INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LABORATORY**				
Course Code	AME108				
Programme	B.Tech				
Semester	IV	ME			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. CH.V.K.N.S.N Moorthy, Professor				
Course Faculty	Dr. CH.V.K.N.S.N Moorthy, Professor Mr. A. Somaiah, Assistant Professor				

I. COURSE OVERVIEW:

The aim of this course is to conduct experiments on basic principles of fluid mechanics and it is further extended to cover the application of fluid mechanics by the inclusion of fluid machinery. Nowadays the principles of fluid mechanics find wide applications in many situations. The course deals with the fluid machinery, like turbines, pumps in general and in power stations. This course includes experiments deal with the study of water.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AHS007	I	Applied Physics	4
UG	AME002	II	Engineering Mechanics	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Mechanics of Fluids 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	Calculations of the observations
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.	2	Characteristic curves
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
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	2	Term observations

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** To produce engineering professional capable of synthesizing and analyzing mechanical systems including allied engineering streams.	2	Seminar
PSO 2	**Problem solving skills:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	2	Seminar
PSO 3	**Successful career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	1	Presentation on real-world problems

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Demonstrate the basic principles of fluid mechanics.
II	Analyze the effect of friction on flow through pipes.
III	Estimate the performance of hydraulic turbines.
IV	Evaluate the functioning and characteristic curves of 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
AME108.01	CLO 1	Understand basic units of measurement, convert units, and appreciate their magnitudes.	PO 1	3
AME108.02	CLO 2	Utilize basic measurement techniques of fluid mechanics.	PO 1, PO 3	3
AME108.03	CLO 3	Measure fluid pressure and relate it to flow velocity.	PO 1, PO 3	3
AME108.04	CLO 4	Demonstrate practical understanding of the various equations of Bernoulli.	PO 1, PO 2, PO 4	2
AME108.05	CLO 5	Demonstrate practical understanding of friction losses in internal flows.	PO 1, PO 3	2
AME108.06	CLO 6	Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.	PO 1, PO 2, PO 4	2
AME108.07	CLO 7	Calculate the performance analysis in turbines can be used in power plants.	PO 1, PO 2, PO 3	1
AME108.08	CLO 8	Calculate the performance analysis in pumps.	PO 1, PO 2, PO 3	1
AME108.09	CLO 9	Draw and analysis of performance characteristic curves of pumps.	PO 1, PO 2	2
AME108.10	CLO 10	Draw and analysis of performance characteristic curves of turbines.	PO 1, PO 3	2
AME108.11	CLO 11	Draw and analysis of characteristic curves of flow meters.	PO 1, PO 3	3
AME108.12	CLO 12	Determine the coefficient of impact of different types of vanes.	PO 1, PO 2	3
AME108.13	CLO 13	Determine the coefficient of discharge of different types of flow meters.	PO 1, PO 3	3
AME108.14	CLO 14	Determine the friction factor of different types of cross section of pipes.	PO 1, PO 2	2
AME108.15	CLO 15	Draw the characteristic curves of friction apparatus.	PO 1, PO 3, PO 4	2
AME108.16	CLO 16	Determine the friction factor using moody's chart.	PO 1, PO 2	2
AME108.17	CLO 17	Applying the Darcy's Weisbach equation for the measurement of coefficient of friction.	PO 1, PO 2	3
AME108.18	CLO 18	Evaluate the performance of hydraulic turbines.	PO 1, PO 2	2
AME108.19	CLO 19	Evaluate the performance of hydraulic pumps.	PO 1, PO 3, PO 4	1
AME108.20	CLO 20	Analyze flow in closed pipes, and design and selection of pipes including sizes.	PO 1, PO 2	1
AME108.21	CLO 21	Explain the working principle of various types of hydro turbines and know their application range	PO 1, PO 2, PO 3, PO 4,	2
AME108.22	CLO 22	Demonstrate the various types of major and minor losses in pipes and explain flow between parallel plates.	PO 3, PO 4,	2

