INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	**FLUID MACHINERY AND IC ENGINE LABORATORY**				
Course Code	**AMEB13**				
Programme	B.Tech				
Semester	IV	ME			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	-	-	-	2	1
Chief Coordinator	Mr. G.Sarat raju, Assistant Professor				
Course Faculty	Dr. CH.V.K.N.S.N Moorthy, Professor Mr. G.Sarat raju, 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	Waves and optics	4
UG	AME002	II	Engineering Mechanics	4

III MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
FLUIDMACHINERYAND ICENGINE 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.	1	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.	1	Seminar
PSO 2	**Problem solving skills:** An ability to adopt and integrate current technologies in the design and manufacturing domain to enhance the employability.	-	-
PSO 3	**Successful career and Entrepreneurship:** To build the nation, by imparting technological inputs and managerial skills to become technocrats.	-	-

3 = High; 2 = Medium; 1 = Low

VIII COURSE OBJECTIVES :

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 and pumps
IV	Evaluate the functioning and characteristic curves of I.C.engine

IX COURSE OUTCOMES (COs):

COS	Course outcomes	CLOS	Course Learning Outcomes
CO1	Ability to measure flow rate by using flow meters and measure friction factor	CLO 1	Understand basic units of measurement, convert units, and appreciate their magnitudes.
		CLO 2	Utilize basic measurement techniques of fluid mechanics.
		CLO 3	Measure fluid pressure and relate it to flow velocity.
		CLO 4	Demonstrate practical understanding of the various equations of Bernoulli.
		CLO 5	Demonstrate practical understanding of friction losses in internal flows.
CO2	Able to perform operation of turbines and find its efficiency	CLO 6	Calculate the performance analysis in turbines can be used in power plants.
		CLO 7	Draw and analysis of performance characteristic curves of turbines.
		CLO 8	Evaluate the performance of hydraulic turbines.
		CLO 9	Explain the working principle of various types of hydro turbines and know their application range
CO3	Determine the performance operation of pumps and find its efficiency	CLO 10	Calculate the performance analysis in pumps.
		CLO 11	Draw and analysis of performance characteristic curves of pumps.
		CLO 12	Evaluate the performance of hydraulic pumps.
		CLO 13	Explain the working principle of various types of pumps and know their application range
CO4	Can find efficiency of four stroke petrol and diesel engines	CLO 14	Understand the concept of Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.
		CLO 15	Know the Performance test for 4-stroke SI engine and draw performance curves
		CLO 16	Performance Test on 4-stroke CI engine and to draw the performance curves
		CLO 17	Performance of Machining practice on balancing of heat losses and heat input in SI/CI engines
		CLO 18	Understand the Performance Test on CI engine when the compression ratio is changing
CO5	Can analyze performance of air compressor	CLO 19	Understand the Performance of air compressor Unit
		CLO 20	Explains the working principle of air compressor

X 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	2
AME108.03	CLO 3	Measure fluid pressure and relate it to flow velocity.	PO 1, PO 3	2
AME108.04	CLO 4	Demonstrate practical understanding of the various equations of Bernoulli.	PO 1, PO 2	3
AME108.05	CLO 5	Demonstrate practical understanding of friction losses in internal flows.	PO 1, PO 3	2
AME108.06	CLO 6	Calculate the performance analysis in turbines can be used in power plants.	PO 3	1
AME108.07	CLO 7	Draw and analysis of performance characteristic curves of turbines.	PO 2, PO 3	2
AME108.08	CLO 8	Evaluate the performance of hydraulic turbines.	PO 1, PO 2	3
AME108.09	CLO 9	Explain the working principle of various types of hydro turbines and know their application range	PO 3, PO 4	2
AME108.10	CLO 10	Calculate the performance analysis in pumps.	PO 2, PO 3	2
AME108.11	CLO 11	Draw and analysis of performance characteristic curves of pumps.	PO 1, PO 3	2
AME108.12	CLO 12	Evaluate the performance of hydraulic pumps.	PO 1, PO 2	3
AME108.13	CLO 13	Explain the working principle of various types of pumps and know their application range	PO 1, PO 3	2
AME108.14	CLO 14	Understand the concept of Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	PO 3	1
AME108.15	CLO 15	Know the Performance test for 4-stroke SI engine and draw performance curves	PO 1, PO 3	3
AME108.16	CLO 16	Performance Test on 4-stroke CI engine and to draw the performance curves	PO 2, PO 3	2
AME108.17	CLO 17	Performance of Machining practice on balancing of heat losses and heat input in SI/CI engines	PO 3	1
AME108.18	CLO 18	Understand the Performance Test on CI engine when the compression ratio is changing	PO 1, PO 2	2
AME108.19	CLO 19	Understand the Performance of air compressor Unit	PO 3	1
AME108.20	CLO 20	Explains the working principle of air compressor	PO 1, PO 2	1

