INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

AERONAUTICALENGINEERING

COURSE DESCRIPTOR

Course Title	**FLUID DYNAMICS LABORATORY**				
Course Code	AAEB05				
Programme	B.Tech				
Semester	III	AE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	2	1
Chief Coordinator	Mr. G Satya Dileep, Assistant Professor				
Course Faculty	Mr. G Satya Dileep, Assistant Professor Mr. U Shiva Prasad, Assistant Professor				

I. COURSE OVERVIEW:

The aim of this lab complements the Fluid Dynamics course. The objective of this lab is to teach students, the knowledge of various flow meters and the concept of fluid mechanics. This labhelps to gain knowledge on working of centrifugal pumps, positive displacement pumps,and hydraulic turbines. Students will comparethe performance of various machines at different operating points.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AAEB05	III	Fluid Dynamics	4

III. MARKSDISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Fluid Dynamics 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 forinternal assessment and 70 marks for semester end lab examination. Out of 30 marks ofinternal assessment, continuous lab assessment will be done for 20 marks for the day today performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end labexamination for 70 marks shall be conducted by two examiners, one of them beingInternal Examiner and the other being External Examiner, both nominated by thePrincipal 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, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	2	Calculations of the observations
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Calculations of the observations
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	Mini Projects

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:** Able to utilize the knowledge of aeronautical/aerospace engineering in innovative, dynamic and challenging environment for design and development of new products	1	Lab Practices
PSO2	**Problem-solving Skills:** Imparted through simulation language skills and general purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.	--	--
PSO 3	**Practical implementation and testing skills:** Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies	--	--
PSO 4	**Successful career and entrepreneurship:** To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aeronautical/aerospace allied systems to become technocrats.	--	--

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

The course should enable the students to:	
I	Gain knowledge on working of centrifugal pumps, positive displacement pumps, hydraulic turbines centrifugal blowers and steam turbines.
II	Compare performance of various machines at different operating points.
III	Knowledge of various flow meters and the concept of fluid mechanics.
IV	Analyze the errors and cause of errors in computational analysis.

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
AAEB05.01	CLO 1	Analyze the flow discharge through venturimeter and orifcemeter.	PO 1	2
AAEB05.02	CLO 2	Understand the effects of friction for various pipe flows.	PO 1	2
AAEB05.03	CLO 3	Explain the pipe flow losses in various pipes.	PO 2	1
AAEB05.04	CLO 4	Understand the application of Bernoulli's theorem.	PO 1, PO 2	1
AAEB05.05	CLO 5	Understand the concepts od dimensionless numbers in fluid flows.	PO 1, PO 2	2
AAEB05.06	CLO 6	Observe the transition of flow under various circumstances.	PO 1, PO 2	2
AAEB05.07	CLO 7	Understand the impact of jet on different vanes and its applications on impellers.	PO 2, PO 3	1
AAEB05.08	CLO 8	Analyze the power efficiency of a centrifugal pump.	PO 2, PO 3	1
AAEB05.09	CLO 9	Analyze the power efficiency of a reciprocating pump.	PO 2, PO 3	2
AAEB05.10	CLO 10	Differentiate the flow properties around centrifugal pump and reciprocating pump.	PO 2, PO 3	2
AAEB05.11	CLO 11	Analyze the power efficiency and mechanical efficiency of a Pelton wheel.	PO 2, PO 3	1
AAEB05.12	CLO 12	Analyze the power efficiency and mechanical efficiency of a Francis turbine.	PO 2, PO 3	1
AAEB05.13	CLO 13	Differentiate the flow properties and efficiencies of Pelton wheel and Francis turbine	PO 2, PO 3	1
AAEB05.14	CLO 14	Understand the rate of discharge for flow through weirs	PO 1, PO 2	2
AAEB05.15	CLO 15	Understand the calculation of discharge for flow through dams.	PO 1, PO 2	2
AAEB05.16	CLO 16	Analyze the flow discharges through different shapes of mouth pieces.	PO 1, PO 2	2

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	PSO4
CLO 1	2															
CLO 2	2															
CLO 3		1											2			
CLO 4	1	2														
CLO 5	2	2														
CLO 6	2	1														
CLO 7		1	1													
CLO 8		1	2													
CLO 9		2	2													
CLO 10		2	2										1			
CLO 11		2	1													
CLO 12		1	1										2			
CLO 13		2	1													
CLO 14	2	2											1			
CLO 15	2	2														
CLO 16	1	2														

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO 1, PO 2 PO 3	SEE Exams	PO 1, PO 2 PO 3	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO 2 PO 3	Student Viva	-	Mini Project	PO 3	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	**CALIBRATION**
Calibration of Venturimeter and Orifice meter.	
Week-2	**PIPE FLOW LOSSES**
Determination of pipe flow losses in rectangular and circular pipes	
Week-3	**BERNOULLI'S THEOREM**
Verification of Bernoulli's theorem.	
Week-4	**REYNOLDS EXPERIMENT**
Determination of Reynolds Number of fluid flow	
Week-5	**IMPACT OF JET ON VANES**
Study Impact of jet on Vanes.	
Week-6	**CENTRIFUGAL PUMPS**
Performance test on centrifugal pumps.	
Week-7	**RECIPROCATING PUMPS**
Performance test on reciprocating pumps.	
Week-8	**PELTON WHEEL TURBINE**
Performance test on Pelton wheel turbine.	
Week-9	**FRANCIS TURBINE**
Performance test on Francis turbine.	
Week-10	**FLOW THROUGH WEIRS**
Rate of discharge Flow through Weirs	
WeeK-11	**FLOW THROUGH NOTCH**
Flow through rectangular and V-Notch	
Week-12	**FLOW THOUGH ORIFICE MOUTH PIECE**
Flow analysis of different shapes of mouth pieces	
Reference Books:	
1. Yuan S W, "Foundations of fluid Mechanics", Prentice-Hall, 2nd Edition, 1987. 2. Milne Thompson L M, "Theoretical Hydrodynamics", MacMillan, 5th Edition, 1968. 3. Rathakrishnan. E, "Fundamentals of Fluid Mechanics", Prentice-Hall, 5th Edition, 2007. 4. Som S. K., Biswas. G, "Introduction to fluid mechanics and fluid machines", Tata McGraw-Hill, 2nd Edition, 2004.	

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	Calibration of Venturimeter and Orifice meter.	CLO 1	R1: 1.2

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
2	Determination of pipe flow losses in rectangular and circular pipes	CLO 2, CLO 3	R4: 3.5
3	Verification of Bernoulli's theorem.	CLO 4	R1: 3.4
4	Determination of Reynolds Number of fluid flow	CLO 5, CLO 6	R1: 2.2
5	Study Impact of jet on Vanes.	CLO 7	R1: 2.4
6	Performance test on centrifugal pumps.	CLO 8, CLO 10	R1: 4.5
7	Performance test on reciprocating pumps.	CLO 9, CLO 10	R2: 2.6
8	Performance test on Pelton wheel turbine.	CLO 11, CLO 13	R2: 2.6
9	Performance test on Francis turbine.	CLO 12, CLO 13	R1: 5.2
10	Rate of discharge Flow through Weirs	CLO 14	R1: 5.2
11	Flow through rectangular and V-Notch	CLO 15	R1:7.2
12	Flow analysis of different shapes of mouth pieces	CLO 16	R1:7.3

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.	Guest Lectures	PO 1, PO 2	PSO 1
2	Encourage students to solve real time applications and prepare towards competitive examinations.	NPTEL	PO 2, PO 3	PSO 1

Prepared by:
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