Semester:	02				
Course Code:	ME1010				
Course Name:	Elementary Fluid Mechanics and Thermodynamics				
Credit Value:	3 (Notional hours: 150)				
Pre-requisites:	None				
Core/Optional	Core				
Hourly Breakdown	Lecture hrs.	Tutorial hrs.	Practical class hrs.	Assignments hrs.	Independent Learning & Assessment hrs.
	32	3	18	2	95

Course Aim (s):

To introduce the fundamentals of fluid mechanics used in the analysis of problems involving static fluids and simple fluid flows.

To allow students to appreciate the implications of the principles of thermodynamics and apply them to relatively simple situations.

Intended Learning Outcomes:

- **Carry out** fluid pressure measurements and calculate the forces and moments exerted on plane and curved surfaces by fluid at rest.
- **Explain** velocity field and flow pattern in fluid flow around bluff body
- **Calculate** pressure variation in one-dimensional steady frictionless fluid flows and forces exerted by simple fluid flows.
- **Relate** the macroscopic thermodynamic behaviour of systems to the microscopic nature of matter.
- **Apply** the Second Law to, determine the reversibility in thermodynamic processes, and to estimate the performance of heat engines.

Course Content: (Only main topics & subtopics)

- **Fluid statics:** Properties of fluids, pressure measurements, atmospheric pressure variation, hydrostatic forces on submerged plane and curved surfaces, stability of floating bodies
- **Fluid flow concepts and control volume analysis:** Continuum concept, classification of flows, temporal and spatial acceleration, flow lines, stream function and velocity potential, flow nets, Control volume analysis, continuity equation , force momentum equation, energy equation, Euler equation, Bernoulli equation and some applications
- **Microscopic and Macroscopic view of thermodynamics and ideal gas law:** Introduction:What and the Why, Molecular hypothesis, Microscopic and Macroscopic View, System and Surroundings ; Open and Closed Systems , Kinetic energy, absolute temperature of ideal gasses, Zeroth Law and temperature, Kinetic theory of gasses and the ideal gas law, Ideal gas law and internal energy, Work, Internal energy, the first law and the meaning of heat

- **Introduction to second law of thermodynamics and entropy:** Kelvin-Planck version of the second law of thermodynamics, Quasi-static adiabatic, reachability, The second law of thermodynamics and the existence of the property called Entropy, Properties of entropy, Clausius statement and irreversibility, Heat engines and limits of energy conversion, Thermalization and quality of energy (exergy)
- **Entropy balance:** Microscopic definition of Entropy , Entropy as a measure of uncertainty, Maximum entropy inference, Micro Canonical Ensemble and thermodynamics of isolated systems, Canonical Ensemble and thermodynamics of closed systems, Grand canonical ensemble and thermodynamics of open systems

Teaching /Learning Methods:

Lectures, tutorial, practical, assignments, projects

Assessment Strategy:

Continuous Assessment 40%	Final Assessment 60%		
Details: quizzes,……..20% Mid Semester Examination……% Other (PBL reports) …20%	Theory 60%	Practical	Other

Recommended Reading:

- Cengel, YA, Cimbala AM, Fluid Mechanics –Fundamentals and Applications", 3rd Edition, McGraw Hill, 2014
- Massey, BS, Mechanics of Fluids, 6th Edition, Springer US, 2012
- White, FM, Fluid Mechanics, 5th edn, New York, McGraw-Hill, 2003
- Douglas, JF, Janusz Maria Gasiorek, John A. Swaffield, Fluid Mechanics, 6th Edition, Pearson Education Limited, United Kingdom, 2017
- Schiller, C, From Heat to Time-Invariance, Motion Mountain: The Adventures of Physics, E-Book, Vol-1, Chapter 13. Available online at: www.motionmountain.net.
- Feynman, RP, Leighton, RB, and Sands, M, The Feynman Lectures on Physics, Publishers: Addison Wesley, Reading, MA, USA, Vol. I, Chapter 44, pp 44.1-44.13, Feb 1977. Available online at: http://www.feynmanlectures.caltech.edu.
- Gould, H., and Tobochnik, J, Thermal and Statistical Physics, Princeton University Press, 2009. Available online at: http://stp.clarku.edu/notes/