INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

CIVIL ENGINEERING

COURSE DESCRIPTOR

Course Title	**FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY**				
Course Code	ACE107				
Programme	B. Tech				
Semester	V	CIVIL			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	3	3	2
Chief Coordinator	Mr. R. Suresh Kumar, Assistant Professor				
Course Faculty	Mr. R. Suresh Kumar, Assistatn Professor Mr. Ch. V. S. S. Sudheer, Assistant Professor				

I. COURSE OVERVIEW:

The primary objective of Fluid Mechanics and Hydraulic Machinery laboratory is to develop the analytical ability of the students by better understanding the concepts of flow studies. The experiments carried out like Calibration of flow measuring devices, determination of Coefficient of Discharge, Coefficient of Velocity for flow measuring devices, estimation of both major and minor losses, Verification of Bernoulli's equation, determination of impact of jet on vanes for the blades of the turbine, determination of efficiencies of various types of turbines, Specific speed of the turbines and working of single stage and multi-stage centrifugal pumps will be studied in addition to this the working of reciprocating pump will also be studied

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	ACE005	IV	Fluid Mechanics	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Fluids Mechanics and Hydraulic Machines Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✘	Quiz	✘	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Presentation on real- world problems
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	3	Seminar
PO 3	**Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Engineering Knowledge:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	2	Presentation on real- world problems
PSO 2	**Broadness and Diversity:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	-	-
PSO 3	**Self-Learning and Service:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	2	Seminar

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Enrich the concept of fluid mechanics and hydraulic machines..
II	Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.
III	Correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
IV	Discuss the performance characteristics of turbines and pumps

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACE017.01	CLO 1	Calibration of Venturimeter & Orifice meter	PO 1, PO 2, PO 3	3
ACE017.02	CLO 2	Coefficient of discharge for a small orifice / Mouth piece by constant head method	PO 1, PO 2	3
ACE017.03	CLO 3	Calibration of contracted rectangular notch / triangular Notch	PO 1, PO 2, PO 3	2
ACE017.04	CLO 4	Determination of friction factor of pipe	PO 1, PO 2, PO 3	3
ACE017.05	CLO 5	Co-efficient for minor losses in different types of pipes	PO 1, PO 2	2
ACE017.06	CLO 6	Verification of Bernoulli‟s Equation	PO 1,PO 2, PO 3	3
ACE017.07	CLO 7	Impact of jet on vanes	PO 1, PO 2, PO 3	2
ACE017.08	CLO 8	Performance test on Pelton wheel turbine	PO 1, PO 2, PO 3	3
ACE017.09	CLO 9	Performance test on Francis turbines	PO 1, PO 2, PO 3	3
ACE017.10	CLO 10	Performance characteristics of a single stage Centrifugal pump	PO 1, PO 2, PO 3	3
ACE017.11	CLO 11	Performance characteristics of multi- stage Centrifugal pump	PO 1	3
ACE017.12	CLO 12	Performance characteristics of a Reciprocating pump	PO 1	2
ACE017.13	CLO 13	Study of hydraulic jump	PO 1	1

3 = High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	3	3										3		3
CLO 2	3	3											3		3
CLO 3	2	2	2										2		2
CLO 4	3	3	3										3		3

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 5	2	2											2		2
CLO 6	3	3	3										3		3
CLO 7	2	2	2										2		2
CLO 8	3	3	3										3		3
CLO 9	3	3	3										3		3
CLO 10	3	3	3										3		3
CLO 11	3												3		3
CLO 12	3												3		3
CLO 13	1												2		2

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2, PO 3 PSO 1, PSO 3	SEE Exams	PO 1, PO 2, PO 3, PSO 1,PSO 3	Assignments	-	Seminars	-
Laboratory Practices	PO 2	Student Viva	PSO 1	Mini Project	-	Certification	-

