Semester:	4				
Course Code:	ME2040				
Course Name:	Applied Thermodynamics				
Credits Value:	3 (Notional hours: 150)				
Pre-requisites:	None				
Core/ Optional:	Core				
Hourly Breakdown	Lectures (hours)	Tutorials (hours)	Practical classes (hours)	Assignments (hours)	Independent Learning & Assessment (hours)
	32	7		12	99

Course Aim: To introduce fundamental thermodynamic property relationships, basics of the process of combustion, fundamentals of thermodynamic cycles, internal combustion cycles & power cycles, so that the students become capable of analyzing and quantifying the performance of practical thermal energy conversion systems.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to,

- **determine** efficiencies, and capacities and demonstrate limitations of ideal & practical thermal energy conversion systems.
- **estimate** the energy conversion in the combustion process of a fuels,
- **compare** the heat, work interactions, and efficiencies of different configurations of different power cycles and internal combustion engines.

Course Content:

- **Fundamentals of Thermodynamics:** Thermodynamic property relationships; Equation of state and its derivations, the specific heat of ideal gases, phase change, compressibility, Exergy (availability) Gibbs energy function, Second law efficiency and Entropy change
- **Combustion:** Fuels, analysis of combustion process, analysis of combustion products, determining air/fuel ratio. The internal energy of combustion, Enthalpy of combustion. Application of the first law of thermodynamics to the combustion process. Principles of operation of Bomb calorimeter & Junker's calorimeter.
- **Internal Combustion (IC) Engines & Air-compressors:** Engine classification, reciprocating engines, and engine cycles, valve timing and port timing, fuel-metering systems, and engine performance analysis. Air compressors, analysis of work input, pressure-volume relationship, multi-stage compression, intercooler, volumetric efficiency, types of compressors and applications.

- **Power cycles:** Gas turbine cycles: Gas turbine cycles; Brayton cycle and variations, isentropic efficiency and effects of pressure drop. Performance analysis and modifications to simple gas turbine cycle, and aircraft cooling systems. Steam power plants: Improving Rankine cycle efficiency & work, Combine cycles; gas and steam cycle, integrated gasification combined cycles (IGCC), regenerative cycle, heat recovery steam generators. Performance analysis. Combined gas/steam-based power cycles based on alternative fuels

Teaching/ Learning Methods:
Classroom lectures, tutorials, and in-class exercises and assignments

Assessment Strategy:

Continuous Assessment 30%		**Final Assessment** 70%		
Details:		Theory (%)	Practical (%)	Other (%)
Assignments/Quizzes	20%	70%		
Practical/laboratories/fieldwork	10%			

Recommended Reading:

- Rogers G.F.C., Mayhew Y.R., *Engineering thermodynamics work and heat transfer* (4th Edition)
- John B. Heywood, *Internal combustion engine fundamentals*, McGraw-Hill international editions
- Cengel Y.A., Turner R.H., *Fundamentals of thermal fluid sciences* (2nd Edition)
- Moran M.J., Shapiro H.N., Munson B.R., DeWitt D.P., *Introduction to Thermal Systems Engineering: Thermodynamics, Fluid Mechanics, and Heat Transfer*, John Wiley & Sons, Inc.
- Kenneth Wark, Donald E Richard, *Thermodynamics* (6th Edition), McGraw-Hill.