5	L3
4	250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135˚, find the magnitude and direction of the force on the bend. The pressure of water flowing is 400 kN/m2. Take specific weight of water as 9.81 kN/m3.(June-2012)	CO5	L3
5	Distinguish between: i) Venturimeter and orificemeter ii) Rectangular with inlet and cipolletti notch.(June-2012)	CO6	L4
6	The following are the date given for laying a water supply pipe line. The change in diameter is gradual from 20 cm at A to 50 cm at B. pressure at A and B are 80 kN/m2 and 60 kN/m2 respectively. The end B is 3 m higher than A. If the flow in the pipe is 200 lit/s, find : i) The direction of flow ii) The loss of head due to friction between A and B(Jan-2013)	CO5	L3
7	A 300mm x150mrn venturimeter is provided in a vertical pipeline carrying oil of the specific gravity 0.9, flow being upward. The difference in elevation of the	CO6	L4

	throat section and entrance section of the venturimeter is 300mm. The differential —tube mercury manometer shows a gauge deflection of 250mm. Calculate i) The discharge of oil ii) The pressure difference between the entrance section and the throat section. Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6.(Dec-2011)		
8	A pitot static tube is inserted in a 30 cm diameter pipe. The static pressure in the pipe is 12.5 cm of mercury (vacuum). The stagnation pressure at the centre of the pipe is 1.15 N/cm2 (Gauge). Calculate the rate of flow of water through the pipe. The mean velocity of flow is 0.875 times the central velocity. Take C = 0.985.(June-2012)	CO6	L4
9	A horizontal venturimeter with inlet diameter of 25 cm and throat diameter of 15 cm is used to measure the flow of water. The pressure at the throat is 30 cm of mercury (vacuum) and that at the inlet is 200 kN/m2(Gauge). Find the discharge of water through the meter. Take Cd = 0.98.(June-2012)	CO6	L4
10	A pitot tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6 m and static pressure head is 5 m. Calculate the velocity of flow assuming the coefficient of pilot tube = 0.98.(Jan-2013)	CO6	L4
11	A pitot tube is mounted on an airplane to indicate the speed of the plane relative to the prevailing wind. What differential pressure intensity in kPa will the instrument register when the plane is traveling at a speed of 200km/hr in a wind of 60 km/hr blowing against the direction of the plane? eau = 1.2 kg/m3.(July-2013)	CO6	L4
12	It is required to establish the throat diameter of a venturimeter in an installation of 100mm diameter pipe conveying water. The maximum range available in mercury-water differential manometer gauge is 50cm of mercury deflection. Find the maximum throat diameter which will indicate the fill gauge deflection when the flow rate is 20 LPs assuming coefficient of venturimeter as 0.984.(July-2013)	CO6	L4
13	Distinguish between : i) Steady and unsteady flow ii) Uniform and non-uniform flow iii) Compressible and incompressible flow.	CO5	L3
14	Name the different forces present in a fluid flow. What are the forces considered for the Euler's equation of motion?(Jan-2014)	CO5	L3
15	The diameters at the ends of a 16 m long vertical conical pipe conveying water are 0.5 m and 1.5 m. The loss of head between the ends is 2.65 m in either directions when the velocity at the smaller section is 9 m/s. If the smaller section is at the top and pressure head at this section is 2.15 m of water, fmd the pressure head at the lower end when the flow is, i) Downward and ii) Upward.(Jan-2014)	CO5	L3
16	A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and Cv = 0.98.(Jan-2014)	CO6	L4
17	Derive the equation for the discharge through venturimeter.(July-2014)	CO5	L3
18	Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.52 N/cm- and the pressure at the upper end is 9.81 N/cm`. Determine the difference in datum head if the flow through pipe is 40/ps.(July-2014)	CO5	L3
19	The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm.2 while the vacuum. pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the venturimeter. (Jan-2015)	CO6	L4
20	A pitot-static tube having a coefficient of 0.98 is used to measure the velocity of water in a pipe. The stagnation pressure recorded is 3 m and the static	CO6	L4

	pressure 2 m. Determine the velocity.(Jan-2015)		
21	A pipe of 300mm diameter is conveying 0.3m3/s of water has a right angled bend in horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.525 x 104 p.a and 23.544 x 104 p.a respectively.(July-2015)	CO5	L3
22	Define momentum equation. Derive an expression for force exerted by a fluid on a pipe bend.	CO5	L4
23	The water is flowing through a tapering pipe having diameter 300 mm and 150 mm at section 1 and 2 respectively. The discharge through the pipe is 40 litres/sec. The section 1 is 10 m above the datum and section 2 is 6 m above datum. Find the velocity of pressure at section 2 if that at section 1 is 400 kN/m2.	CO6	L4
24	Derive the expression for the point velocity using pitot tube.	CO5	L3
25	State the differential form of Energy equation. Integrate it. Name the resulting equation.	CO5	L3
26	List the assumptions made in the derivation of energy equation.	CO5	L3
27	A 50mm tube gradually expands to 100mm diameter tube a length of 10 mts. If the tube makes an angle of 20˚ in upward direction with the horizontal, determine the pressure P2 at the exit end, if the tube carries a discharge of 3.925 lts/sec and the inlet pressure P1 is 60kN/m2. Assuming i) No energy loss and ii) A loss of 0.20m.	CO6	L4
28	Pitot — Static tube placed in the centre of a 200mm pipe line has one orifice pointing upstream and the other perpendicular to it. If the pressure difference between the two orifices is 40mm of water when the discharge through the pipe is 1365 litres per minute. Calculate the coefficient of the pitot tube. Take the mean velocity in the pipe to be 0.83 of the central velocity.	CO6	L4
29	A 400 m long pipe tapers from 1.20 m diameter at high end and 0.60 m diameter at the low end, the slope of the pipe being 1 in 100. The pipe conveys a discharge of 1025 cum/s. If the pressure at high end is 75 KPa, find the pressure at the low end, ignore losses.	CO6	L4
30	A Pitot tube records a reading of 7.85 kPa as the stagnation pressure, when it is held at the centre of a pipe of 250 mm diameter conveying water. The static pressure in the pipe is 40 mm of mercury (vacuum). Calculate the discharge in the pipe assuming that the mean velocity of flow is 0.8 times the velocity at the centre. Take co-efficient of Pitot tube as 0.98.	CO6	L4
31	At a point in the pipe line where the diameter is 20cm, the velocity of water is 4 m/s and pressure is 343 kN/m2 . At a point 15m downstream the diameter reduces to 10cm. Calculate the pressure at this point if pipe is (i) horizontal (ii) vertical with flow downwards	CO5	L4
32	A pitot tube records reading of 7.85 KPa as the stagnation pressure, when it is held at centre of pipe of 250mm diameter conveying water. The static pressure pipe is 40mm of mercury (Vacuum). Calculate the discharge in pipe assuming, the mean velocity of flow is 0.8 times the velocity at centre. Take C v = 0.98.	CO6	L4
33	A Pitot tube records a reading of 7.85 kPa as the stagnation pressure, when it is held at the centre of a pipe of 250 mm diameter conveying wiater. The static pressure in the pipe is 40 mm of mercury (vacuum). Calculate the discharge in the pipe assuming that the mean velocity of flow is 0.8 times the velocity at the centre. Take co-efficient of Pitot tube as 0.98	CO6	L4
	Experiences	-	-
1			
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4			

