


**Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bangalore**

	COURSE TITLE: HYDRAULICS AND ENVIRONMENTAL LAB		
	Credits (L:T:P) : 0:2:4	Total Contact Hours: 78	Course Code :15CE47P
	Type of Course Delivery: Tutorial and Practice	Credit :03	Core/ Elective: Core
CIE- 25 Marks		SEE- 50 Marks	

Prerequisites: Basic knowledge of science and water supply engineering.

Course Objectives:

1. Exposure to the principles of Hydraulics in flow measurements.
2. Ability to critically observe/ examine and Measure the discharges through flow measuring devices.
3. Ability to critically examine the quality of water as per IS code of Practice.

Course Outcomes: (CO's)

On successful completion of this course, the student will be able to:

Course Outcome		CL	Linked experiments	Linked PO	Teaching Hrs
CO1	Apply Bernoulli's equations in flow experiments to determine the coefficient of discharge.	<i>U/A</i>	1,2,3,4,5	1,2,3,4,5,6,8,10	03
CO1	Determine hydraulic coefficients of notches and orifices	<i>U/A</i>	1,2,3,4,5	1,2,3,4,5,6,8,10	06
CO3	Determine flow rates, pressure changes, and major head losses for viscous flows through pipes.	<i>U/A</i>	5,6	1,2,3,4,5,6,8,10	06
CO4	Assess physical characteristics of water as per BIS code of practice.	<i>U/A</i>	7,8,9,10	1,2,3,4,5,6,8,9,10	03
CO5	Assess chemical characteristics of water as per BIS code of practice.	<i>U/A</i>	10,11,12,13,14,15,16	1,2,3,4,5,6,8,9,10	48
CO6	Apply techniques, skills developed for sustainable engineering solutions in environmental and societal context.	<i>U/A</i>	18	1,2,3,4,5,6,8,9,10	12
				Total sessions	78

COURSE-PO ATTAINMENT MATRIX

Mapping of COs with POs	PROGRAMME OUTCOME (PO)									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
	Basic Knowledge	Discipline Knowledge	Experiments & practice	Engineering Tools	Engineer and society	Environment & Sustainability	Ethics	Individual and Team work	Communication	Lifelong learning
Hydraulics and environmental lab	3	3	3	3	3	3	-	3	2	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

UNITS		HOURS
Hydraulics Lab		
1	Determination of Coefficient of discharge for Rectangular Notch	3
2	Determination of Coefficient of discharge for Triangular Notch	3
3	Determination of Co-efficient of discharge for Trapezoidal Notch	3
4	Determination of Coefficient of discharge for Venturimeter.	3
5	Determination of Coefficient of discharge, Coefficient of contraction, and Coefficient of velocity for Circular Orifice.	3
6	Determination of Loss of Head due to Friction in Pipe line of different diameters.	3
Water Analysis Lab		
7	Collection of Water Samples- Surface, Running and Ground water samples.	6
8	Determination of Turbidity of Water by Jackson turbidity meter / Nephelo Turbidity meter	6
9	Determination of Color of Water.	3
10	Determination of Total solids, Suspended Solids and Dissolved solids of water.	6
11	Determination of hardness- total hardness, Calcium and Magnesium Hardness, Permanent Hardness.	6
12	Determination of pH Value (pH meter method & pH paper) of water sample.	3
13	Determination of Alkalinity & acidity of water sample.	6
14	Determination of Chlorides of water sample.	3
15	Determination of Nitrates of water sample.	3
16	Determination of Calcium of water sample.	3
17	Tests	6
18	Field Visits to water treatment plant and sewerage treatment plant and preparation of Report and Presentation.	9
Total		78



TEXT BOOKS & REFERENCES:

1. Hydraulic Lab Manual Compiled – T.T.T.I. – Chennai – 113.
2. Ghosh and Talapohia– Experimental Hydraulic –Khanna Publishers –New Delhi
3. Central Public Health EnggOrganisation(CPHEO) water supply Manual
4. National environmental engineering Institute (NEERI) water supply manual
5. Water supply engineering by-Birdie
6. Water supply and sewage disposal by – S.K.Garg.
7. Water supply and sanitary engg. By –Rangawala.

SUGGESTED LIST OF STUDENT ACTIVITIES

*Note: Following is the list of proposed student activities such as (5 marks for CIE)
Each student should submit Field visit report on any one of the following visits.*

Sl No.	Student Activity
1	Visit to Water Treatment Plant
2	Visit to Sewerage Treatment Plant
3	Visit to a HOUSING Colony and Study of Water Supply and Sewerage System
4	Prepare/Download a dynamic animation to illustrate the following: <ul style="list-style-type: none"> • Working principle of hydraulic pumps. • Working of different types of hydraulic devices (applications). • Download the catalogue of Hydraulic devices. • Arrange visit to nearby Hydraulic equipment based industries.
5	Prepare reagents for conducting graded exercises.

Course Delivery:

The course will be delivered through lectures, Demonstration and practices.

Course Assessment and Evaluation Scheme:

	What	To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	CIE (Continuous Internal Evaluation)	Students	Two IA tests for Theory: (Average marks of Two Tests to be computed).	10	Blue Books	ALL CO's
			Graded Exercise Practice	10	Records	ALL CO's
			Field Visit/Student Activity	05	Log of Activity/Report on field visit	ALL CO's
			TOTAL	25		

	SEE (Semester End Examination)	End Exam	Students	End Of the Course	50	Answer Scripts at BTE	ALL CO's
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course	Feed Back Forms		All Cos Delivery of course
	End Of Course Survey			End Of The Course	Questionnaires		All Cos Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation

*SEE – Semester End Examination

Note:

1. I.A. test shall be conducted as per SEE scheme of valuation. However obtained marks shall be reduced to 10 marks. Average marks of two tests shall be rounded off to the next higher digit.
2. Rubrics to be devised appropriately by the concerned faculty to assess Student activities.

Questions for CIE and SEE will be designed to evaluate the various educational components such as:

Sl. No	Bloom's Category	% in Weightage
1	Remembering and Understanding	30
2	Applying the knowledge acquired from the course	55
3	Analysis	07
4	Evaluation	55
5	Creating new knowledge	03

Scheme of Valuation:

Sl no	Particulars	Marks
Hydraulics lab		
1	Writing Procedure /Formulae and Tabular column	05
2	Conduction of Experiment	15
Water Analysis Lab		
3	Writing Procedure /Formulae and Tabular column	05
4	Conduction of Experiment	15
5	Calculation and Result	05
6	Graded exercise + Suggested activity report	05
Total Marks		50

List of equipments for Hydraulics lab:

1. Venturimeter with accessories.
2. Flow through notches apparatus with all accessories.
3. Flow through pipes (friction) apparatus with all accessories.

4. Piezometer with scale and tube.
5. Differential manometer set.
6. Orifice apparatus.

List of equipments for Water Analysis lab:

1. Spectrophotometer/colorimeter
2. Hot air Oven
3. Hot plate
4. Digital TDS meter for suspended solids
5. Electronic digital balance (1mg accuracy)
7. Digital turbidity meter
8. Digital PH meter
9. Water bath double walled
10. Porcelain dish
11. Dessicator with accessories-2 lts capacity
12. Jackson turbidimeter
13. Nephelometer
14. Crucible, Burettes.
15. BOD bottles -250 ml
16. COD-Reflux apparatus
17. Volumetric flask 100ml,250ml,500ml
18. Reagent bottle-250 ml
19. Distillation kit
20. Beaker 100ml,250ml,500ml,1000ml
21. Funnel, Pipettes 5ml & 10ml(graduated)
22. Imhoff cone.