# INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

| THERMAL ENGINEERING LABORATORY | | | | | | | | |
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| **IV Semester: ME** | | | | | | | | |
| **Course Code** | **Category** | **Hours / Week** | | | **Credits** | **Maximum Marks** | | |
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **AMEE19** | **Core** | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| **Contact Classes: Nil** | **Tutorial Classes: Nil** | **Practical Classes: 36** | | | | **Total Classes:36** | | |
| **Prerequisite: Fluid Mechanics and Hydraulic Machines Laboratory** | | | | | | | | |

## I. COURSE OVERVIEW:
Applied thermodynamics laboratory is intended to study the working principle of internal combustion 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. COURSES OBJECTIVES:
**The students will try to learn**

I. The cycle timings of S.I and C.I engines and visualize the working of the models.
II. The operating principle of C.I and S.I engines and to determine performance characteristics of engines.
III. The Performance test for 4-stroke SI engine and draw performance curves and Determine the volumetric efficiency and break thermal efficiency.

## III. COURSE OUTCOMES:
**At the end of the course students should be able to:**

CO1 Practice the various components and mechanisms of I. C. Engines to Appreciate the Mechanism of ports /Valves functioning in 2-stroke petrol /Diesel engine.
CO2 Evaluate the performance characteristics of single cylinder petrol engine at different loads and single cylinder diesel engine at different loads and draw the heat balance sheet.
CO3 Analyze the method of finding the indicated power of individual cylinders of an engine by using morse test.
CO4 Distinguish the performance characteristics of Multi cylinder engine for various operating conditions.
CO5 Apply the concepts of intercooling in multistage air compressor for minimum power input.
CO6 Determine the performance parameters of internal combustion engines under variable input conditions for optimum fuel consumption.

## IV. COURSE CONTENT:

### EXCERCISE-1: VALVE TIMING DIAGRAM OF SINGLE CYLINDER, 4-STROKE ENGINE
To draw and analyze the valve timing diagram of a single-cylinder, four-stroke internal combustion engine and determine valve opening and closing angles.

### EXCERCISE-2: PORT TIMING DIAGRAM OF SINGLE CYLINDER, 2-STROKE ENGINE
To draw the port timing diagram of a single-cylinder, two-stroke engine and study the timing of inlet, transfer, and exhaust ports.

### EXCERCISE-3: PERFORMANCE TEST ON SINGLE CYLINDER, 2-STROKE AIR-COOLED PETROL ENGINE TEST RIG
To determine brake power, indicated power, mechanical efficiency, brake thermal efficiency, and specific fuel consumption of a two-stroke petrol engine.

### EXCERCISE-4: PERFORMANCE TEST ON MULTI CYLINDER, 4-STROKE PETROL ENGINE WITH ELECTRICAL LOADING
To conduct a performance test on a multi-cylinder petrol engine using an electrical dynamometer and evaluate engine performance parameters at different loads.

### EXCERCISE-5: PERFORMANCE TEST ON SINGLE CYLINDER, 4-STROKE WATER-COOLED DIESEL ENGINE TEST RIG
To determine the performance characteristics such as brake power, thermal efficiency, fuel consumption, and heat balance of a diesel engine.

### EXCERCISE-6: PERFORMANCE TEST ON VARIABLE COMPRESSION RATIO (VCR) ENGINE TEST RIG
To study the effect of compression ratio on engine performance parameters such as efficiency, fuel consumption, and power output.

### EXCERCISE-7: MORSE TEST ON MULTI CYLINDER PETROL ENGINE
To determine the indicated power of individual cylinders and mechanical efficiency of a multi-cylinder petrol engine using Morse test.

### EXCERCISE-8: HEAT BALANCE TEST ON I.C. ENGINE
To conduct a heat balance test on an internal combustion engine and account for heat distribution in useful work, cooling water, exhaust gases, and losses.

### EXCERCISE-9: PERFORMANCE TEST ON AIR COMPRESSOR TEST RIG
To determine volumetric efficiency, isothermal efficiency, and power consumption of a reciprocating air compressor.

### EXCERCISE-10: STUDY AND PERFORMANCE TEST ON REFRIGERATION / AIR COMPRESSOR SYSTEM
To study construction and working principles of air compressors and evaluate their performance characteristics.

### EXCERCISE-11: STUDY OF BOILERS MODEL
To study the construction, working principles, mountings, accessories, and industrial applications of different types of boilers.

### EXCERCISE-12: PERFORMANCE ANALYSIS OF BOILER (MODEL / DEMONSTRATION)
To analyze boiler efficiency, draught system, and heat utilization through model-based study.

### EXCERCISE-13: CHARACTERISTIC CURVES OF I.C. ENGINES
To plot and analyze characteristic curves such as power vs speed, fuel consumption vs load, and efficiency vs load for I.C. engines.

### EXCERCISE-14: STUDY OF ENGINE AND THERMAL SYSTEMS TEST RIGS
To study the construction, instrumentation, working principles, and industrial applications of I.C. engine test rigs, compressors, and boiler models.

## V. TEXT BOOKS:

1. Ganesan, “I.C. Engines”, Tata McGraw-Hill, 3rd edition, 2011
2. B. John Heywood, “Internal Combustion Engine Fundamentals”, Tata McGraw-Hill, 2nd edition, 2011.

## VI. REFERENCE BOOKS:

1. K. Rajput, “Thermal Engineering”, Lakshmi Publications, 1st edition, 2011.

## VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/112/105/112105218.
2. https://nptel.ac.in/courses/112/104/112104117
3. https://ocw.mit.edu/courses/2-005-thermal-fluids-engineering-i-fall-2013/.

## VIII. MATERIALS ONLINE:

1. Course Outline Description
2. Laboratory Manual
3. Laboratory Exercises