Module – 4

Title:		Appr Time:	13 Hrs
a	***Course Outcomes***	-	**Blooms**

-	The student should be able to:	-	**Level**
1	Attain discharge in orifice and mouth pieces by applying Bernoulli's principles.	CO7	L4
2	Attain discharge over notches and weirs by applying Bernoulli's principles.	CO8	L4
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Hydraulic coefficients	CO7	L3
2	Flow through orifice	CO7	L3
3	Numerical problems	CO7	L4
4	Mouthpiece & Classification	CO7	L3
5	Borda's Mouthpiece	CO7	L3
6	Discharge over rectangular notch	CO8	L4
7	Discharge over triangular notch	CO8	L4
8	Discharge over trapezoidal notch.	CO8	L4
9	Discharge over Cippoletti notch	CO8	L4
10	Discharge over broad crested weirs	CO8	L4
11	Numerical problems	CO8	L4
12	Ventilation of weirs	CO8	L4
13	Discharge over submerged weirs	CO8	L4
c	**Application Areas**	**CO**	**Level**
1	Apply Bernoulli's principle to find disharge in tanks.	CO7	L3
2	Apply Bernoulli's principle to find disharge over notches and weirs.	CO8	L4
d	**Review Questions**	-	-
34	What is meant by 'end contraction'? Explain briefly.(Dec-2011)	CO8	L2
35	Derive an expression for the discharge over a triangular notch in terms of the head of water over the crest of the notch.(Dec-2011)	CO7	L4
36	Explain cipolletti notch. What is the advantage of cipolletti notch over trapezoidal notch? Give the equation of discharge over a cipolletti notch.(Jan-2013)	CO8	L2
37	Distinguish between : i) Notch and weir ii) Venturimeter and orificemeter iii) Coefficient of velocity and coefficient of discharg(Jan-2013)	CO8	L3
38	Define hydraulic co-efficient and Determine the hydraulic co-efficients experimentally.(July-2014)	CO7	L2
39	A 25mm diameter nozzle discharges 0.76m" of water/minute. when the head is 60m. The diameter of the jet is 22.5mm. Determine the values Cd and loss of head due to fluid resistance.(July-2014)	CO7	L4
40	A jet of water issuing from an orifice 25 mm diameter under a constant head of 1.5 m falls 0.915 m vertically before it strikes the ground at a distance of 2.288 m measured horizontally from the vena contracta. The discharge was found to be 102 £pm. Calculate the hydraulic coefficients of the orifice. (June-2012)	CO8	L4
41	Find the discharge over 10 m long rectangular weir under a head if 2 m, if the channel approaching the weir is 20 m wide and 2.5 m deep. Consider velocity of approach. Assume Cd = 0.6. Neglect end contraction. Take one trial.(Jan-2013)	CO8	L4
42	A discharge of 0.06 m3 /s was measured over a right angled notch. While measuring the head over the notch an error of 1.5mm was made. Determine the percentage error in discharge if the coefficient of discharge for the notch is 0.6.(July-2013)	CO8	L4
43	With the help of neat sketches explain i) Cipolletti notch and ii) Ogee weir.	CO8	L4
44	Derive an expression for discharge through a triangular notch. (Jan-2014)	CO8	L4
45	A rectangular notch of crest width 400 mm is used to measure flow of water in a rectangular channel 600 mm wide and 450 mm deep. If the water level in the channel is 225 mm above the weir crest, find the discharge in the channel. For the notch assume Cd = 0.63 and take velocity of approaeltito account. (Jan-2014)	CO8	L4
46	Distinguish between: i)Sharp crested and broad crested weirs	CO7	L4

	ii)Orifice and mouth piece. iii) Broad crested weir and submerged weir.(July-2014)		
47	Water flows over a rectangular weir I m wide at a depth of 1 5cm and afterwards passes through a triangular right angled weir. 'faking Cu tbr rectangular weir 0.62 and for triangular 0.59. Find the depth over the triangular weir.(July-2014)	CO8	L4
48	Explain the procedure to measure discharge using i) Triangular notch ii) Cipolletti notch iii) Orificemeter.(Jan-2015)	CO8	L4
49	A broad-crested weir of 50 m length, has 50 cm height of water above its crest. Find the maximum discharge. Take Cd = 0.60. Neglect velocity of approach. Also, if the velocity of approach is to be taken into consideration, find the maximum discharge when the channel has a cross sectional area of 50 m- on the upstream side.(Jan-2015)	CO8	L4
50	A rectangular notch 40cm long is used for measuring a discharge of 30 Cps. An error of 1.5mm was made while measuring the head over the notch. Calculate the percent error in the discharge Cd = 0.6.(July-2015)	CO8	L4
51	Explain with sketches i) Ogee weir ii) Broad crested weir	CO8	L4
52	Water is flowing in a rectangular channel of 1m wide and 0.75m deep. Find the discharge over a rectangular weir of crest length 600 mm, if the head of water over the crest of weir is 200mm and water from channel flows over the weir. Take Cd = 0.62, Neglect end contractions. Take velocity of approach into consideration.	CO8	L4
53	Define various hydraulic coefficients of an orifice and derive the relation between them.	CO8	L4
54	Differentiate between a large and small orifice. Obtain an expression for discharge through a large rectangular orifice.	CO7	L4
55	Water under a constant head of 4.5 m discharges through an external cylindrical mouthpiece of 50 mm diameter and 150 mm long. If Cc for the orifice is 0.6, find (i) the discharge in litres per second and ii) the absolute pressure at the vena contracta. Assume atmospheric pressure to be 10.3 m of water.	CO7	L4
56	What are the advantages of triangular notch over a rectangular notch?	CO8	L2
57	A right angle triangular notch is used for measuring a discharge of 30 lps. An error of 1.5 mm was made while measuring the head over the notch. Calculate the percentage error in estimating the discharge. Take Cd = 0.62.	CO8	L4
58	A suppressed rectangular weir is constructed across a channel of 0.77 m width with a head of 0.39 m and the crest 0.6 m above the bed of the channel. Estimate the discharge over it. Consider the velocity of approach and assume Cd = 0.623.	CO8	L4
59	Find the discharge of water flowing over rectangular notch of 3m length when the constant head of water over a notch is 40cm. Take Cd = 0.6.	CO8	L4
e	**Experiences**	-	-
1			
2			
3			
4		CO8	L3
5			

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	18CV33	Sem:	III	Marks:	30	Time:	75 minutes
Course:	Fluid Mechanics						

-	-	Note: Answer any 2 questions, each carry equal marks.	Marks	CO	Level
1	a	Derive the Bernoulli's equation from the Euler's equation for a steady flow of fluid and list the assumptions made in it.	10	CO5	L3

	b	250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135˚, find the magnitude and direction of the force on the bend. The pressure of water flowing is 400 kN/m2. Take specific weight of water as 9.81 kN/m3.	10	CO5	L3
2	a	Derive the equation for the discharge through venturimeter.	10	CO5	L3
	b	A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and Cv = 0.98.	10	CO6	L4
3	a	Differentiate between a large and small orifice. Obtain an expression for discharge through a large rectangular orifice.	10	CO7	L4
	b	Water under a constant head of 4.5 m discharges through an external cylindrical mouthpiece of 50 mm diameter and 150 mm long. If Cc for the orifice is 0.6, find (i) the discharge in litres per second and ii) the absolute pressure at the vena contracta. Assume atmospheric pressure to be 10.3 m of water.	10	CO7	L4
4	a	Derive an expression for discharge through a triangular notch.	10	CO8	L4
	b	A rectangular notch of crest width 400 mm is used to measure flow of water in a rectangular channel 600 mm wide and 450 mm deep. If the water level in the channel is 225 mm above the weir crest, find the discharge in the channel. For the notch assume Cd = 0.63 and take velocity of approaeltito account.	10	CO8	L4

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18CV33	Sem:	III	Marks:	30	Time:	90-120 minutes
Course:	Fluid Mechanics						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT15CV053	Derive the Bernoulli's equation from the Euler's equation for a steady flow of fluid and list the assumptions made in it.(Dec-2011)	10	CO5	L3
2	1KT16CV020	State the Bernoulli's theorem. Starting from Euler's equation of motion along a stream line, derive the Bernoulli's equation. List the assumptions and limitations.	10	CO5	L3
3	1KT16CV026	A 45˚ bend a rectangular air duct of 1 m2 cross sectional area is gradually reduced to 0.5m2 area. Find the magnitude and direction of the force required to hold the duct in position if the velocity of flow at 1m2 section is 10 m/s, and pressure is 30 kN/m2 . Take the specific weight of air as 0.0116 kN/m3. (Dec-2011)	10	CO5	L3
4	1KT16CV028	250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135˚, find the magnitude and direction of the force on the bend. The pressure of water flowing is 400 kN/m2. Take specific weight of water as 9.81 kN/m3.(June-2012)	10	CO5	L3
5	1KT16CV035	Distinguish between: i) Venturimeter and orificemeter ii) Rectangular with inlet and cipolletti notch.(June-2012)	10	CO6	L4
6	1KT16CV038	The following are the date given for laying a water supply pipe line. The change in diameter is gradual from 20 cm at A to 50 cm at B. pressure at A and B are 80 kN/m2 and 60 kN/m2 respectively. The end B is 3 m higher than A. If the flow in the pipe is 200 lit/s, find :	10	CO5	L3

