CE1013	APPLIED HYDRAULIC ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	FLUID MECHANICS				

PURPOSE

The purpose of this course is to get exposure about the application of hydraulic engineering in the field by means of studying the various devices, equipments, machinery, and structures.

	INSTRUCTIONAL OBJECTIVES
1.	To study the measurement of pressure of fluid in pipes using various devices like manometers, mechanical gauges.
2.	To study the measurement of velocity and discharge using weirs, notches, venturimeter etc.
3.	To study open channel flow through Chezy's, Manning's, Kutter's formulae; economical channel sections, hydraulic jump; introduction to irregular flows.
4.	To understand the components, function, and uses of centrifugal and reciprocating pumps.
5.	To understand the components, function, and uses of Pelton wheel, Kaplan and Francis turbines.

UNIT I – PRESSURE MEASUREMENT (6 hours)

Pressure and Pressure head - Pascal's law – Atmospheric, Absolute, Gauge and Vacuum pressure – Measurement - Manometers - Simple Manometers, Differential Manometers - Advantages and Limitation of Manometers - Mechanical gauges - Bourdan tube gauge.

UNIT II – FLOW MEASUREMENT (10 hours)

Velocity - Pitot tube - Current meter - Floats - Discharge - Venturimeter - Orificemeter - Rotameter – Notches/Weirs - Rectangular, Triangular, Trapezoidal, Stepped - Effect onDischarge due to error in head measurement - Broad crested, Narrow crested and Ogee weir.

UNIT III – OPEN CHANNEL FLOW (11 hours)

Open channel - Types of flow - Uniform flow - Chezy's formula - Kutter's formula - Manning's formula - Most economical section - Rectangular and trapezoidal section - Non-Uniform flow - Specific energy and Specific energy curves - Hydraulic jump - Measurement of flow in irregular channels.

UNIT IV – PUMPS (9 hours)

Classification - Centrifugal pump - Component and Working - Velocity triangle – Work done - Losses and Efficiencies - Specific speed - Multi-stage Centrifugal pump - Characteristic curves - Net Positive Suction Head - Reciprocating pump - Component and Working - Discharge, Work done, Coefficient of discharge, Slip - Indicator diagram - Effect of acceleration and friction - Air vessel.

UNIT V – TURBINES (9 hours)

Components of Hydro Electric Power Plant - Classification of Turbine - Pelton wheel - Kaplan turbine - Francis turbine - Construction and working - Velocity triangles - Work done - Design aspects - Draft tube theory - Specific speed - Cavitation - Selection of turbines.

TEXT BOOKS

1. Modi .P.N and Seth S.M, *"Hydraulics and Fluid Mechanics"*, Standard Book House, 2005.
2. Rajput .R.K, *"Fluid Mechanics and Hydraulic Machines"*, S.Chand and Company Ltd., 2005.

REFERENCES

1. Bansal .R.K., *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications 2005.
2. Subramanya .K.,*"Theory and Applications of Fluid Mechanics"*, Tata McGraw Hill Publishing Company, 2002.

CE1013 APPLIED HYDRAULIC ENGINEERING													
	Course designed by	Department of Civil Engineering											
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
		X	X	X		X						X	
2.	Mapping of instructional objectives with student outcome	1-5	1-5	1-5		1-5						1-5	
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences andTechnical Arts (E)				Professional Subjects (P)			
		--		--		--				X			
4.	Broad area	Structural Engineering		Geotechnical Engineering		Water Resources Engineering				Geomatics Engineering			
		--		--		X				--			
5.	Approval	23rd meeting of academic council , May, 2013											

Lesson Plan- CE1013- Applied Hydraulic Engineering

CE1013	Applied Hydraulic Engineering	Lecture Hours (L)	Tutorial Hours (T)	Practical Hours (P)	Credits (C)
		3	0	0	3
	Prerequisite CE1006 Fluid Mechanics				

Academic year 2014-15
(Semester commencing in January 2015)

Instructional objectives no.	Instructional objectives (IO)
1	To study the measurement of pressure of fluid in pipes using various devices like manometers, mechanical gauges.
2	To study the measurement of velocity and discharge using weirs, notches, venturimeter etc.
3	To study open channel flow through Chezy's, Manning's, Kutter's formulae; economical channel sections, hydraulic jump; introduction to irregular flows.
4	To understand the components, function, and uses of centrifugal and reciprocating pumps.
5	To understand the components, function, and uses of Pelton wheel, Kaplan and Francis turbines.

