Course Code	ME 223
Course Title	Applied Thermodynamics I
No. of Credits	3
Pre-requisites	None
Compulsory/Optional	Compulsory for Mechanical Engineering stream

Aim(s):

To introduce the fundamentals of non-ideal thermodynamic cycles and the process of combustion of fuels so that all students become capable of analyzing and comparing the performance of practical thermal energy conversion systems.

Intended Learning Outcomes:

On successful completion of the course, the students should be able to

- determine limitations & efficiencies of non-ideal thermal energy conversion systems,
- estimate the energy generated in the process of combustion of fuels,
- determine the performance of IC engines,
- compare the heat, work interactions, and efficiencies of different configurations of different power cycles.

Time Allocation (Hours) : Lectures 32 , Tutorials 07 , Assignments 12
(Notional Hours : 150)

- **Fundamentals of Thermodynamics:** Analysis of on ideal thermodynamic cycles, Gibbs free energy function, Exergy and the Second law efficiency and Entropy change, Variable specific heat of ideal gases
- **Combustion:** Fuels, Analysis of combustion process, Analysis of combustion products, Determining air/fuel ratio. Internal energy of combustion, Enthalpy of combustion, Principles of operation of Bomb calorimeter & Junker's calorimeter. Application of the first law of thermodynamics to combustion process.
- **Internal Combustion (IC) Engines, Air-compressors and expanders:** Engine classification, Reciprocating engines and engine cycles, Valve timing and port timing diagrams, Fuel-metering systems, Engine performance analysis. Air compressors, Multi stage compression, Intercooling, Steam expanders, Indicator diagrams, Volumetric efficiency
- **Power cycles:** Gas turbine cycles, Isentropic efficiency and effects of pressure drops, Modifications to simple gas turbine cycle, Air cycle refrigeration systems, Aircraft cooling systems. Improving Rankine cycle efficiency & work, Combine cycles; gas and steam cycle, Integrated gasification combined cycles (IGCC), Regenerative cycle, Heat recovery steam generators.

Recommended Texts (if any) :

- Cengel Y.A., and Turner R.H., (2016). *Fundamentals of Thermal Fluid Sciences*, (5thEdition). McGraw-Hill Education. New York, USA.
- Rogers G.F.C., Mayhew Y.R., (1996). *Engineering Thermodynamics: Work and Heat Transfer*, (4th Edition). Prentice Hall, Boston, USA.
- Moran M.J., Shapiro H.N., Munson B.R., DeWitt D.P., (2002*). Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer*. John Wiley & Sons, Inc. New Jersey, United States.
- John B. Heywood, (2018). Internal Combustion Engine Fundamentals (2nd Edition). McGraw-Hill Education. New York, USA.

Assessment	Percentage Mark
In-course Tutorials/Assignments/Quizzes/Practicals Mid Semester Examination	 30 -
End-semester evaluation: Written Examination	70