		i) The direction of flow ii) The loss of head due to friction between A and B(Jan-2013)			
7	1KT16CV039	A 300mm x150mrn venturimeter is provided in a vertical pipeline carrying oil of the specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300mm. The differential —tube mercury manometer shows a gauge deflection of 250mm. Calculate i) The discharge of oil ii) The pressure difference between the entrance section and the throat section. Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6.(Dec-2011)	10	CO6	L4
8	1KT16CV042	A pitot static tube is inserted in a 30 cm diameter pipe. The static pressure in the pipe is 12.5 cm of mercury (vacuum). The stagnation pressure at the centre of the pipe is 1.15 N/cm2 (Gauge). Calculate the rate of flow of water through the pipe. The mean velocity of flow is 0.875 times the central velocity. Take C = 0.985.(June-2012)	10	CO6	L4
9	1KT16CV047	A horizontal venturimeter with inlet diameter of 25 cm and throat diameter of 15 cm is used to measure the flow of water. The pressure at the throat is 30 cm of mercury (vacuum) and that at the inlet is 200 kN/m2(Gauge). Find the discharge of water through the meter. Take Cd = 0.98.(June-2012)	10	CO6	L4
10	1KT16CV048	A pitot tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6 m and static pressure head is 5 m. Calculate the velocity of flow assuming the coefficient of pilot tube = 0.98.(Jan-2013)	10	CO6	L4
11	1KT16CV055	A pitot tube is mounted on an airplane to indicate the speed of the plane relative to the prevailing wind. What differential pressure intensity in kPa will the instrument register when the plane is traveling at a speed of 200km/hr in a wind of 60 km/hr blowing against the direction of the plane? eau = 1.2 kg/m3.(July-2013)	10	CO6	L4
12	1KT16CV060	It is required to establish the throat diameter of a venturimeter in an installation of 100mm diameter pipe conveying water. The maximum range available in mercury-water differential manometer gauge is 50cm of mercury deflection. Find the maximum throat diameter which will indicate the fill gauge deflection when the flow rate is 20 LPs assuming coefficient of venturimeter as 0.984.(July-2013)	10	CO6	L4
13	1KT16CV077	Distinguish between : i) Steady and unsteady flow ii) Uniform and non-uniform flow iii) Compressible and incompressible flow.	10	CO5	L3
14	1KT16CV082	Name the different forces present in a fluid flow. What are the forces considered for the Euler's equation of motion?(Jan-2014)	10	CO5	L3
15	1KT16CV088	The diameters at the ends of a 16 m long vertical conical pipe conveying water are 0.5 m and 1.5 m. The loss of head between the ends is 2.65 m in either directions when the velocity at the smaller section is 9 m/s. If the smaller section is at the top and pressure head at this section is 2.15 m of water, fmd the pressure head at the lower end when the flow is, i) Downward and ii) Upward.(Jan-2014)	10	CO5	L3
16	1KT16CV094	A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and Cv = 0.98.(Jan-2014)	10	CO6	L4

17	1KT16CV098	Derive the equation for the discharge through venturimeter. (July-2014)	10	CO5	L3
18	1KT16CV102	Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.52 N/cm- and the pressure at the upper end is 9.81 N/cm`. Determine the difference in datum head if the flow through pipe is 40/ps. (July-2014)	10	CO5	L3
19	1KT17CV007	The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/cm.2 while the vacuum. pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of Cd for the venturimeter. (Jan-2015)	10	CO6	L4
20	1KT17CV008	A pitot-static tube having a coefficient of 0.98 is used to measure the velocity of water in a pipe. The stagnation pressure recorded is 3 m and the static pressure 2 m. Determine the velocity.(Jan-2015)	10	CO6	L4
21	1KT17CV010	A pipe of 300mm diameter is conveying 0.3m3/s of water has a right angled bend in horizontal plane. Find the resultant force exerted on the bend if the pressure at inlet and outlet of the bend are 24.525 x 104 p.a and 23.544 x 104 p.a respectively. (July-2015)	10	CO5	L3
22	1KT17CV011	Define momentum equation. Derive an expression for force exerted by a fluid on a pipe bend.	10	CO5	L4
23	1KT17CV012	The water is flowing through a tapering pipe having diameter 300 mm and 150 mm at section 1 and 2 respectively. The discharge through the pipe is 40 litres/sec. The section 1 is 10 m above the datum and section 2 is 6 m above datum. Find the velocity of pressure at section 2 if that at section 1 is 400 kN/m2.	10	CO6	L4
24	1KT17CV013	Derive the expression for the point velocity using pitot tube.	10	CO5	L3
25	1KT17CV015	State the differential form of Energy equation. Integrate it. Name the resulting equation.	10	CO5	L3
26	1KT17CV017	List the assumptions made in the derivation of energy equation.	10	CO5	L3
27	1KT17CV019	A 50mm tube gradually expands to 100mm diameter tube a length of 10 mts. If the tube makes an angle of 20° in upward direction with the horizontal, determine the pressure P2 at the exit end, if the tube carries a discharge of 3.925 lts/sec and the inlet pressure P1 is 60kN/m2. Assuming i) No energy loss and ii) A loss of 0.20m.	10	CO6	L4
28	1KT17CV020	Pitot — Static tube placed in the centre of a 200mm pipe line has one orifice pointing upstream and the other perpendicular to it. If the pressure difference between the two orifices is 40mm of water when the discharge through the pipe is 1365 litres per minute. Calculate the coefficient of the pitot tube. Take the mean velocity in the pipe to be 0.83 of the central velocity.	10	CO6	L4
29	1KT17CV021	A 400 m long pipe tapers from 1.20 m diameter at high end and 0.60 m diameter at the low end, the slope of the pipe being 1 in 100. The pipe conveys a discharge of 1025 cum/s. If the pressure at high end is 75 KPa, find the pressure at the low end, ignore losses.	10	CO6	L4
30	1KT17CV023	A Pitot tube records a reading of 7.85 kPa as the stagnation pressure, when it is held at the centre of a pipe of 250 mm diameter conveying water. The static pressure in the pipe is 40 mm of mercury (vacuum). Calculate the discharge in the pipe assuming that the mean velocity of flow is 0.8 times the	10	CO6	L4

		velocity at the centre. Take co-efficient of Pitot tube as 0.98.			
31	1KT17CV024	At a point in the pipe line where the diameter is 20cm, the velocity of water is 4 m/s and pressure is 343 kN/m2 . At a point 15m downstream the diameter reduces to 10cm. Calculate the pressure at this point if pipe is (i) horizontal (ii) vertical with flow downwards	10	CO5	L4
32	1KT17CV025	A pitot tube records reading of 7.85 KPa as the stagnation pressure, when it is held at centre of pipe of 250mm diameter conveying water. The static pressure pipe is 40mm of mercury (Vacuum). Calculate the discharge in pipe assuming, the mean velocity of flow is 0.8 times the velocity at centre. Take C v = 0.98.	10	CO6	L4
33	1KT17CV026	A Pitot tube records a reading of 7.85 kPa as the stagnation pressure, when it is held at the centre of a pipe of 250 mm diameter conveying wiater. The static pressure in the pipe is 40 mm of mercury (vacuum). Calculate the discharge in the pipe assuming that the mean velocity of flow is 0.8 times the velocity at the centre. Take co-efficient of Pitot tube as 0.98	10	CO6	L4
34	1KT17CV028	What is meant by 'end contraction'? Explain briefly.(Dec-2011)	10	CO8	L2
35	1KT17CV029	Derive an expression for the discharge over a triangular notch in terms of the head of water over the crest of the notch.(Dec-2011)	10	CO7	L4
36	1KT17CV031	Explain cipolletti notch. What is the advantage of cipolletti notch over trapezoidal notch? Give the equation of discharge over a cipolletti notch.(Jan-2013)	10	CO8	L2
37	1KT17CV032	Distinguish between : i) Notch and weir ii) Venturimeter and orificemeter iii) Coefficient of velocity and coefficient of discharg(Jan-2013)	10	CO8	L3
38	1KT17CV033	Define hydraulic co-efficient and Determine the hydraulic co-efficients experimentally.(July-2014)	10	CO7	L2
39	1KT17CV034	A 25mm diameter nozzle discharges 0.76m" of water/minute. when the head is 60m. The diameter of the jet is 22.5mm. Determine the values Cd and loss of head due to fluid resistance.(July-2014)	10	CO7	L4
40	1KT17CV035	A jet of water issuing from an orifice 25 mm diameter under a constant head of 1.5 m falls 0.915 m vertically before it strikes the ground at a distance of 2.288 m measured horizontally from the vena contracta. The discharge was found to be 102 £pm. Calculate the hydraulic coefficients of the orifice. (June-2012)	10	CO8	L4
41	1KT17CV036	Find the discharge over 10 m long rectangular weir under a head if 2 m, if the channel approaching the weir is 20 m wide and 2.5 m deep. Consider velocity of approach. Assume Cd = 0.6. Neglect end contraction. Take one trial.(Jan-2013)	10	CO8	L4
42	1KT17CV037	A discharge of 0.06 m3 /s was measured over a right angled notch. While measuring the head over the notch an error of 1.5mm was made. Determine the percentage error in discharge if the coefficient of discharge for the notch is 0.6. (July-2013)	10	CO8	L4
43	1KT17CV038	With the help of neat sketches explain i) Cipolletti notch and ii) Ogee weir.	10	CO8	L4
44	1KT17CV040	Derive an expression for discharge through a triangular notch. (Jan-2014)	10	CO8	L4
45	1KT17CV041	A rectangular notch of crest width 400 mm is used to measure flow of water in a rectangular channel 600 mm wide and 450 mm deep. If the water level in the channel is 225 mm above the weir crest, find the discharge in the channel. For the notch assume Cd = 0.63 and take velocity of approaeltito account. (Jan-2014)	10	CO8	L4

