

COURSE TITLE	INTERNAL COMBUSTION ENGINES & AUTOMOBILES
COURSE CODE	01ME1605
COURSE CREDITS	4

Objective:

- 1 This course provides an in-depth study of internal combustion (IC) engines and automotive systems, with an emphasis on thermodynamic analysis, combustion processes, fuel supply mechanisms, performance testing, and emission control. The course also integrates current industry practices and recent technological trends, including the use of alternative fuels.

Course Outcomes: After completion of this course, student will be able to:

- 1 Students will able to apply thermodynamic principles to compare and analyze air-standard cycles in IC engines
- 2 Students will able to apply knowledge of fuel supply systems in SI and CI engines to analyze fuel delivery mechanisms and their impact on engine efficiency and emissions
- 3 Students will able to analyze combustion phenomena in SI and CI engines and evaluate their effects on performance and emissions.
- 4 Students will able to apply standard procedures to measure and evaluate engine performance parameters such as brake power, indicated power, and fuel consumption.
- 5 Students will be able to analyze various emission control technologies and evaluate their effectiveness in reducing pollutants in compliance with regulatory standards.
- 6 Students will be able to apply technical knowledge to analyze and evaluate recent trends in IC engine technology, including alternative fuels, hybrid systems, and electric vehicle technologies, based on performance, efficiency, and environmental impact.

Pre-requisite of course: Thermodynamics, Heat Transfer

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	IC Engine Fundamentals and Thermodynamic Cycles Classification of IC engines, Working of 2-stroke and 4-stroke engines, Fuel Air Cycles and Actual Cycles, Assumptions for fuel-air cycles, Reasons for variation of Specific heat of gases, Change of Internal energy and Enthalpy during a process with variable Specific heats, Isentropic expansion with variable Specific heat, Effect of variable Specific heat on Otto, Diesel and Dual cycle, Dissociation, Comparison of Air standard and Fuel air cycles, Effect of operating variables, Comparison of Air standard and Actual cycles, Effect of Time loss, Heat loss and Exhaust loss in Petrol and Diesel engines, Valve and Port timing diagrams	8
2	Fuel Supply Systems SI engine fuel supply: carburetors, MPFI, GDI, CI engine fuel supply: fuel injection systems, CRDI, Fuel filters, fuel pumps, injectors, fuel atomization, Effect of fuel system design on performance and emissions	6
3	Combustion in IC Engines Combustion in SI and CI engines, Ignition delay, flame propagation, knocking, Combustion chamber design	6
4	Engine Performance and Testing Dynamometers, indicated thermal, brake thermal and volumetric efficiencies, measurement of friction power, indicated power and brake power,, heat balance, Engine performance maps, Engine testing standards	8
5	Emission Control and Environmental Considerations Emission formation mechanisms, Catalytic converters, Exhaust Gas Recirculation (EGR), Selective Catalytic Reduction (SCR), Diesel Oxidation Catalyst (DOC), BS and Euro norms, emission testing procedures	8
6	Future Trends and Technologies Biofuels, ethanol, biodiesel, hydrogen, CNG, LNG, Properties, Suitability, Engine Modifications,, Merits and Demerits as fuels, Hybrid and electric vehicle systems, Fuel cell vehicles, Evaluation of emerging technologies: trade-offs in efficiency, cost, and emissions	6
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Analysis of thermodynamic cycles Analysis of thermodynamic cycles	2
2	Calculate engine parameters for 2 stroke and 4 stroke SI engine Calculate engine parameters for 2 stroke and 4 stroke SI engine	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
3	Identify various components of 4 stroke multi cylinder CI engine and find engine parameters Identify various components of 4 stroke multi cylinder CI engine and find engine parameters	2
4	Demonstration of combustion chamber designs using cut-section models of two-stroke and four-stroke SI engines Demonstration of combustion chamber designs using cut-section models of two-stroke and four-stroke SI engines	2
5	Demonstration of combustion chamber designs using cut-section models of four-stroke CI engines Demonstration of combustion chamber designs using cut-section models of four-stroke CI engines	2
6	Performance test on a 4-stroke Petrol Engine Performance test on a 4-stroke Petrol Engine	2
7	Determination of Indicated Power of Multi Cylinder Petrol Engine using Morse Test Determination of Indicated Power of Multi Cylinder Petrol Engine using Morse Test.	2
8	Performance test on a 4-stroke Diesel Engine Performance test on a 4-stroke Diesel Engine	2
9	Determination of friction power of single cylinder Diesel engine using Willan's Line Method. Determination of friction power of single cylinder Diesel engine using Willan's Line Method.	2
10	Comparative study of Bharat Stage and Euro Emission Norms Comparative study of Bharat Stage and Euro Emission Norms	2
11	Comparative evaluation of alternative fuels Comparative evaluation of alternative fuels	2
12	Case study on hybrid and electric vehicles Case study on hybrid and electric vehicles	2
Total Hours		24

Textbook :

- 1 Internal Combustion Engines, V. M. Domkundwar, Dhanpat Rai Publications, 2010
- 2 Internal Combustion Engines, R.K. Rajput, Laxmi Publications, 2012
- 3 Internal Combustion Engine Fundamentals, John B. Heywood, McGraw Hill Education Pvt Ltd, 2005

References:

- 1 Internal Combustion Engine, Internal Combustion Engine, V Ganeshan, McGraw Hill Education Pvt. Ltd. , 2000
- 2 Internal Combustion Engine, Internal Combustion Engine, M.L.Mathur and R.P.Sharma, Dhanpat Rai Publications (P) Ltd., 2001

References:

- 3 Fundamentals of Internal Combustion engine, Fundamentals of Internal Combustion engine, H.N.Gupta, PHI Learning, 2008
- 4 Internal Combustion Engines, Internal Combustion Engines, K. K. Ramalingam, Scitech Publications Pvt. Ltd. , 2009

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
0.00	0.00	60.00	30.00	10.00	0.00

Instructional Method:

- 1 Power Point Presentation
- 2 Lab Experiments

Supplementary Resources:

- 1 <http://nptel.ac.in/>
- 2 <http://ocw.mit.edu/>