

1. Preamble

To make the students understand the engine combustion and heat transfer aspects through Diffusion flames, combustion process in IC Engines (Conduction, convection & radiation). Stages of combustion in IC Engines Pressure-Crank Angle Diagram and combustion

2. Pre-requisite

1151AU102 Basic Engineering Thermodynamics

3. Links to other courses

- IC Engines

4. Course Educational Objectives

Students undergoing this course are expected to

- To know the various stages of combustion in S.I and C.I ENGINE
- To understand the process of knock & detonation in I.C engines
- Discuss the heat transfer modes and thermal stresses in engine components
- Analyze the combustion process with respect to p-theta diagram and temperature measurement in engine components

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
C01	Show the combustion in pre-mixture and diffusion flame, combustion process in IC engine	K2
C02	Describe the stages of combustion in SI engine, flame propagation variation among cycle, detonation and effect of engine variables on combustion	K2
C03	Explain the droplet formation, stages of combustion, heat release and diesel knock	K3
C04	Illustrate the heat transfer modes, thermal stresses in engine components and radiator oil cooler design	K4
C05	Explain combustion process with photographic, P- θ diagram in engines, temperature measurement of engine components	K3

6. Correlation of COs with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	M	L		L	L		M	L	M	H
CO2	H	H	H	H	M	L		L	L		M	L	M	H
CO3	H	H	H	H	M	L		L	L		M	L	M	H
CO4	H	H	H	H	M	L		L	L		M	L	M	H
CO5	H	H	H	H	M	L		L	L		M	L	M	H

H- Strong; M-Medium; L-Low

7. Course Content

UNIT I - INTRODUCTION

L-9

Premixed and Diffusion Combustion Process in IC Engines. First and Second Law of Thermodynamics Applied to Combustion - Combustion Stoichiometry - Chemical Equilibrium, Spray Formation and Droplet Combustion.

UNIT II - NORMAL AND ABNORMAL COMBUSTION IN SI ENGINES

L-9

Stages of Combustion in SI Engines - Flame Propagation - Rate of Pressure Rise – Cycle - To-Cycle Variation - Abnormal Combustion. Theories of Detonation, Effect of Engine Operating Variables On Combustion.

UNIT III - COMBUSTION AND KNOCK IN CI ENGINES

L-9

Droplet and Spray Combustion Theory - Stages of Combustion - Delay Period - Peak Pressure - Heat Release - Gas Temperature and Diesel Knock.

UNIT IV - HEAT TRANSFER IN IC ENGINES

L-9

Basic Definitions - Conduction, Convection and Radiation Heat Transfer. Temperature Distribution and Thermal Stresses in Piston, Cylinder Liner, Cylinder Head, Fins and Valves -Heat Transfer Correlations for Engines. Fin Design, Radiators and Oil Coolers.

UNIT V - MEASUREMENT & SIMULATION TECHNIQUES

L-9

Photographic Studies of Combustion Processes, Pressure-Crank Angle Diagram in SI And CI Engines. Temperature Measurement in Piston, Cylinder Liner, Cylinder Head and Engine Valves. In Cylinder Flow Measurement Techniques.

**TOTAL: 45
Periods**

8. Text Books

1. SPALDING. D.B. - 'Some Fundamentals of Combustion' - Butterworth Science Publications, London - 1985.
2. J.I.Ramos, "Modeling of Internal Combustion Engine", Mcgraw hill book company New york 1990

9. Reference Book

1. Irvin Glasman, "Combustion" Academic Press, London, 1987, ISBN 0-12-285851-4.
2. Taylor.E.F. "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
3. Ashley Campbel, "Thermodynamic analysis of combustion engine", John book company, Newyork,1979.
4. Heywood J.B "Internal Combustion Engine Fundamentals", McGraw-Hill Book CO., USA - 1995.