46	1KT17CV042	Distinguish between: i)Sharp crested and broad crested weirs ii)Orifice and mouth piece. iii) Broad crested weir and submerged weir.(July-2014)	10	CO7	L4
47	1KT17CV050	Water flows over a rectangular weir I m wide at a depth of 1 5cm and afterwards passes through a triangular right angled weir. 'faking Cu tbr rectangular weir 0.62 and for triangular 0.59. Find the depth over the triangular weir.(July-2014)	10	CO8	L4
48	1KT17CV053	Explain the procedure to measure discharge using i) Triangular notch ii) Cipolletti notch iii) Orificemeter.(Jan-2015)	10	CO8	L4
49	1KT17CV055	A broad-crested weir of 50 m length, has 50 cm height of water above its crest. Find the maximum discharge. Take Cd = 0.60. Neglect velocity of approach. Also, if the velocity of approach is to be taken into consideration, find the maximum discharge when the channel has a cross sectional area of 50 m- on the upstream side.(Jan-2015)	10	CO8	L4
50	1KT17CV412	A rectangular notch 40cm long is used for measuring a discharge of 30 Cps. An error of 1.5mm was made while measuring the head over the notch. Calculate the percent error in the discharge Cd = 0.6.(July-2015)	10	CO8	L4
51	1KT18CV400	Explain with sketches i) Ogee weir ii) Broad crested weir	10	CO8	L4
52	1KT18CV401	Water is flowing in a rectangular channel of 1m wide and 0.75m deep. Find the discharge over a rectangular weir of crest length 600 mm, if the head of water over the crest of weir is 200mm and water from channel flows over the weir. Take Cd = 0.62, Neglect end contractions. Take velocity of approach into consideration.	10	CO8	L4
53	1KT18CV402	Define various hydraulic coefficients of an orifice and derive the relation between them.	10	CO8	L4
54	1KT18CV403	Differentiate between a large and small orifice. Obtain an expression for discharge through a large rectangular orifice.	10	CO7	L4
55	1KT18CV404	Water under a constant head of 4.5 m discharges through an external cylindrical mouthpiece of 50 mm diameter and 150 mm long. If Cc for the orifice is 0.6, find (i) the discharge in litres per second and ii) the absolute pressure at the vena contracta. Assume atmospheric pressure to be 10.3 m of water.	10	CO7	L4
56	1KT18CV405	What are the advantages of triangular notch over a rectangular notch?	10	CO8	L2
57	1KT18CV406	A right angle triangular notch is used for measuring a discharge of 30 lps. An error of 1.5 mm was made while measuring the head over the notch. Calculate the percentage error in estimating the discharge. Take Cd = 0.62.	10	CO8	L4
58	1KT18CV407	A suppressed rectangular weir is constructed across a channel of 0.77 m width with a head of 0.39 m and the crest 0.6 m above the bed of the channel. Estimate the discharge over it. Consider the velocity of approach and assume Cd = 0.623.	10	CO8	L4
59	1KT18CV408	Find the discharge of water flowing over rectangular notch of 3m length when the constant head of water over a notch is 40cm. Take Cd = 0.6.	10	CO8	L4
60	1KT18CV409	Derive the Bernoulli's equation from the Euler's equation for a steady flow of fluid and list the assumptions made in it.(Dec-2011)	10	CO5	L3
61	1KT18CV410	State the Bernoulli's theorem. Starting from Euler's equation of motion along a stream line, derive the Bernoulli's equation. List the assumptions and limitations.	10	CO5	L3
62	1KT18CV411	A 45° bend a rectangular air duct of 1 m2 cross sectional area is gradually reduced to 0.5m2 area. Find the magnitude and direction of the force required to hold the duct in position if	10	CO5	L3

		the velocity of flow at 1m2 section is 10 m/s, and pressure is 30 kN/m2 . Take the specific weight of air as 0.0116 kN/m3.(Dec-2011)			
63	1KT18CV412	250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135°, find the magnitude and direction of the force on the bend. The pressure of water flowing is 400 kN/m2. Take specific weight of water as 9.81 kN/m3.(June-2012)	10	CO5	L3
64	1KT18CV413	Distinguish between: i) Venturimeter and orificemeter ii) Rectangular with inlet and cipolletti notch.(June-2012)	10	CO6	L4
65	1KT18CV414	The following are the date given for laying a water supply pipe line. The change in diameter is gradual from 20 cm at A to 50 cm at B. pressure at A and B are 80 kN/m2 and 60 kN/m2 respectively. The end B is 3 m higher than A. If the flow in the pipe is 200 lit/s, find : i) The direction of flow ii) The loss of head due to friction between A and B(Jan-2013)	10	CO5	L3
66	1KT18CV415	A 300mm x150mrn venturimeter is provided in a vertical pipeline carrying oil of the specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300mm. The differential —tube mercury manometer shows a gauge deflection of 250mm. Calculate i) The discharge of oil ii) The pressure difference between the entrance section and the throat section. Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6.(Dec-2011)	10	CO6	L4
67	1KT18CV416	A pitot static tube is inserted in a 30 cm diameter pipe. The static pressure in the pipe is 12.5 cm of mercury (vacuum). The stagnation pressure at the centre of the pipe is 1.15 N/cm2 (Gauge). Calculate the rate of flow of water through the pipe. The mean velocity of flow is 0.875 times the central velocity. Take C = 0.985.(June-2012)	10	CO6	L4
68	1KT18CV417	A horizontal venturimeter with inlet diameter of 25 cm and throat diameter of 15 cm is used to measure the flow of water. The pressure at the throat is 30 cm of mercury (vacuum) and that at the inlet is 200 kN/m2(Gauge). Find the discharge of water through the meter. Take Cd = 0.98.(June-2012)	10	CO6	L4
69	1KT18CV418	A pitot tube is used to measure the velocity of water in a pipe. The stagnation pressure head is 6 m and static pressure head is 5 m. Calculate the velocity of flow assuming the coefficient of pilot tube = 0.98.(Jan-2013)	10	CO6	L4
70	1KT18CV419	A pitot tube is mounted on an airplane to indicate the speed of the plane relative to the prevailing wind. What differential pressure intensity in kPa will the instrument register when the plane is traveling at a speed of 200km/hr in a wind of 60 km/hr blowing against the direction of the plane? eau = 1.2 kg/m3.(July-2013)	10	CO6	L4
71	1KT18CV420	It is required to establish the throat diameter of a venturimeter in an installation of 100mm diameter pipe conveying water. The maximum range available in mercury-water differential manometer gauge is 50cm of mercury deflection. Find the maximum throat diameter which will indicate the fill gauge deflection when the flow rate is 20 LPs assuming coefficient of venturimeter as 0.984.(July-2013)	10	CO6	L4
72	1KT18CV421	Distinguish between : i) Steady and unsteady flow ii) Uniform and non-uniform flow iii) Compressible and incompressible flow.	10	CO5	L3

73	1KT18CV422	Name the different forces present in a fluid flow. What are the forces considered for the Euler's equation of motion?(Jan-2014)	10	CO5	L3
74	1KT18CV423	The diameters at the ends of a 16 m long vertical conical pipe conveying water are 0.5 m and 1.5 m. The loss of head between the ends is 2.65 m in either directions when the velocity at the smaller section is 9 m/s. If the smaller section is at the top and pressure head at this section is 2.15 m of water, fmd the pressure head at the lower end when the flow is, i) Downward and ii) Upward.(Jan-2014)	10	CO5	L3
75	1KT18CV424	A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and Cv = 0.98.(Jan-2014)	10	CO6	L4
76	1KT18CV425	Derive the equation for the discharge through venturimeter.(July-2014)	10	CO5	L3

D3. TEACHING PLAN - 3

Module – 5

Title:		Appr Time:	16 Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Compute major and minor losses in pipe lines due to pipe fittings.	CO9	L4
2	Compute pressure variation of fluid in pipe lines by applying water hammer.	CO10	L3
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Major and minor losses in pipe flow.	CO9	L2
2	Darcy- Weisbach equation for head loss due to friction in a pipe.	CO9	L3
3	Pipes in series, pipes in parallel, equivalent pipe-problems.	CO9	L4
4	Minor losses in pipe flow, equation for head loss due to sudden expansion.	CO9	L3
5	Numerical problems.	CO9	L4
6	Hydraulic gradient line, energy gradient line.	CO9	L3
7	Pipe Networks	CO9	L3
8	Hardy Cross method	CO9	L3
9	Numerical problems.	CO9	L3
10	Water hammer in pipes	CO10	L2
11	Equations for pressure rise due to gradual valve closure for rigid and elastic pipes	CO10	L3
12	Equations for pressure rise due to sudden valve closure for rigid and elastic pipes	CO10	L3
13	Numerical problems.	CO10	L4
c	**Application Areas**	**CO**	**Level**
1	To evaluate losses in pipelines.	CO9	L4
2	To find pressure due to closing and opening of valves in pipe lines.	CO10	L3
d	**Review Questions**	-	-
1	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.(Dec-2011)	CO9	L2
2	Briefly explain the pipes in series and pipes in parallel.	CO9	L2
4	Explain : i) Pipes in series ii) Phenomenon of water hammer in pipes.(Jan-2013)	CO9	L2

