Course Code **Course Title** **No. of Credits** **Pre-requisites** **Compulsory/Optional**	ME 323 Applied Thermodynamics II 3 ME 223 or ME 207 Compulsory for Design track and Energy Systems track under Mechanical Engineering stream/Optional for others.

Aim(s):

This course aims to provide the fundamentals of heat transfer, psychometry, and turbomachinery so that all the students are capable of analyzing the performance and design of refrigeration and heating ventilation and air conditioning systems.

Intended Learning Outcomes:

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

- estimate the heat interaction occurring in heat transfer equipment,
- estimate and use thermal/physical properties of moist air, refrigerants and other working fluids as required in heat and work interactions of refrigeration systems and air conditioning systems,
- analyze the performance of simple turbo machineries.

Time Allocation (Hours) : Lectures 36 , Tutorials 03 , Assignments 12
(Notional Hours: 150)

Course content / Course description :

- **Fundamentals of Heat transfer**
  Conduction: One-dimensional steady-state conduction, Thermal resistance, General form of Fourier's law of heat conduction, Heat transfer from extended surfaces (finned surfaces), Heat diffusion, Transient heat conduction
  Convective heat transfer: Fluid flow over a solid surface, Thermal boundary layer, Heat transfer coefficients, Heat transfer in fluid flows laminar flow, Turbulent flow, Heat transfer in circular/ noncircular tubes.
  Radiation heat transfer*:* Fundamentals and applications
- **Refrigeration and heat pump systems:** History of mechanical refrigeration and refrigerants, Basic vapor compression refrigeration cycle, Multistage vapor compression cycles. Refrigeration systems design considerations, Classification of refrigerants, Alternative refrigeration cycles; Air cycle refrigeration, Absorption cycle.
- **Psychometric and air-conditioning:** Properties of Atmospheric air; Relative humidity and specific humidity ratio. Application of psychometric chart in air conditioning design, Psychometric processes design consideration of air conditioning systems. Equipment of air conditioning systems; Cooling towers, Refrigeration systems, Configurations of delivery and air handling.
- **Turbomachinery:** Classifications, Applications, Blade geometry/angles & flow configurations, and Estimate of power output.

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, USA.

• Incropera F.P, Dewitt D.P, Bergman T.L., Lavine A.S. (2006). Fundamentals of Heat and Mass Transfer, (6th Edition). John Wiley & Sons, Inc. New Jersey, USA.	
Assessment	**Percentage Mark**
In-course Tutorials/Assignments/Quizzes/Practicals Mid Semester Examination	 30 -
End-semester: Written examination	70