XII. ASSESSMENT METHODOLOGIES - INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

LIST OF EXPERIMENTS	
Week – 1	**INTRODUCTION TO FLUID MECHANICS & HYDRAULIC MACHANERY LABORATORY**
Introduction	
Week – 2	**CALIBRATION OF VENTURIMETER & ORFICEMETER**
Calibration of Venturimeter & Orifice meter	
Week – 3	**DETERMINATION OF COEFFICIENT OF DISCHARGE FOR A SMALL ORIFICE / MOUTH PIECE BY CONSTANT HEAD METHOD**
Coefficient of discharge for a small orifice / Mouth piece by constant head method	
Week – 4	**CALIBRATION OF CONTRACTED TRIANGULAR NOTCH AND RECTANGULAR NOTCH**
Calibration of contracted rectangular notch / triangular Notch	

Week – 5	**DETERMINATION OF FRICTION FACTOR OF PIPE / MINOR LOSSES**
Determination of friction factor of pipe / minor losses in different types of pipes	
Week – 6	**VERIFICATION OF BERNOULLI"S EQUATION**
Verification of Bernoulli"s Equation	
Week – 7	**IMPACT OF JET ON VANES**
Impact of jet on vanes	
Week – 8	**PERFORMANCE TEST ON PELTON WHEEL TURBINE**
Performance test on Pelton wheel turbine	
Week – 9	**PERFORMANCE TEST ON FRANCIS TURBINE**
Performance test on Francis turbines	
Week – 10	**PERFORMANCE CHARACTERISTICS OF A SINGLE STAGE CENTRIFUGAL PUMP**
Performance characteristics of a single stage Centrifugal pump	
Week – 11	**PERFORMANCE CHARACTERISTICS OF A MULTI – STAGE CENTRIFUGAL PUMP**
Performance characteristics of multi- stage Centrifugal pump	
Week – 12	**PERFORMANCE CHARACTERSTICS OF A RECIPROCATING PUMP**
Performance characteristics of a Reciprocating pump	
Week – 13	**STUDY OF HYDRAULIC JUMP**
Study of hydraulic jump	
Week - 14	**REVISION**
Revision	
Text books: 1. Manoj Kumar Rout , "Lab manual for Fluid Mechanics and Hydraulic Machines" BT University, 2008. 2. Dr. N. Kumar Swamay, "Fluid Mechanics and Machinery Laboratory manual", Charator publications.	
Reference books:	
1. Modi, Seth, "Fluid Mechanics. Hydraulic and Hydraulic Machines", Standard Book House, 2011. 2. Annapureddy Domodara Reddy, " Fluid Mechanics and Hydraulic Machines Lab manual", LAMBERT Academic Publications. 3. Madan Mohan Das, Mimi Das Saikia, Bhargab Mohan Das, "Hydraulics and Hydraulic Machines Textbook", PHI Learning, 1st edition, 2013.	

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Introduction to Fluid Mechanics and Hydraulic Machinery Lab	CLO1	T1,T2
2	Calibration of Venturimeter & Orifice meter	CLO 2	T1,T2
3	Coefficient of discharge for a small orifice / Mouth piece by constant head method	CLO 3	T1,T2
4	Calibration of contracted rectangular notch / triangular Notch	CLO 4	T1,T2

Week	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
5	Calibration of friction factor of pipe / minor losses in different types of pipes	CLO 5	T1,T2
6	Verification of Bernoulli‟s Equation	CLO 6	T1,T2
7	Impact of jet on vanes	CLO 7	T1,T2
8	Performance test on Pelton wheel turbine	CLO 8	T1,T2
9	Performance test on Francis turbines	CLO 9	T1,T2
10	Performance characteristics of a single stage Centrifugal pump	CLO 10	T1,T2
11	Performance characteristics of multi- stage Centrifugal pump	CLO 11	T1,T2
12	Performance characteristics of a Reciprocating pump	CLO 12	T1,T2
13	Study of hydraulic jump	CLO 13	T1,T2

XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	To improve standards and analyze the concepts.	Seminars	PO 1	PSO 1
2	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL /Videos	PO 3	PSO 3

Prepared by:

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