5	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	CO9	L2
7	Water is flowing in a pipe of 150mm diameter with a velocity of 2.5 m/s. When it is suddenly brought to rest by closing the value find the pressure rise assuming the pipe is elastic E = 206 GN/m2 , Poisson's ratio 0.25 and K for water = 206 GN/m2, pipe wall is 5mm thick.(Dec-2011)	CO10	L3
8	Water is to be supplied to the inhabitants of a college campus, through a supply main. The following data is given: Distance of the reservoir from the campus = 3000 m Number of inhabitants = 4000 Consumption of water per day of each inhabitants = 180 liters. Loss of head due to friction = 18 m Coefficient of friction for the pipe, f = 0.007. If one half of the daily supply is pumped in 8 hours, determine the size the supply main.(June-2012)	CO9	L3
9	A hydraulic pipe line 3 km long, 500 mm diameter is used to convey water with a velocity of 1.5 m/sec. Determine the pressure growth if the valve provided at the out flow end is closed in (i) 20 seconds (ii) 3.5 seconds . Consider pipe to be rigid and take bulk modules of water K water = 20x 108 N/m2.(June-2012)	CO9	L3
10	A compound piping system consists of 1800 m of 0.5 m, 1200 m of 0.4 m and 600 m of 0.3 m new cast iron pipes connected in series. Convert the system to i) An equivalent length of 0.4 m pipe ii) Equivalent size pipe 3600 m long.(Jan-2013)	CO9	L3
11	A pipe line of 600mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. If the friction factor is 0.04 and the head at the inlet is 0.3m, calculate the increase in discharge. (July-2013)	CO9	L3
12	The velocity of water in a 60cm diameter and 15mm thick cast iron pipe (E = 1.04 x 10" pa) is changed from 3 m/s to zero in 1.25 s by closure of a valve i) if the pipe length is 800m what will be the water hammer pressure at the valve? What will be the corresponding pressure rise if the closure takes place in; ii) 2 s and iii) 0.8s respectively? Bulk module of elasticity of water is 2.11 x 109 N/m2. (July-2013)	CO10	L3
13	Explain the phenomenon of water hammer. List the four factors affecting water hammer.(Jan-2014)	CO10	L2
14	Derive an expression for head loss due to sudden enlargement in a pipe flow. (Jan-2014)	CO9	L3
15	A pipe of 200 mm diameter and length 2000 m connects two reservoirs, having difference of water level as 20 m. Determine the discharge through the pipe. If an additional pipe of diameter 200 mm and length 1200 m is attached to the last 1200 m of the existing pipe, find the increase in discharge. Take f = 0.015 and neglect minor losses.	CO9	L3
16	Define: i) hydraulic gradient: Energy gradient.(July-2014)	CO9	L2
17	Distinguish between compound pipe and equivalent pipe.(July-2014)	CO9	L2
18	At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. Estimate the rate of 11(w. (July-2014)	CO9	L3
19	An oil of sp.gr. 0.9 and viscosity 0.1)6 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/s. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow.(Jan-2015)	CO9	L3
20	At a sudden enlargement of water inain from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow. (Jan-2015)	CO9	L3
21	Water is flowing through a horizo- ital pipe of diameter 200 mm at a velocity of 3 m/s. A circular solid plate of diameter 150 mrn is placed in the pipe to obstruct the flow. Find the loss of head due to obstruction in the pipe if Cc = 0.62. (Jan-2015)	CO9	L4

22	A horizontal pipe of diameter D1 has a sudden expansion to a diameter D2. At what ratio would the differential pressure on either side of the expansion be maximum? What is the corresponding loss of head differential pressure head?(July-2015)	CO9	L4
23	A 0.5m diameter and 100m long pipeline carrying 0.5m3/s of water is fitted with a valve at the downstream end. Calculate the rise of pressure caused within the pipe due to valve closure if i) instantaneously and ii) in 1 second. Assume sonic velocity as 1430 m/s. (July-2015)	CO9	L4
24	Explain : i) Equivalent pipe ii) Pipe in parallel	CO9	L2
25	Explain minor losses. Give expression for head loss due to i) Sudden expansion ii) Major loss.	CO9	L2
26	A valve is provided at the end of a cast iron pipe of diameter 150mm and of thickness10mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2 x 104 N/m2. Take K for water as 19.62x 108 N/m2 and E for cast iron pipe as 11.772x 101˚ N/m2.	CO10	L4
27	Distinguish between hydraulic gradient line and energy gradient line.	CO10	L2
28	A pipe line of 0.6 m diameter is 1.5 km long. To augment the discharge, another pipeline of the same diameter is introduced parallel to the first in the second half of its length. Find the increase of discharge if f = 0.04 and head at the inlet is 30 m.	CO9	L4
30	The rate of flow through a horizontal pipe is 0.03 m3/s. Length of pipe is lkm. Diameter of pipe for first half of length is 20cm and suddenly enlarges to 40cm for the remaining length. Find the difference in water surface elevation in the two reservoirs connected to either side of pipe. Take f = 0.01 in equation fLV2/2gD. Consider minor losses.	CO9	L4
31	The water is flowing with a velocity of 1.25m/s in a pipe of 2km length and 250mm diameter. The valve at the end of pipe is closed in 27sec. Find the rise in pressure. Take C = 1400m/s.	CO10	L4
32	Define the term 'Equivalent diameter' of pipe. Obtain the 'Equivalent diameter' for the system of pipes in series.	CO9	L2
33	A 300mm diameter pipe gradually tapers to 150mm diameter in a length of 10mts. If the discharge through pipe is 0.15m3/sec. Determine the loss of head due to friction, if f = 0.01.	CO9	L4
34	A discharge of 60.70 lits/sec of water flows through a bend in 100mm diameter pipe and gives 300mm of differential mercury head across the bend. Determine the discharge coefficient of the bend.	CO9	L4
35	Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch.	CO10	L2
36	Derive an expression for pressure rise due to sudden closure of valve when the pipe is elastic.	CO10	L4
37	Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses.	CO9	L4
e	**Experiences**	-	-
1		CO10	L2
2			
3			
4		CO9	L3
5			

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	18CV33	Sem:	III	Marks:	30	Time:	75 minutes
Course:	Fluid Mechanics						

-	-	Note: Answer any 2 questions, each carry equal marks.	Marks	CO	Level
1	a	Explain minor losses. Give expression for head loss due to i) Sudden expansion ii) Major loss.	10	CO9	L2
	b	A horizontal pipe of diameter D1 has a sudden expansion to a diameter D2. At what ratio would the differential pressure on either side of the expansion be maximum? What is the corresponding loss of head differential pressure head?	10	CO9	L3
2	a	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.	10	CO9	L3
	b	Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses.	10	CO9	L4
3	a	Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch.	10	CO10	L3
	b	Water is flowing through a horizo- ital pipe of diameter 200 mm at a velocity of 3 m/s. A circular solid plate of diameter 150 mrn is placed in the pipe to obstruct the flow. Find the loss of head due to obstruction in the pipe if Cc = 0.62.	10	CO10	L4
4	a	Derive an expression for pressure rise due to sudden closure of valve when the pipe is elastic.	10	CO10	L3
	b	A 0.5m diameter and 100m long pipeline carrying 0.5m3/s of water is fitted with a valve at the downstream end. Calculate the rise of pressure caused within the pipe due to valve closure if i) instantaneously and ii) in 1 second. Assume sonic velocity as 1430 m/s.	10	CO10	L4

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	18CV33	Sem:	III	Marks:	30	Time:	90-120 minutes
Course:	Fluid Mechanics						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1	1KT15CV053	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.(Dec-2011)	10	CO9	L2
2	1KT16CV020	Briefly explain the pipes in series and pipes in parallel.	10	CO9	L2
3	1KT16CV026	Explain : i) Pipes in series ii) Phenomenon of water hammer in pipes.(Jan-2013)	10	CO9	L2
4	1KT16CV028	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	10	CO9	L2
5	1KT16CV035	Water is flowing in a pipe of 150mm diameter with a velocity of 2.5 m/s. When it is suddenly brought to rest by closing the value find the pressure rise assuming the pipe is elastic E = 206 GN/m2 , Poisson's ratio 0.25 and K for water = 206 GN/m2, pipe wall is 5mm thick.(Dec-2011)	10	CO10	L3
6	1KT16CV038	Water is to be supplied to the inhabitants of a college campus, through a supply main. The following data is given: Distance of the reservoir from the campus = 3000 m	10	CO9	L3