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XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OFPROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes (COs)	Program Outcomes (POs)				
	PO 1	PO 2	PO3	PO 4	PSO1
CO 1	3	2			1
CO 2		2	1		
CO 3	3			1	
CO 4		2	1		1
CO 5	3	2			1

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

CLO 20	1	1											1		

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XIII 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	-

XIV ASSESSMENT METHODOLOGIES - INDIRECT

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

XV SYLLABUS

Week-1	**CALIBRATION OF FLOW METERS**
Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through venturimeter Determination of coefficient of discharge (C_d) and generation of various characteristic curves for water flowing through Orifice meter.	
Week-2	**DETERMINATION OF FRICTION FACTOR**
Determination of friction factor for a given pipe line.	
Week-3	**BERNOULLI'S THEOREM**
Verification of Bernoulli"s theorem.	
Week-4	**PERFORMANCE TEST ON REACTION TURBINES**
Performance Test on Francis Turbine and generate various characteristic curves. Performance Test on Kaplan wheel and generate various characteristic curves.	
Week-5	**PERFORMANCE TEST ON IMPULSE TURBINE**
Performance test on Pelton wheel and generate various characteristic curves.	
Week-6	**PERFORMANCE TEST ON POSITIVE DISPLACEMENT PUMP**
Performance Test on Reciprocating Pump and generate various characteristic curves	
Week-7	**PERFORMANCE TEST ON ROTODYNAMIC PUMPS**
Performance Test on Centrifugal Pumps and generate various characteristic curves	
Week-8	**IC Engines Valve/Port timing diagram**

Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	
Week-9	**IC Engine performance test for 4-stroke SI Engine**
Performance test for 4-stroke SI engine and draw performance curves	
WeeK-10	**IC Engine performance test on 4-Stroke CI engine**
Performance Test on 4-stroke CI engine and to draw the performance curves	
Week-11	**Performance Test on Air Compressor Unit**
Volumetric Efficiency of Reciprocating Air compressor unit	
Week-12	**Performance test on Variable Compression Ratio(VCR) engine**
Performance Test on CI engine when the compression ratio is changing.	
Week-13	**Examination**

XVI 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,	T1:1.4 R1:1.2
2	Determination of friction factor for a given pipe line..	CLO 1, CLO 2, CLO 3,	T1:1.5 R1:2.4
3	Verification of Bernoulli‟s theorem.	CLO 2, CLO 3, CLO 4	T1:2.5 R1:2.5
4	Performance Test on Francis Turbine, Kaplan wheel and generate various characteristic curves.	CLO 6, CLO 7	T1:2.5 R1:2.6
5	Performance test on Pelton wheel and generate various characteristic curves..	CLO8, CLO 9	T1:22.7
6	Performance Test on Reciprocating Pump and generate various characteristic curves	CLO 10, CLO 11,	T1:6.3 R1:5.3
7	Performance Test on Centrifugal Pumps and generate various characteristic curves	CLO 10, CLO12,	T1:7.5 R1:6.3
8	Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	CLO 14, CLO 18,	T1:8.5 R1:6.8
9	Performance test for 4-stroke SI engine and draw performance curves	CLO 16, CLO 17	T1:12.2 R1:13.1
10	Performance Test on 4-stroke CI engine and to draw the performance curves	CLO 18	T1:12.3 R1:13.2
11	Volumetric Efficiency of Reciprocating Air compressor unit	CLO 19	T1:12.10 R1:13.7
12	Performance Test on CI engine when the compression ratio is changing.	CLO 20,	T1:11.2 R1:10.2

XVII 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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