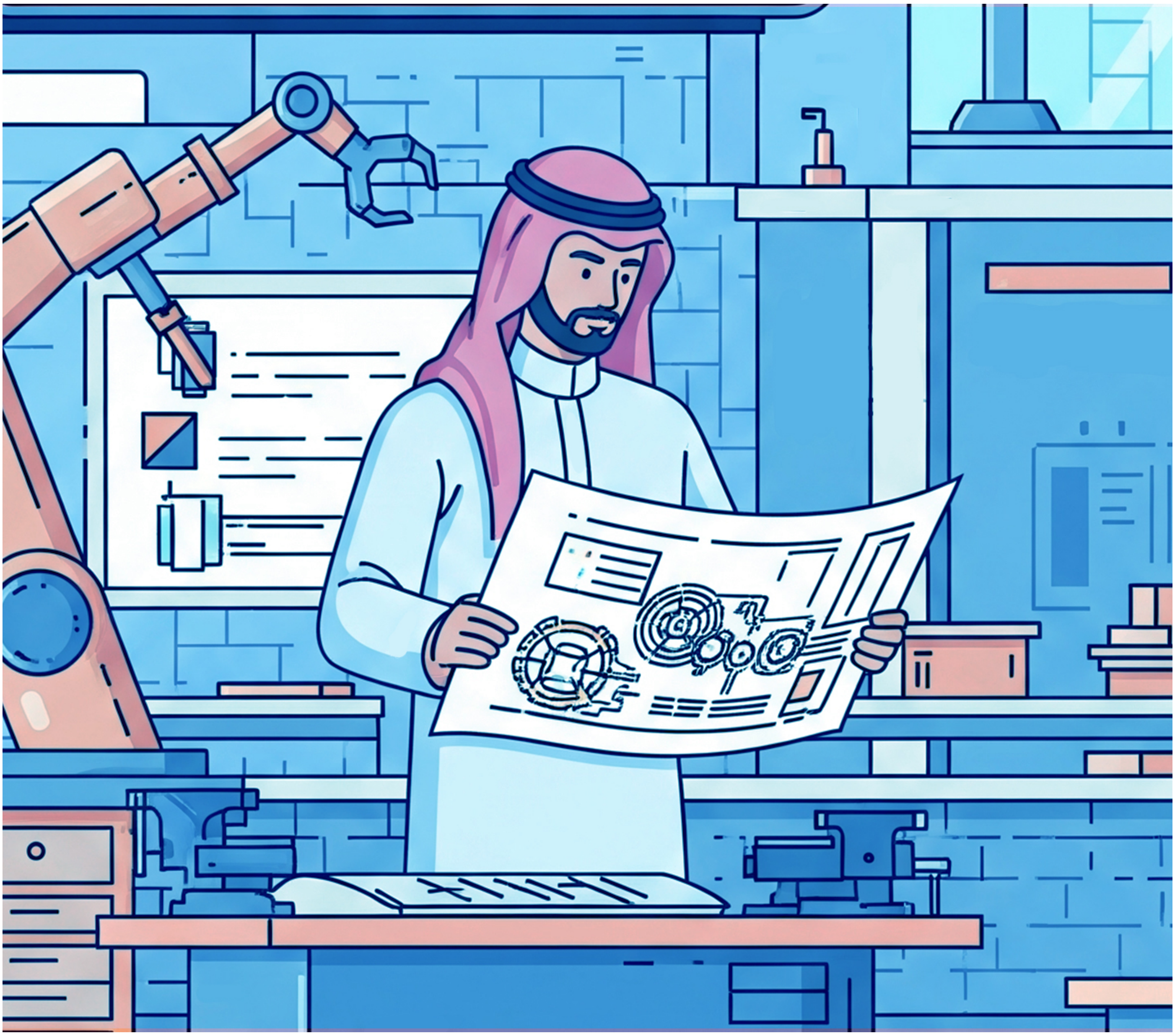

Mechanical Engineering

Heat Transfer Applications of Industrial Process

Course Introduction

Process industry optimal operation is dependent on the continuous proper performance of the heating and cooling systems. Any problems and deterioration in such utilities affect the main process and thus the profits of the company. In addition, the correct selection of the thermal equipment appropriate with the process ensures minimal trouble-shooting and downtime. Equipment like furnaces and boilers use combustion of fuel to transfer the energy in the fuel to the process fluid or generate steam for different applications. Heat exchangers and cooling towers transfer heat from or to process fluid or dump heat to the environment. In many cases these heating processes are inefficient with large amount of energy being wasted. All intensified energy con-suming industry can benefit substantially by reviewing heat transfer processes and maximizing their potential saving. Lastly, Pinch technology optimize steam heating and water cooling requirements and thus reduce fuel cost

Target Audience

- Automotive Engineer
- Boiler Engineer
- Ceramics Engineer
- Equipment Engineer
- High-Pressure Engineer
- Marine Engineer
- Mechanical Design Engineer
- Mechanical Engineer
- Naval Architect
- Pipeline Engineer
- Power Engineer
- Rotating Equipment Engineer
- Senior Mechanical Engineer
- Turbine Engineer
- Validation Engineer

Learning Objectives

- To analyze actual systems involving multiple modes of heat transfer
- To calculate heat flux and the temperature gradient through a wall due to steady-state conduction heat transfer.
- To Calculate heat loss from a surface due to convection and radiation heat transfer
- To increase awareness on heat transfer in smelting furnaces.
- To illustrate how heat transfer could be modeled in a smelt-ing furnace refractory and how different lining thickness could be estimated.
- To increase awareness on process heating by burners used in melting, drying and steam generation.
- To assess the performance heat transfer systems
- To understand the concept and types of heat exchangers.
- To increase awareness on heat recovery systems and meth-ods of maximizing heat gain.