		Number of inhabitants = 4000 Consumption of water per day of each inhabitants = 180 liters. Loss of head due to friction = 18 m Coefficient of friction for the pipe, f = 0.007. If one half of the daily supply is pumped in 8 hours, determine the size the supply main.(June-2012)			
7	1KT16CV039	A hydraulic pipe line 3 km long, 500 mm diameter is used to convey water with a velocity of 1.5 m/sec. Determine the pressure growth if the valve provided at the out flow end is closed in (i) 20 seconds (ii) 3.5 seconds . Consider pipe to be rigid and take bulk modules of water K water = 20x 108 N/m2. (June-2012)	10	CO9	L3
8	1KT16CV042	A compound piping system consists of 1800 m of 0.5 m, 1200 m of 0.4 m and 600 m of 0.3 m new cast iron pipes connected in series. Convert the system to i) An equivalent length of 0.4 m pipe ii) Equivalent size pipe 3600 m long.(Jan-2013)	10	CO9	L3
9	1KT16CV047	A pipe line of 600mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. If the friction factor is 0.04 and the head at the inlet is 0.3m, calculate the increase in discharge. (July-2013)	10	CO9	L3
10	1KT16CV048	The velocity of water in a 60cm diameter and 15mm thick cast iron pipe (E = 1.04 x 10" pa) is changed from 3 m/s to zero in 1.25 s by closure of a valve i) if the pipe length is 800m what will be the water hammer pressure at the valve? What will be the corresponding pressure rise if the closure takes place in; ii) 2 s and iii) 0.8s respectively? Bulk module of elasticity of water is 2.11 x 109 N/m2. (July-2013)	10	CO10	L3
11	1KT16CV055	Explain the phenomenon of water hammer. List the four factors affecting water hammer.(Jan-2014)	10	CO10	L2
12	1KT16CV060	Derive an expression for head loss due to sudden enlargement in a pipe flow. (Jan-2014)	10	CO9	L3
13	1KT16CV077	A pipe of 200 mm diameter and length 2000 m connects two reservoirs, having difference of water level as 20 m. Determine the discharge through the pipe. If an additional pipe of diameter 200 mm and length 1200 m is attached to the last 1200 m of the existing pipe, find the increase in discharge. Take f = 0.015 and neglect minor losses.	10	CO9	L3
14	1KT16CV082	Define: i) hydraulic gradient: Energy gradient.(July-2014)	10	CO9	L2
15	1KT16CV088	Distinguish between compound pipe and equivalent pipe. (July-2014)	10	CO9	L2
16	1KT16CV094	At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. Estimate the rate of 11(w. (July-2014)	10	CO9	L3
17	1KT16CV098	An oil of sp.gr. 0.9 and viscosity 0.1)6 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/s. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow.(Jan-2015)	10	CO9	L3
18	1KT16CV102	At a sudden enlargement of water inain from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow.(Jan-2015)	10	CO9	L3
19	1KT17CV007	Water is flowing through a horizo- ital pipe of diameter 200 mm at a velocity of 3 m/s. A circular solid plate of diameter 150 mrn is placed in the pipe to obstruct the flow. Find the loss of head due to obstruction in the pipe if Cc = 0.62. (Jan-2015)	10	CO9	L4
20	1KT17CV008	A horizontal pipe of diameter D1 has a sudden expansion to a diameter D2. At what ratio would the differential pressure on either side of the expansion be maximum? What is the	10	CO9	L4

		corresponding loss of head differential pressure head?(July-2015)			
21	1KT17CV010	A 0.5m diameter and 100m long pipeline carrying 0.5m3/s of water is fitted with a valve at the downstream end. Calculate the rise of pressure caused within the pipe due to valve closure if i) instantaneously and ii) in 1 second. Assume sonic velocity as 1430 m/s. (July-2015)	10	CO9	L4
22	1KT17CV011	Explain : i) Equivalent pipe ii) Pipe in parallel	10	CO9	L2
23	1KT17CV012	Explain minor losses. Give expression for head loss due to i) Sudden expansion ii) Major loss.	10	CO9	L2
24	1KT17CV013	A valve is provided at the end of a cast iron pipe of diameter 150mm and of thickness10mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2 x 104 N/m2. Take K for water as 19.62x 108 N/m2 and E for cast iron pipe as 11.772x 101° N/m2.	10	CO10	L4
25	1KT17CV015	Distinguish between hydraulic gradient line and energy gradient line.	10	CO10	L2
26	1KT17CV017	A pipe line of 0.6 m diameter is 1.5 km long. To augment the discharge, another pipeline of the same diameter is introduced parallel to the first in the second half of its length. Find the increase of discharge if f = 0.04 and head at the inlet is 30 m.	10	CO9	L4
27	1KT17CV019	The rate of flow through a horizontal pipe is 0.03 m3/s. Length of pipe is lkm. Diameter of pipe for first half of length is 20cm and suddenly enlarges to 40cm for the remaining length. Find the difference in water surface elevation in the two reservoirs connected to either side of pipe. Take f = 0.01 in equation fLV2/2gD. Consider minor losses.	10	CO9	L4
28	1KT17CV020	The water is flowing with a velocity of 1.25m/s in a pipe of 2km length and 250mm diameter. The valve at the end of pipe is closed in 27sec. Find the rise in pressure. Take C = 1400m/s.	10	CO10	L4
29	1KT17CV021	Define the term 'Equivalent diameter' of pipe. Obtain the 'Equivalent diameter' for the system of pipes in series.	10	CO9	L2
30	1KT17CV023	A 300mm diameter pipe gradually tapers to 150mm diameter in a length of 10mts. If the discharge through pipe is 0.15m3/sec. Determine the loss of head due to friction, if f = 0.01.	10	CO9	L4
31	1KT17CV024	A discharge of 60.70 lits/sec of water flows through a bend in 100mm diameter pipe and gives 300mm of differential mercury head across the bend. Determine the discharge coefficient of the bend.	10	CO9	L4
32	1KT17CV025	Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch.	10	CO10	L2
33	1KT17CV026	Derive an expression for pressure rise due to sudden closure of valve when the pipe is elastic.	10	CO10	L4
34	1KT17CV028	Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses.	10	CO9	L4
35	1KT17CV029	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.(Dec-2011)	10	CO9	L2
36	1KT17CV031	Briefly explain the pipes in series and pipes in parallel.	10	CO9	L2
37	1KT17CV032	Explain : i) Pipes in series	10	CO9	L2

		ii) Phenomenon of water hammer in pipes.(Jan-2013)			
38	1KT17CV033	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	10	CO9	L2
39	1KT17CV034	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.(Dec-2011)	10	CO9	L2
40	1KT17CV035	Briefly explain the pipes in series and pipes in parallel.	10	CO9	L2
41	1KT17CV036	Explain : i) Pipes in series ii) Phenomenon of water hammer in pipes.(Jan-2013)	10	CO9	L2
42	1KT17CV037	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	10	CO9	L2
43	1KT17CV038	Water is flowing in a pipe of 150mm diameter with a velocity of 2.5 m/s. When it is suddenly brought to rest by closing the value find the pressure rise assuming the pipe is elastic E = 206 GN/m2 , Poisson's ratio 0.25 and K for water = 206 GN/m2, pipe wall is 5mm thick.(Dec-2011)	10	CO10	L3
44	1KT17CV040	Water is to be supplied to the inhabitants of a college campus, through a supply main. The following data is given: Distance of the reservoir from the campus = 3000 m Number of inhabitants = 4000 Consumption of water per day of each inhabitants = 180 liters. Loss of head due to friction = 18 m Coefficient of friction for the pipe, f = 0.007. If one half of the daily supply is pumped in 8 hours, determine the size the supply main.(June-2012)	10	CO9	L3
45	1KT17CV041	A hydraulic pipe line 3 km long, 500 mm diameter is used to convey water with a velocity of 1.5 m/sec. Determine the pressure growth if the valve provided at the out flow end is closed in (i) 20 seconds (ii) 3.5 seconds . Consider pipe to be rigid and take bulk modules of water K water = 20x 108 N/m2. (June-2012)	10	CO9	L3
46	1KT17CV042	A compound piping system consists of 1800 m of 0.5 m, 1200 m of 0.4 m and 600 m of 0.3 m new cast iron pipes connected in series. Convert the system to i) An equivalent length of 0.4 m pipe ii) Equivalent size pipe 3600 m long.(Jan-2013)	10	CO9	L3
47	1KT17CV050	A pipe line of 600mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length. If the friction factor is 0.04 and the head at the inlet is 0.3m, calculate the increase in discharge. (July-2013)	10	CO9	L3
48	1KT17CV053	The velocity of water in a 60cm diameter and 15mm thick cast iron pipe (E = 1.04 x 10" pa) is changed from 3 m/s to zero in 1.25 s by closure of a valve i) if the pipe length is 800m what will be the water hammer pressure at the valve? What will be the corresponding pressure rise if the closure takes place in; ii) 2 s and iii) 0.8s respectively? Bulk module of elasticity of water is 2.11 x 109 N/m2. (July-2013)	10	CO10	L3
49	1KT17CV055	Explain the phenomenon of water hammer. List the four factors affecting water hammer.(Jan-2014)	10	CO10	L2
50	1KT17CV412	Derive an expression for head loss due to sudden enlargement in a pipe flow. (Jan-2014)	10	CO9	L3
51	1KT18CV400	A pipe of 200 mm diameter and length 2000 m connects two reservoirs, having difference of water level as 20 m. Determine the discharge through the pipe. If an additional pipe of diameter 200 mm and length 1200 m is attached to the last 1200 m of the existing pipe, find the increase in discharge.	10	CO9	L3