Student outcomes

Student outcome number	Student outcome (SO)
a	an ability to apply knowledge of mathematics, science, and engineering
b	an ability to design and conduct experiments, as well as to analyze and interpret data
c	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
e	an ability to identify, formulate, and solve engineering problems
k	an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Mapping of Instructional Objectives (IOs) with Student Outcomes (SOs)
CE1013- Applied Hydraulic Engineering

Instructional objectives	Student Outcomes				
	a	b	c	e	k
To study the measurement of pressure of fluid in pipes using various devices like manometers, mechanical gauges.	X			X	X
To study the measurement of velocity and discharge using weirs, notches, venturimeter etc.	X	X	X	X	
To study open channel flow through Chezy's, Manning's, Kutter's formulae; economical channel sections, hydraulic jump; introduction to irregular flows.	X	X	X	X	X
To understand the components, function, and uses of centrifugal and reciprocating pumps.	X	X	X	X	X
To understand the components, function, and uses of Pelton wheel, Kaplan and Francis turbines.	X			X	X

Lecture No	TOPICS TO BE COVERED	No. of Hours	IO	SO	REFERENCE
1.	Introduction – brief recap of all the units	1	1, 2, 3, 4, 5	a, b, c, e, k	1, 2
Unit I Pressure Measurement					
2	Pressure and Pressure head of a liquid, Pascal's law	1	1	a	1, 2
3	Absolute and Gauge pressure	1	1	a	1, 2
4	Measurement of pressure, types of manometers	1	1	a, e	1, 2
5	Advantages and limitation of manometers	1	1	a	1, 2
6	Mechanical gauges, Bourdan tube gauge	1	1	k	1, 2
Unit II Velocity and Discharge Measurement					
7.	Velocity and discharge, Pitot tube & current meter	1	2	a, k	1, 2
8.	Floats and their types	1	2	a, k	1, 2
9.	Venturimeter – Problems	1	2	a, e, k	1, 2
10.	Orificemeter – Problems	1	2	a, e, k	1, 2
11.	Rotometer , Types of notches	1	2	a, k	1, 2
12.	Rectangular and triangular notch	1	2	a, k	1, 2
13.	Trapezoidal, Stepped notch, Broad, Narrow and Ogee weir	1	2	a, k	1, 2
14.	Problems in notches	1	2	a, b, e, k	1, 2
15.	Discharge due to error in head		2	a, e	1, 2
16.	Broad crested, Narrow crested and Ogee weir problems	1	2	a, e, k	1, 2
Unit III Open Channel Flow					
17.	Definitions, types of channels, types of flows	1	3	a	1, 2
18.	Chezys, Kutter and Mannings formula	1	3	a	1, 2
19.	Problems on Chezys and Kutter's equation	1	3	a	1, 2
20.	Problems on Mannings equation	1	3	a, e	1, 2
21.	Most economical section – Rectangular	1	3	a, c, e	1, 2
22.	Most economical section – Trapezoidal	1	3	a, c, e	1, 2
23.	Problems	1	3	a, e	1, 2
24.	Non uniform flow, specific energy and curves	1	3	a	1, 2
25.	Problems on Non uniform flow	1	3	a, e	1, 2
26.	Hydraulic jump and problems	1	3	a, e	1, 2
27.	Measurement of flow of irregular channels	1	3	a, e, k	1, 2
Unit IV Pumps					
26.	Classification of Pumps, Centrifugal pump, Component & Working	1	4	a, k	1, 2
30.	Velocity triangle, workdone, losses and efficiency, specific speed	1	4	a, k	1, 2
31.	Problems	1	4	a, e	1, 2
32.	Problems	1	4	a, e	1, 2
33.	Multistage pump, Characteristic curves	1	4	a, b	1, 2
34.	Reciprocating pump, component and working	1	4	a, e	1, 2
35.	Discharge, workdone, coefficient of discharge, slip, Indicator diagram	1	4	a, e	1, 2
36.	Effect of acceleration and friction , Air vessel	1	4	a, e, k	1, 2
37.	Problems	1	4	a, e	1, 2
Unit V Turbines					
38.	Components of Hydro Electric Power plant	1	5	a	1, 2
39.	Classification of turbines	1	5	a	1, 2
40.	Pelton turbine - Problems	1	5	a, b, c, k	1, 2
41.	Kaplan turbine – Problems	1	5	a, b, c, k	1, 2
42.	Francis turbine – Problems	1	5	a, b, c, k	1, 2
43.	Problems	1	5	a, b, c, k	1, 2
44.	Draft tube theory, specific speed	1	5	a, e	1, 2
45.	Cavitation and selection of turbines	1	5	a	1, 2

TEXT BOOKS
1. Modi .P.N and Seth S.M, *"Hydraulics and Fluid Mechanics"*, Standard Book House, 2005.
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4. Subramanya .K.,*"Theory and Applications of Fluid Mechanics"*, Tata McGraw Hill Publishing Company, 2002.

Course Coordinator
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