THERMAL ENGINEERING-I

Course Code:13ME1113

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Pre requisites: Basic thermodynamics

Course Educational Objectives:

To make the student understand

- Theory and application of thermodynamic cycles
- Working principles of IC engines
- Testing and performance of IC engines
- Types of air compressors

Course Outcomes:

The student will be able to

1. Differentiate between various thermodynamic cycles
2. Explain working principles of IC engines and their systems
3. Evaluate the performance of IC engines
4. Explain the working of air compressors

UNIT-I (12 Lectures)

POWER CYCLES:

Otto, Diesel, Dual Combustion cycles, Sterling cycle, Atkinson cycle, Ericcson cycle, Lenoir cycle, Brayton cycle – description and representation on P–V and T-S diagram, thermal efficiency, mean effective pressures on air standard basis – comparison of cycles.

UNIT-II (14 Lectures)

I.C. ENGINES AND SYSTEMS:

Introduction- Basic Engine components and nomenclature- working principles of engines- classification of engines- application of IC engines-

valve timing & port timing diagrams- air/fuel ratios- fuels- introduction – important qualities of engine fuels.

carburetion- definition - factors affecting carburetion- air/fuel mixtures- mixture requirements at different loads and speeds- principle of carburetion.

Fuel injection system (Mechanical)- Classification -injection pump- fuel injector and ignition – battery ignition system & magneto ignition system - firing order- ignition timing and engine parameters. Cooling: liquid cooled and air cooled systems- comparison lubrication: function of lubrication- lubrication system.

UNIT-III (12 Lectures)

COMBUSTION IN SI ENGINES:

Introduction- homogeneous mixture- stages of combustion in SI engines- flame front propagation- factors influencing the flame speed- rate of pressure rise- abnormal combustion, phenomenon of knock in SI engines, effect of engine variables on knock fuel requirements and fuel rating, anti knock additives, combustion chamber – requirements, types.

COMBUSTION IN CI ENGINES:

Stages of combustion- factors effecting delay period - effect of engine variables- the phenomenon of knock- comparison of knock in SI and CI engines- combustion chambers- fuel requirements and fuel rating.

UNIT-IV (08 Lectures)

TESTING AND PERFORMANCE:

Introduction- friction power- indicated power- brake power- fuel consumption, air consumption – speed- exhaust and cooling temperature- engine power- engine efficiencies- heat balance.

UNIT-V (14 Lectures)

AIR COMPRESSORS:

Reciprocating compressors- construction and working- single stage compressor- equation for work (with clearance)- isothermal efficiency- volumetric efficiency- effect of clearance- actual PV indicator diagram for single stage- multi stage compression- free air delivered (F.A.D) and displacement.

Roots blower, vane sealed compressor– working – efficiency considerations

Axial flow compressors: Construction and working- velocity diagram- degree of reaction- work done factor- isentropic efficiency- pressure rise calculations, polytrophic efficiency- losses- surging, choking and stalling- comparison between reciprocating and rotary compressors.

TEXT BOOKS:

1. V. Ganesan, *"IC Engines"*, TMH Publications, 2007 (Units II to IV).
2. R.K. Rajput, *"Thermal Engineering"*, Lakshmi Publications, 2010 (Units I & V).

REFERENCES:

1. Mathur, and Sharma, *"IC Engines"*, Danpath Rai and Sons, 4th Edition, 2010.
2. Nag, P.K., *"Engineering Thermodynamics"*, TMH, 4th Edition, 2008.