		Take f = 0.015 and neglect minor losses.			
52	1KT18CV401	Define: i) hydraulic gradient: Energy gradient.(July-2014)	10	CO9	L2
53	1KT18CV402	Distinguish between compound pipe and equivalent pipe. (July-2014)	10	CO9	L2
54	1KT18CV403	At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. Estimate the rate of 11(w. (July-2014)	10	CO9	L3
55	1KT18CV404	An oil of sp.gr. 0.9 and viscosity 0.1)6 poise is flowing through a pipe of diameter 200 mm at the rate of 60 litres/s. Find the head lost due to friction for a 500 m length of pipe. Find the power required to maintain this flow.(Jan-2015)	10	CO9	L3
56	1KT18CV405	At a sudden enlargement of water inain from 240 mm to 480 mm diameter, the hydraulic gradient rises by 10 mm. Estimate the rate of flow.(Jan-2015)	10	CO9	L3
57	1KT18CV406	Water is flowing through a horizo- ital pipe of diameter 200 mm at a velocity of 3 m/s. A circular solid plate of diameter 150 mrn is placed in the pipe to obstruct the flow. Find the loss of head due to obstruction in the pipe if Cc = 0.62. (Jan-2015)	10	CO9	L4
58	1KT18CV407	A horizontal pipe of diameter D1 has a sudden expansion to a diameter D2. At what ratio would the differential pressure on either side of the expansion be maximum? What is the corresponding loss of head differential pressure head?(July-2015)	10	CO9	L4
59	1KT18CV408	A 0.5m diameter and 100m long pipeline carrying 0.5m3/s of water is fitted with a valve at the downstream end. Calculate the rise of pressure caused within the pipe due to valve closure if i) instantaneously and ii) in 1 second. Assume sonic velocity as 1430 m/s. (July-2015)	10	CO9	L4
60	1KT18CV409	Explain : i) Equivalent pipe ii) Pipe in parallel	10	CO9	L2
61	1KT18CV410	Explain minor losses. Give expression for head loss due to i) Sudden expansion ii) Major loss.	10	CO9	L2
62	1KT18CV411	A valve is provided at the end of a cast iron pipe of diameter 150mm and of thickness10mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2 x 104 N/m2. Take K for water as 19.62x 108 N/m2 and E for cast iron pipe as 11.772x 101˚ N/m2.	10	CO10	L4
63	1KT18CV412	Distinguish between hydraulic gradient line and energy gradient line.	10	CO10	L2
64	1KT18CV413	A pipe line of 0.6 m diameter is 1.5 km long. To augment the discharge, another pipeline of the same diameter is introduced parallel to the first in the second half of its length. Find the increase of discharge if f = 0.04 and head at the inlet is 30 m.	10	CO9	L4
65	1KT18CV414	The rate of flow through a horizontal pipe is 0.03 m3/s. Length of pipe is lkm. Diameter of pipe for first half of length is 20cm and suddenly enlarges to 40cm for the remaining length. Find the difference in water surface elevation in the two reservoirs connected to either side of pipe. Take f = 0.01 in equation fLV2/2gD. Consider minor losses.	10	CO9	L4
66	1KT18CV415	The water is flowing with a velocity of 1.25m/s in a pipe of 2km length and 250mm diameter. The valve at the end of pipe is closed in 27sec. Find the rise in pressure. Take C = 1400m/s.	10	CO10	L4
67	1KT18CV416	Define the term 'Equivalent diameter' of pipe. Obtain the 'Equivalent diameter' for the system of pipes in series.	10	CO9	L2
68	1KT18CV417	A 300mm diameter pipe gradually tapers to 150mm diameter in a length of 10mts. If the discharge through pipe is	10	CO9	L4

		0.15m3/sec. Determine the loss of head due to friction, if f = 0.01.			
69	1KT18CV418	A discharge of 60.70 lits/sec of water flows through a bend in 100mm diameter pipe and gives 300mm of differential mercury head across the bend. Determine the discharge coefficient of the bend.	10	CO9	L4
70	1KT18CV419	Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch.	10	CO10	L2
71	1KT18CV420	Derive an expression for pressure rise due to sudden closure of valve when the pipe is elastic.	10	CO10	L4
72	1KT18CV421	Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses.	10	CO9	L4
73	1KT18CV422	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.(Dec-2011)	10	CO9	L2
74	1KT18CV423	Briefly explain the pipes in series and pipes in parallel.	10	CO9	L2
75	1KT18CV424	Explain : i) Pipes in series ii) Phenomenon of water hammer in pipes.(Jan-2013)	10	CO9	L2
76	1KT18CV425	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	10	CO9	L2

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Fluid Mechanics					Month / Year	May /2018	
Crs Code:	18CV33	Sem:	III	Marks:	100	Time:	180 minutes	
Module	**Note**	Answer all FIVE full questions. All questions carry equal marks.				**Marks**	**CO**	**Level**
1	a	Define the following fluid properties with units: i) Mass Density ii) Specific Gravity iii) Dynamic Viscosity iv) Vapour Pressure v) Capillarity(Dec 2011, July 2013, July2014, 2015)				10	CO1	L2
	b	A thin plate is placed between two flat surfaces 'h' cm apart such that the viscosity of the liquids on the top and bottom of the plate are μ1 and μ2 respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of the thin plate is minimum. Assume 'h' to be very small. (July 2013)				10	CO1	L3
		OR						
1	a	State and prove Pascal's law.(July-2014)				10	CO2	L2
	b	An inverted U-tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cms. When an oil (S = 0.8) is used as a gauge fluid, the vertical height of the water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cms. Determine the difference of pressure between the pipes. Pipe B is lying below the pipe A.(June-2012)				10	CO2	L3
2	a	Derive an expression for the depth of centre of pressure from the free surface of liquid of an inclined plane surface submerged in the liquid.(Dec-2011)				10	CO3	L3
	b	A rectangular plate 2m wide and 3m depth is immersed in water such that				10	CO4	L4

		its ends are at depths of 1.5 m and 3m respectively. Determine the total pressure acting on the plate and locate centre of pressure.(Jan-2013)			
		OR			
2	a	Show that streamlines and equipotential lines form a set of perpendicular lines.	10	CO4	L3
	b	A circular plane surface 4m in diameter is immersed in water such that the top and bottom edges are 1.5 and 4m below the water surface. Find the total pressure and the position of centre of pressure with respect to the water surface.	10	CO4	L4
3	a	State the Bernoulli's theorem. Starting from Euler's equation of motion along a stream line, derive the Bernoulli's equation. List the assumptions and limitations.	10	CO5	L3
	b	A 45° bend a rectangular air duct of 1 m2 cross sectional area is gradually reduced to 0.5m2 area. Find the magnitude and direction of the force required to hold the duct in position if the velocity of flow at 1m2 section is 10 m/s, and pressure is 30 kN/m2 . Take the specific weight of air as 0.0116 kN/m3. (Dec-2011)	10	CO5	L3
		OR			
3	a	Derive the equation for the discharge through venturimeter.(July-2014)	10	CO5	L3
	b	Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.52 N/cm- and the pressure at the upper end is 9.81 N/cm`. Determine the difference in datum head if the flow through pipe is 40/ps.(July-2014)	10	CO5	L3
4	a	Derive an expression for the discharge over a triangular notch in terms of the head of water over the crest of the notch.(Dec-2011)	10	CO7	L4
	b	Find the discharge over 10 m long rectangular weir under a head if 2 m, if the channel approaching the weir is 20 m wide and 2.5 m deep. Consider velocity of approach. Assume Cd = 0.6. Neglect end contraction. Take one trial.(Jan-2013)	10	CO8	L4
		OR			
4	a	Differentiate between a large and small orifice. Obtain an expression for discharge through a large rectangular orifice.	10	CO7	L4
	b	Water under a constant head of 4.5 m discharges through an external cylindrical mouthpiece of 50 mm diameter and 150 mm long. If Cc for the orifice is 0.6, find (i) the discharge in litres per second and ii) the absolute pressure at the vena contracta. Assume atmospheric pressure to be 10.3 m of water.	10	CO7	L4
5	a	Explain minor losses. Give expression for head loss due to i) Sudden enlargement ii) Major loss.(Jan-2013)	10	CO9	L2
	b	Water is flowing in a pipe of 150mm diameter with a velocity of 2.5 m/s. When it is suddenly brought to rest by closing the value find the pressure rise assuming the pipe is elastic E = 206 GN/m2 , Poisson's ratio 0.25 and K for water = 206 GN/m2, pipe wall is 5mm thick.(Dec-2011)	10	CO10	L3
		OR			
5	a	Explain the phenomenon of water hammer. List the four factors affecting water hammer.(Jan-2014)	10	CO10	L2
	b	A pipe of 200 mm diameter and length 2000 m connects two reservoirs, having difference of water level as 20 m. Determine the discharge through the pipe. If an additional pipe of diameter 200 mm and length 1200 m is attached to the last 1200 m of the existing pipe, find the increase in discharge. Take f = 0.015 and neglect minor losses.	10	CO9	L3

