PE/PC/B/T/223 HEAT TRANSFER

Content delivery methods

- ✓ Class room lecture
- ✓ Visual presentation
- ✓ Tutorial

Course Outcome (CO): At the end of the course the students will be able to

- **CO1:** Describe the primary modes of heat transfer and interpret the corresponding governing physics (**K2**)
- **CO2:** Develop the governing equations of heat transfer through conduction, convection and radiation in simple representative configurations (**K3**)
- **CO3:** Apply the relevant laws and correlations for solving heat transfer problems involving one or multiple modes of heat transfer (**K3**)
- **CO4:** Calculate performance of different heat transfer devices (**K4**)

Mapping of the CO with the PO and PSOs of the Department (1 means weak, 3 means strong)
(see next page for explanation of PO and SO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2		
CO2	2	3	2	1									2		
CO3	2	3	1		1				1				1		
CO4	2	3	1	1									1		1

Syllabus:

Basic concepts of Heat Transfer, thermophysical properties relevant for heat transfer: thermal conductivity, thermal diffusivity. Concept of heat transfer coefficient.

Conduction: General heat conduction equation, Steady state one-dimensional conduction, Conduction through plane walls, cylinder, sphere and composite walls, Concept of film coefficients and thermal resistance, Network problems. Critical thickness of insulation, Extended surfaces, Transient conduction in 1-D: lumped capacitance approach.

Convection: Concepts of forced, free and mixed convections in internal and external flows; concept of thermal boundary layer and nondimensional numbers in convective heat transfer. Relation between fluid friction and heat transfer. Heat transfer correlations in different geometry, flow and thermal configurations. Forced convection in external flows. Free convection over plates and other obstacles.

Heat transfer in fully developed flows through pipes and ducts. Fouling factors.

Heat exchangers: LMTD and NTU methods of computation of heat transfer in heat exchangers.

Radiation: Basic laws e.g. Planck's law, Stefan-Boltzmann law etc., intensity of radiation, Radiations properties: emissivity, absorptivity, reflectivity, transmissivity. View factor and view factor algebra. Radiation exchange between surfaces and enclosures.

Application of heat transfer in power plants and solar devices.

Text Book:

1) Fundamentals of Heat and Mass Transfer by Incropera and DeWitt

2) Heat Transfer: A Practical Approach bu Yunus A. Çengel

3) Heat Transfer - A Basic Approach by N. Ozisik

Program Outcomes (POs) (Graduate Attributes of Washington Accord)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design & Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Investigation of Complex Problem:** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an under- standing of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning**: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Program Specific Outcome (PSO) for Power Engg. Dept.

PSO1: Interdisciplinary Domain Exposure: Interpret problems and apply enabling technologies to develop comprehensive solutions for the energy and power sectors

PSO2: Economic and sustainable energy resources: Assess and analyze energy resources and formulate optimized solutions for sustainable development

PSO3: Safe and secured energy: Recognize safety, control and management aspects of new generation energy technology