



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTOR

Course Title	THERMAL ENGINEERING LABORATORY				
Course Code	AME109				
Programme	B Tech				
Semester	V	ME			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	-	-		3	2
Chief Coordinator	Mr. P. Sadanandam, Assistant Professor				
Course Faculty	Dr. CH VKNSN Moorthy, Professor Mr. P. Sadanandam, Assistant Professor				

I. COURSE OVERVIEW:

In this laboratory, students will have the opportunity to study the working principle of IC engines (both SI and CI engines), performance and characteristics in terms of heat balancing, economical speed variations, air fuel ratio influence on the engine to reinforce classroom theory by having the student perform required tests, analyze subsequent data, and present the results in a professionally prepared report.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	-	-

III. MARKSDISTRIBUTION

Subject	SEE Examination	CIA Examination	Total Marks
Thermal Engineering Laboratory	70 Marks	30 Marks	100

IV. DELIVERY/INSTRUCTIONAL METHODOLOGIES:

X	CHALK & TALK	X	LCD / PPT	X	OPEN ENDED EXPERIMENTS
✓	LCD/ PPT	✓	Seminar	X	Mini Project
X	Open Ended Experiment				

V. EVALUATION METHODOLOGY:

Each laboratory is 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 20 marks for day to day performance and 10 marks for the final lab assessment.

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

The emphasis on the questions 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 calculation and graph related to the concern experiment.
20 %	To test the results and 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 Internal Examination (CIE), 05 marks for Quiz and 05 marks for Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

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

Continuous Internal Examination (CIE):

One CIE examination 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	2

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	Exercise, Discussion and Seminars
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	Lab Experiments
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.	1	Lab Experiments

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	Experiments, Discussion and Seminars
PSO 2	Software Engineering Practices: 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:

The course should enable the students to:	
I	Visualize the cycle timings of S.I and C.I engines
II	Determine performance characteristics of C.I and S.I engines
II	Differentiate between water tube and fire tube boilers.
IV	Estimate the importance of multi-staging of air compressors.

IX COURSE OUTCOMES (COs):

Cos	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the features and specifications of IC engines	CLO 1	Understand the concept of Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.
		CLO 2	Know the Performance test for 4-stroke SI engine and draw performance curves
		CLO 3	Understand Basic fundamentals and Determination of volumetric efficiency and break thermal efficiency.
CO 2	Develop the process and calculate the performance of Engines	CLO 4	Understand Fundamentals and Determination of frictional power of IC engine.
		CLO 5	Performance of Machining practice on balancing of heat losses and heat input in SI/CI engines
		CLO 6	Performance Test on SI engine with speed as a parameter
CO 3	Use the Diesel engines and perform the efficiency	CLO 7	Calculating air/fuel ratio of a 4-stroke SI Engine
		CLO 8	Understand the Performance Test on CI engine when the compression ratio is changing.
		CLO 9	Performance Test on 4-stroke CI engine and to draw the performance curves
CO 4	Execute the process to extract the different data from the test rig	CLO 10	Understand the Performance of air compressor Unit
		CLO 11	Awareness of components of given IC engine and assembling /disassembling of parts.
		CLO 12	To study the working operation of different types of boilers

X COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AME109.01	CLO 1	Understand the concept of Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	PO 1	3
AME109.02	CLO 2	Know the Performance test for 4-stroke SI engine and draw performance curves	PO 2	2
AME109.03	CLO 3	Understand Basic fundamentals and Determination of volumetric efficiency and break thermal efficiency.	PO 1	3
AME109.04	CLO 4	Understand Fundamentals and Determination of frictional power of IC engine.	PO 1	3
AME109.05	CLO 5	Performance of Machining practice on balancing of heat losses and heat input in SI/CI engines	PO 2	2
AME109.06	CLO 6	Performance Test on SI engine with speed as a parameter	PO 2	2
AME109.07	CLO 7	Calculating air/fuel ratio of a 4-stroke SI Engine	PO 2	2
AME109.08	CLO 8	Understand the Performance Test on CI engine when the compression ratio is changing.	PO 2	2
AME109.09	CLO 9	Performance Test on 4-stroke CI engine and to draw the performance curves	PO 4	1
AME109.10	CLO 10	Understand the Performance of air compressor Unit	PO 4	1
AME109.11	CLO 11	Awareness of components of given IC engine and assembling /disassembling of parts.	PO 2	2
AME109.12	CLO 12	To study the working operation of different types of boilers	PO 2	2