2. SEE Important Questions

Course:	Fluid Mechanics					Month / Year	May /2018	
Crs Code:	18CV33	Sem:	III	Marks:	100	Time:	180 minutes	

	Note	Answer all FIVE full questions. All questions carry equal marks.	-	-	
Module	Qno.	Important Question	**Marks**	**CO**	**Year**
1	a	Define the following fluid properties with units: i) Mass Density ii) Specific Gravity iii) Dynamic Viscosity iv) Vapour Pressure v) Capillarity(Dec 2011, July 2013, July2014, 2015)	10	CO1	2015
	b	A plate having an area of 0.6 m^2 is sliding down the inclined plane at 30° to the horizontal with a velocity of 0.36 m/s. There is a cushion of fluid 1.8mm thick between the plane and the plate. Find the viscosity of the fluid, if the weight of the plate is 280N. (Dec 2011)	10	CO1	2011
	c	Derive an expression for capillary rise and capillary fall with sketches.	05	CO1	2013
	d	Briefly explain with sketches differential and simple manometers.	10	CO2	2013
	e	If mercury barometer reads 700mm and Bourdon gauge at a point in a flow system reads 500 kN/m2, what is the absolute pressure at the point? (July-2013)	10	CO2	2013
2	a	Derive an expression fro total pressure and centre of pressure for an inclined plane surface immersed in a liquid of specific weight.	10	CO3	2012
	b	A rectangular gate 5mx3m is placed under water such that the 3m edges are parallel to the free surface. The top and bottom edges are 4.0 m and 8.0 m below the water surface respectively. Determine the total pressure and the position of the centre of pressure on the gate.	10	CO3	2013
	c	Derive the continuity equation in Cartesian coordinates for steady, incompressible, three dimensional flows.	10	CO4	2015
	d	The velocity components in a two dimensional flow fields is given by u = y3 /3 + 2x - x2y,v = xy2 - 2y - x /3. Show that these functions represent the conditions for an irrotational flow. Obtain an expression for stream function.	10	CO4	2017
3	a	Derive the Bernoulli's equation from the Euler's equation for a steady flow of fluid and list the assumptions made in it.	10	CO5	2012
	b	250 liters/sec of water is flowing in a pipe having a diameter of 300 mm. If the pipe is bent by 135°, find the magnitude and direction of the force on the bend. The pressure of water flowing is 400 kN/m2. Take specific weight of water as 9.81 kN/m3.	10	CO5	2014
	c	Derive the equation for the discharge through venturimeter.	10	CO5	2015
	d	A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and Cv = 0.98.	10	CO6	2016
4	a	Differentiate between a large and small orifice. Obtain an expression for discharge through a large rectangular orifice.	10	CO7	2016
	b	Water under a constant head of 4.5 m discharges through an external cylindrical mouthpiece of 50 mm diameter and 150 mm long. If Cc for the orifice is 0.6, find (i) the discharge in litres per second and ii) the absolute pressure at the vena contracta. Assume atmospheric pressure to be 10.3 m of water.	10	CO7	2013
	c	Derive an expression for discharge through a triangular notch.	10	CO8	2017
	d	A rectangular notch of crest width 400 mm is used to measure flow of water in a rectangular channel 600 mm wide and 450 mm deep. If the	10	CO8	2015

		water level in the channel is 225 mm above the weir crest, find the discharge in the channel. For the notch assume Cd = 0.63 and take velocity of approaeltito account.			
5	a	Explain minor losses. Give expression for head loss due to i) Sudden expansion ii) Major loss.	10	CO9	2011
	b	A horizontal pipe of diameter D1 has a sudden expansion to a diameter D2. At what ratio would the differential pressure on either side of the expansion be maximum? What is the corresponding loss of head differential pressure head?	10	CO9	2013
	c	Derive the Darcy-Weisbach equation for head loss due to friction in a pipe.	10	CO9	2016
	d	Two tanks are connected with help of two pipes in series. The lengths of pipes are 1000m and 800m where as the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in two tanks is 15m. Find the rate of flow of water through pipes, considering all losses.	10	CO9	2017
	e	Define Hydraulic Gradient Line and Total Energy Line. Explain with sketch.	10	CO10	2015
	f	Water is flowing through a horizo- ital pipe of diameter 200 mm at a velocity of 3 m/s. A circular solid plate of diameter 150 mrn is placed in the pipe to obstruct the flow. Find the loss of head due to obstruction in the pipe if Cc = 0.62.	10	CO10	2014

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA

Module-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	Concept of fluid, Systems of units. Properties of fluid; Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension& Capillarity. Fluid as a continuum, Newton's law of viscosity. Capillary rise in a vertical tube and between two plane surfaces. Vapor pressure of liquid, compressibility and bulk modulus, capillarity, surface tension, pressure inside a water droplet, pressure inside a soap bubble and liquid jet.	3	- L2 - L3	L3	- -	- Lecture - -	- Slip Test - -
1	Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Measurement of pressure using simple, differential & inclined manometers Introduction to Mechanical and electronic pressure measuring devices.	9	- L2 - L3	L3	- -	- Lecture - Tutorial -	- Assignment - -
2	Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface, total pressure on curved surfaces, water pressure on gravity dams, Lock gates.	4	- L2 - L3 -L4	L4	- -	- Lecture -	- Assignment -
2	Methods of describing fluid motion. Velocity and Total acceleration of a fluid particle.	3	- L2 - L3	L4	- -	- Lecture	- Slip Test -

	Types of fluid flow, Description of flow pattern. Basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system. Derivation for Rotational and irroational motion. Potential function, stream function, orthogonality of streamlines and equi potential lines.		-L4			-	
3	Forces acting on fluid in motion. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Modified Bernoulli's equation.	5	- L2 - L3 -L4	L4	- -	- Lecture -	- Slip Test -
3	Vortex motion; forced vortex, free vortex, problems Momentum equation Introduction. Venturimeter, Orificemeter, Pitot tube.	12	- L3 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
4	Introduction, classification, flow through orifice, hydraulic coefficients, Mouthpiece, classification, Borda's Mouthpiece	8	- L2 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
4	discharge over rectangular, triangular, trapezoidal notches, Cippoletti notch, broad crested weirs. Ventilation of weirs, submerged weirs.	8	- L2 - L4	L4	- -	- Lecture - Tutorial -	- Assignment - -
5	Major and minor losses in pipe flow. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion. Hydraulic gradient line, energy gradient line. Pipe Networks, Hardy Cross method.	5	- L3 - L4	L4	- -	- Lecture - -	- Assignment - -
5	Water hammer in pipes, equations for pressure rise due to gradual valve closure and sudden closure for rigid and elastic pipes.		- L3 - L4	L4	- -	- Lecture - -	- Assignment - -

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Module-#	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*
1	- -	- -	Fluid		- Understand - Fluid Properties - -	Student Should be able to understand fluid and its properties.
1	- -	- -	Fluid properties		- Analyze - Fluid flow -	Student Should be able to analyze fluid flow by applying pressure at a point.

2	- -	- -	Fluid Statics		- Compute hydrostatics - -	Student Should be able to compute and solve problems on fluid at rest by applying the knowledge of Hydrostatics.
2	- -	- -	Fluid Kinamatics		- Apply - Mathematics - -	Student Should be able to apply principles of mathematics to represent kinamatic concepts related to fluid flow.
3	- -	- -	Fluid Dynamics		- Analyze Bernouli's Principle - -	Student Should be able to analyze Bernoulli's principles for real fluids by applying fundamental law of fluid mechanics.
3	- -	- -	Bernoulli's Principles		- Attain - Fluid discharge - -	Student Should be able to attain discharge in closed condutes using flow measuring devices by applying Bernoulli's principles.
4	- -	- -	Bernoulli's Principles		- Attain - Orifice Discharge - -	Student Should be able to attain discharge in orifice and mouth pieces by applying Bernoulli's principles.
4	- -	- -	Bernoulli's Principles		- Attain - Discharge in Notches and weirs	Student Should be able to attain discharge over notches and weirs by applying Bernoulli's principles.
5	- -	- -	Pipe Losses		- Compute - Major & Minor losses	Student Should be able to compute major and minor losses in pipe lines due to pipe fittings.
5			Fluid Pressure		- Compute - Fluid Pressure	Student Should be able to compute pressure variation of fluid in pipe lines by applying water hammer.