Course Outline

- **01 DAY ONE**

  Module 1 : Heat transfer fundamentals:

  - 1.1 Heat transfer rate and Heat flux
  - 1.2 Changes of phase (evaporation and condensation)
  - 1.3 Heat Transfer Modes, Conduction, Convection, and Radiation.
  - 1.4 Fourier low of conduction
  - 1.5 Introduction to Convection, External Flow and Internal Flow
  - 1.6 Laminar and Turbulent flow
  - 1.7 Heat Transfer Coefficient
- **02 DAY TWO**

  Module 2: Radiation Heat Transfer

  - 2.1 Introduction and thermal radiation Properties
  - 2.2 Total Emissive power and Stefan – Boltzman low

- 2.3 Blackbody radiation .
- 2.4 Thermal radiation Emitted from Real Surfaces
- 2.5 Thermal Radiation properties of gases
- 2.6 Radiation shape factor

Module 3: Heat losses from surfaces .

3.1 Composite wall heat conduction.
3.2 Combined conduction and convection.
3.3 Combined convection and Radiation.
3.4 Freeze lining, Refractory, Graphite, Steel , Shell cooling
3.5 Conductivity of insulating materials
3.6 Case study 1: Application of heat losses from a smelting fur-nace to estimate the thickness of a freeze lining on the hot face.
3.7 Case study 2: Heat losses from an insulated and un-insulated steam piping

- **03 DAY THREE**

Module 4 : Burners

- 4.1 Combustion basics and flame temperature
- 4.2 Gross fuel heat input, Net fuel heat input, Available heat, Flue gas heat losses, Wall heat loss
- 4.3 Types of Burners.
- 4.4 Comparison between Natural & Forced Draft burners.
- 4.5 Heat losses and excess air optimization
- 4.6 Combustion efficiency of the burner as a function of exhaust temperature

Module 5: Heat exchangers

- 5.1 Flow arrangements in heat exchangers
- 5.2 Heat duty of a heat exchanger
- 5.3 Effectiveness of heat exchangers versus Number of transfer units
- 5.4 Different types of fouling.
- 5.5 Fouling resistance for different fluids
- 5.6 Effect of fouling in heat duty.
- 5.7 Overall Heat Transfer Coefficients.
- 5.8 Performance of heat exchangers.
- 5.9 Deterioration of equipment and its effect on Performance

- **04 DAY FOUR**

Module 6 : Regenerative heat Exchangers

- 6.1 Double tube heat exchanger

- 6.2 Shell and tube heat exchanger
- 6.3 Selection of Types of Shell and Tube Heat exchangers
- 6.4 Modified Advance shell and tube “Helixchanger”
- 6.5 Hairpin Heat Exchangers
- 6.6 When To Use Fin-tube Hairpin Heat Exchangers.
- 6.7 Plate Type heat exchangers.
- 6.8 Comparison between shell and tube and plate type heat exchangers
- 6.9 Spiral Heat exchangers
- 6.10 Fin Fan Air coolers

Module 7 : Direct contact heat exchangers

- 7.1 Evaporative cooling mechanism in cooling Towers
- 7.2 Types of cooling towers
- 7.3 Components of cooling towers

Module 8 : Process heater

- 8.1 Classification of Process heaters
- 8.2 Parts of Process heaters
- 8.3 Heat Transfer In Process heaters and Efficiency.
- 8.4 Heat recovery in Process heaters.

- **05 DAY FIVE**

Module 9 : Process Heat Integration in Industry

- 9.1 Basic concepts of pinch technology
- 9.2 Temperature-heat load of heat recovery scheme
- 9.3 The Pinch Principle
- 9.4 Rules of minimum energy targets
- 9.5 Stream networks
- 9.6 Design of Energy Recovery Systems
- 9.7 Energy design chart
- 9.8 Heat exchangers at the Pinch
- 9.9 Incorrect design below the Pinch.
- 9.10 Heat recovery circuit.
- 9.11 Selection of Pinch Temperature Difference.
- 9.12 Adjusted temperature intervals and stream data.
- 9.13 Deficit and surplus heat loads.

Confirmed Sessions

FROM	TO	DURATION	FEES	LOCATION
June 16, 2025	June 20, 2025	5 days	4250.00 $	UAE - Dubai
Aug. 18, 2025	Aug. 22, 2025	5 days	4950.00 $	England - London
Nov. 24, 2025	Nov. 28, 2025	5 days	4250.00 $	UAE - Dubai