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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												1	2	
CLO 2	3		3										1		
CLO 3	3		3										1	2	
CLO 4	2	2		2									1	2	
CLO 5	2		2										1	2	
CLO 6	2	2		2										2	
CLO 7	1	1	1										1		
CLO 8	1	1	1											2	
CLO 9	2	2												2	
CLO 10	2		2										1		
CLO 11	3		3											2	
CLO 12	3	3											1		
CLO 13	3		3										1	2	
CLO 14	2	2											1		
CLO 15	2		2	2									1	2	
CLO 16	2	2											1		
CLO 17	3	3											1		
CLO 18	2	2											1	2	
CLO 19	1		1	1										2	
CLO 20	1	1												2	
CLO 21	2	2	2	2									1	2	
CLO 22			2	2									1	2	

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XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PO 2 PO 3, PO 4	SEE Exams	PO 1, PO 2 PO 3, PO 4	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO 2 PO 3, PO 4	Student Viva	-	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	**VENTURIMETER**
Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through Venturimeter	
Week-2	**ORIFICE METER**
Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through Orifice meter.	
Week-3	**PIPE FRICTION**
Determination of friction factor for a given pipe line.	
Week-4	**BERNOULLI'S THEOREM**
Verification of Bernoulli's theorem.	
Week-5	**IMPACT OF JET ON VANES**
Determination of Impact of jet on various types of Vanes.	
Week-6	**PELTON WHEEL TURBINE**
Performance test on Pelton wheel and generate various characteristic curves.	
Week-7	**FRANCIS TURBINE**
Performance Test on Francis Turbine and generate various characteristic curves.	
Week-8	**KAPLAN TURBINE**
Performance Test on Kaplan wheel and generate various characteristic curves.	
Week-9	**CENTRIFUGAL PUMP**
Performance Test on Centrifugal Pump and generate various characteristic curves	
Week-10	**MULTI-STAGE CENTRIFUGAL PUMP**
Performance Test on Multistage Centrifugal Pump and generate various characteristic curves	
WeeK-11	**RECIPROCATING PUMP**
Performance Test on Reciprocating Pump and generate various characteristic curves	
Week-12	**MINIOR LOSSES**
Determination of losses of head due to sudden contraction in a pipe line.	

XIV. COURSE PLAN:

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

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Determination of coefficient of discharge (Cd) and generation of various characteristic curves for water flowing through Venturimeter	CLO 1, CLO 2, CLO 3, CLO 6	T1:1.4 R1:1.2
2	Determination of coefficient of discharge (Cd) and generation of various characteristic curves for water flowing through Orifice meter.	CLO 1, CLO 2, CLO 3, CLO 6	T1:1.5 R1:2.4
3	Determination of friction factor for a given pipe line.	CLO 5, CLO 6, CLO 14, CLO 15, CLO 17	T1:2.5 R1:2.5
4	Verification of Bernoulli's theorem.	CLO 4, CLO 6	T1:2.5 R1:2.6
5	Determination of Impact of jet on various types of Vanes.	CLO 12, CLO 6	T1:22.7
6	Performance test on Pelton wheel and generate various characteristic curves.	CLO 7, CLO 10, CLO 18, CLO 21	T1:6.3 R1:5.3
7	Performance Test on Francis Turbine and generate various characteristic curves.	CLO 7, CLO 10, CLO 18, CLO 21	T1:7.5 R1:6.3
8	Performance Test on Kaplan wheel and generate various characteristic curves.	CLO 7, CLO 10, CLO 18, CLO 21	T1:8.5 R1:6.8
9	Performance Test on Centrifugal Pump and generate various characteristic curves	CLO 8, CLO 9, CLO 19	T1:12.2 R1:13.1
10	Performance Test on Multistage Centrifugal Pump and generate various characteristic curves	CLO 8, CLO 9, CLO 19	T1:12.3 R1:13.2
11	Performance Test on Reciprocating Pump and generate various characteristic curves	CLO 8, CLO 9, CLO 19	T1:12.10 R1:13.7
12	Determination of losses of head due to sudden contraction in a pipe line.	CLO 11, CLO 13, CLO 16, CLO 20, CLO 22	T1:11.2 R1:10.2

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.	CASE STUDIES	PO 1, PO 4	PSO 1
2	Conditional probability, Sampling distribution, correlation, regression analysis and testing of hypothesis	NPTEL	PO 4, PO3	PSO 1
3	Encourage students to solve real time applications and prepare towards competitive examinations.	INTERNSHIPS	PO 2	PSO 1

Prepared by:

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