202050: Applied Thermodynamics

Teaching Scheme:		Credits	Examination Scheme:		
TH:	04 hr/week	Th:04	TH	In-Sem:	50
				End-Sem:	50
PR:	02 hrs/week	PR/OR/TW:01		PR:	50
				OR:	--
				TW:	--

Prerequisites: - 1. Engineering Thermodynamics.
2. Engineering Mathematics

Course Objectives:

- To get familiar with fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance.
- To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.
- To study emission from IC Engines and its controlling method, Various emission norms.
- Perform Testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies
- To understand theory and performance Calculation of Positive displacement compressor.

Course Outcomes:

On completion of the course, learner will be able to–

- Classify various types of Engines, Compare Air standard, Fuel Air and Actual cycles and make out various losses in real cycles.
- Understand Theory of Carburetion, Modern Carburetor, Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.
- Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Theory of Detonation in CI Engines and Comparison of SI and CI Combustion and Knocking and Factors affecting, Criteria for good combustion chamber and types.
- Carry out Testing of I. C. Engines and analyze its performance.
- Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, Ignition, Governing, and Starting) also various harmful gases emitted from exhaust and different devices to control pollution and emission norms for pollution control.
- Describe construction, working of various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors.

Course Contents

Unit I Basics of IC Engines **(5 Hrs)**

Heat Engine, IC and EC engines, I.C. Engine construction - components and materials, Engine nomenclature, Valve timing diagram, Intake and exhaust system, Engine classification, Applications.

Fuel Air Cycle and Actual Cycle **(5 Hrs)**

Fuel air cycle, Assumptions, Comparison with air standard cycle, Effect of variables on performance,

Actual cycle and various losses, Comparison of Air standard Vs Fuel Vs Actual cycle.

Unit II SI Engines **(5 Hrs)**

Theory of Carburetion, Types of carburetors, Electronic fuel injection system, Combustion in spark

Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion,

Phenomenon of Detonation in SI engines, effect of engine variables on Detonation.

Combustion chambers, Rating of fuels in SI engines, Additives.

Unit III CI Engines **(5 Hrs)**

Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Methods of knock control, Types of combustion chambers, rating of fuels in

CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines.

Unit IV Testing of IC Engines **(6 Hrs)**

Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet.

Supercharging (2 Hrs)

Supercharging and turbo-charging methods and their limitations

Unit V I.C. Engine Systems **(6 Hrs)**

Cooling System, Lubrication System, Ignition System, Governing system, Starting System

I.C. Engine Emissions and Control (4 Hrs)

Air pollution due to IC engine and its effect, Emissions from petrol/gas and diesel engines,

Sources of emissions, Euro norms, Bharat stage norms, Emission control methods for SI and CI engines

Unit VI Positive Displacement Compressors (Reciprocating and Rotary) (10 Hrs)

Reciprocating Compressor - Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram, Multistaging of compressor, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter-cooling and after cooling, Capacity control of compressors

Rotary Compressor – Introduction, vane compressors, roots blower, screw compressor. **(Numerical treatment on Reciprocating compressor single stage and multistage only)**

Books:

Text:

1) V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill
2) M.L. Mathur and R.P. Sharma: A course in Internal combustion engines, Dhanpat Rai
3) H.N. Gupta, Fundamentals of Internal Combustion Engines, PHI Learning Pvt. Ltd.

Reference:

1. Heywood: Internal Combustion Engine Fundamentals, Tata McGraw-Hill
2. Domkundwar & Domkundwar: Internal Combustion Engine, Dhanpat Rai
3. R. Yadav: Internal Combustion Engine, Central Book Depot, Ahmedabad.
3. S. Domkundwar, C. P. Kothandaraman, A. Domkundwar, Thermal Engineering, Dhanpat Rai & Co.

List of Practical's:

1. Study of Carburetor
2. Study of Fuel pump and injector
3. Study of Ignition System
4. Demonstration & study of commercial exhaust gas analyzers.
5. Morse Test on Multi cylinder Petrol/ Diesel engine for determination of Friction power.
6. Variable load test on diesel engine to determine various efficiencies, SFC and Heat balance sheet.
7. Test on variable compression ratio engine.
8. Visit to Automobile service station
9. Test on Positive Displacement Air Compressor
10. Assignment on any one advanced technology related to I.C. Engine such as VVT, VGT, HCCI
11. Assignment on alternative fuels used in I.C. Engines.

Notes:

1. Minimum 8 experiments should be performed.
2. Perform any 3 from 1 to 4.
3. Perform any 2 from 5, 6, and 7.
4. Experiment 8 and 9 are compulsory.