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XI MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

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

3= High; 2 = Medium; 1 = Low

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													
CLO 3	3												1		
CLO 4	3												1		
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9				1											
CLO 10				1											
CLO 11		2											1		
CLO 12		2											1		

3= High; 2 = Medium; 1 = Low

XIII ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO1, PO2, PO4, PSO1	SEE Exams	PO1, PO2, PO4, PSO1	Assignments	-	Seminars	PO1, PO2, PO4, PSO1
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-
Term Paper	PO1, PO2, PO4, PSO1						

XIV ASSESSMENT METHODOLOGIES - INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV SYLLABUS:

LIST OF EXERCISES	
Week - 1	IC ENGINES VALVE/PORT TIMING DIAGRAM
Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	
Week - 2	IC Engine performance test for 4-stroke SI Engine
Performance test for 4-stroke SI engine and draw performance curves	
Week - 3	IC Engine performance test for 2-stroke SI Engine
Determination of volumetric efficiency and brake thermal efficiency.	
Week - 4	IC Engines Morse, retardation and motoring test
Determination of frictional power of IC engine.	
Week - 5	IC Engines heat balance-CI/SI engines
Balancing of heat losses and heat input in SI/CI engines	
Week - 6	IC Engines economical speed test on SI Engine
Performance Test on SI engine with speed as a parameter	
Week - 7	IC Engines effect of Air/Fuel ration in a SI engine
Calculating air/fuel ratio of a 4-stroke SI Engine .	
Week - 8	Performance test on Variable Compression Ratio(VCR) engine
Performance Test on CI engine when the compression ratio is changing. .	
Week - 9	IC Engine performance test on 4-Stroke CI engine
Performance Test on 4-stroke CI engine and to draw the performance curves	
Week - 10	Volumetric Efficiency of Reciprocating Air compressor unit
Performance of air compressor unit	
Week - 11	Disassembly/Assembly of Engines
Awareness of components of given IC engine and assembling /disassembling of parts.	
Week - 12	Study of Boilers
To study the working operation of different types of boilers	

TEXT BOOKS:

1	V. Ganesan, —I.C. Engines], Tata McGraw-Hill, 3 rd Edition, New Delhi, India. 2011.
2	B. John Heywood, —Internal combustion engine fundamentals], Tata McGraw-Hill, 2 nd Edition, New Delhi. 2011
3	3. R. K. Rajput , —Thermal Engineering], Lakshmi Publications, 18 th Edition, 2011

REFERENCE BOOKS:

1	https://en.wikipedia.org/wiki/Internal_combustionengines .
2	https://en.wikipedia.org/wiki/Compression_Ignitionengines

XVI COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Understand the concept of Drawing valve and port timing diagram for 4-stroke diesel and 2-stroke petrol engine respectively.	CLO 1	T2:26.3
2	Know the Performance test for 4-stroke SI engine and draw performance curves	CLO 2	R2:21.48
3	Understand Basic fundamentals and Determination of volumetric efficiency and break thermal efficiency.	CLO 3	T2:26.6 R2:21.50
4	Understand fundamentals and Determination of frictional power of IC engine.	CLO 4	T2:26.7 R2:21.51
5	Performance of Machining practice on Balancing of heat losses and heat input in SI/CI engines	CLO 5	T2:155-160
6	Performance Test on SI engine with speed as a parameter	CLO 6	T2:161-174
7	Calculating air/fuel ratio of a 4- stroke SI Engine	CLO 7	T2:175-208
8	Understand the Performance Test on CI engine when the compression ratio is changing.	CLO 8	T2:224-226
9	Performance Test on 4-stroke CI-engine and to draw the performance curves	CLO 9	T1:321-353
10	Understand the Performance of air compressor unit	CLO 10	T2:368-390
11	Awareness of components of given IC engine and assembling/disassembling of parts.	CLO 11	T1:368-390
12	To study the working operation of different types of boilers	CLO 12	T2:321-353

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

S. No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	For the better understanding can go through the addition of thermal engineering	NPTEL & Exercise Practices	PO1, PO2	PSO1
2	Understand the IC engines	NPTEL & Exercise Practices	PO1, PO2	PSO1
3	Introduce of charecteristics of IC Engines	Seminars & Exercise Practice	PO1, PO2	PSO1

Prepared by:

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HOD, ME