16AE206 ADVANCED THEORY OF I.C. ENGINES

Hours Per Week :

L	T	P	C
2	1	-	3

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
30	15	-	2	40	2	5	2	2

Course Description and Objectives:

The course offers advanced concepts of fuel combustion, combustion modelling and thermodynamic analysis of I.C Engines. Objective of the course is to impart the knowledge on thermodynamics involved in IC engine combustion and formation of different emissions along with modelling and simulation .

Course Outcomes:

The student will be able to:

- understand the various working cycles of engine.
- evaluate combustion in IC engines.
- differential between engine combustion parameters.
- carry out thermodynamic analysis of an IC Engine
- model a computer program and simulate it for different engine concepts
- gain knowledge on different types of modern engines.
- understand modern electronic engine management system (EMS) of IC engines.

SKILLS:

ü *Thermodynamic modeling and simulation of I.C. Engine*

ü *Thermodynamic modelling of SI and CI engine emissions*

ü *Identify the problem and take necessary steps to improve combustion efficiency.*

ü *Photographic studies of combustion processes*

UNIT-1   **L-5**

INTRODUCTION :Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process, Chemical composition and molecular structure of fuels, Octane number, Cetane number. Knock rating of SI engine fuels.

UNIT-2   **L-8**

COMBUSTION OF FUELS : Combustion Stoichiometry of petrol, Diesel, Alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature – SI engine combustion – Flame velocity and area of flame front –performance number – CI engine combustion. Fuel spray characteristics – droplet size, Penetration and atomization.

UNIT-3   **L-6**

COMBUSTION MODELING : Basic concepts of engine simulation – Governing equations, thermodynamic models – SI engine and CI engine models.

UNIT-4   **L-6**

NON-CONVENTIONAL I.C ENGINES :Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - MAN combustion chamber and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

UNIT-5   **L-5**

COMBUSTION ANALYSIS IN I.C ENGINES : Photographic studies of combustion processes –
P-E diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

ACTIVITIES:

o Develop project on modeling of engine piston.

o Develop project on Different combustion analysis in IC engines.

TEXT BOOKS:
1. Ganesan,V., "Internal combustion engines", 4th edition ,Tata McGraw Hill Publishing Company, 2012.
2. John,B., Heywood, " Internal Combustion Engine Fundamentals", 5th edition , McGraw Hill Publishing Company, New York, 2015 .

REFERENCE BOOKS:
1. Ramalingam. K.K., "Internal Combustion Engine", 2nd edition , scitech publications, 2009.
2. Ganesan,V., "Compute Simulation of Spark Ignition engine process", Universities Press (India) Ltd., Hyderabad, 1996.
3. Benson, R.S., Whitehouse, N.D., "Internal Combustion Engines", Pergamon Press, Oxford, 1979.