

GUJARAT TECHNOLOGICAL UNIVERSITY

Diploma in Chemical Engineering

Semester: 3

Subject Code

Subject Name Process Heat Transfer

Sr. No.	Course content
1.	Basic Heat Transfer : <ul style="list-style-type: none">• Intorduction – transport phenomena• Nature of heat flow<ul style="list-style-type: none">ConductionConvectionRadiattion• Explain :steady state and unsteady state heat transfer• General heat transfer application.
2.	Heat Transfer by Conduction : <ul style="list-style-type: none">• Introduction• Fouriers law• Thermal conductivity and its variation with temp.• Steady state heat conduction through composite wall• S.S. heat conduction through composite cylindrical up to three layers.• S.S. heat conduction through composite sphere up to three layers.• Simple problems by direct use formula.• Thermal conductivity in solids, liquids, liquids and gases.• Hot and cold insulation : Derivation of equation for critical radius and calculation , lagging of steam pipe, optimum thickness of insulation.
3.	Convection : <ul style="list-style-type: none">• Introduction• Rate of heat flux.• Heat flux, average temperature, average temp. of fluid.• Newton's law.• Definition of overall heat transfer coefficient and individual heat transfer coefficient.• Simple problem of convection for heat flux and heat transfer coefficient.
4.	Heat exchangers : <ul style="list-style-type: none">• Introduction• Types of heat exchanger by flow and by function• Double pipe heat exchanger counter current, co – current flow.• Shell and tube heat exchanger.<ol style="list-style-type: none">1. 1-1 exchanger2. 1-2 exchanger3. 2-4 exchanger.

	<ul style="list-style-type: none"> • Plate type heat exchanger. • Finned type/ extended surface heat exchanger. • Heat transfer in agitated vessels. • L.M.T.D. Equation. • Calculations using direct formula. • Derivation of overall heat transfers co-efficient and simple calculations.
5.	Heat Transfer with and without Phase Change : <ul style="list-style-type: none"> • Introduction • Significant of dimensionless group. <ol style="list-style-type: none"> 1. prattle no. 2. Reynold no. 3. Grashoff no. 4. Nusselt no. • Boiling <ol style="list-style-type: none"> 1. pool boiling 2. Nucleate boiling 3. Boilers. • Condensation <ol style="list-style-type: none"> 1. Dropwise condensation 2. Filmwise condensation 3. Condensers commonly used
6.	Radiation : <ul style="list-style-type: none"> • Introduction • Fundamental facts concerning radiation • Definition of <ol style="list-style-type: none"> I. Emission of radiation II. Wavelength of radiation III. Emission power IV. Black body radiation V. Grey body. VI. White body VII. Opaque body h, monochromatic. • Explanation of <ol style="list-style-type: none"> I. Kirchoff's law. II. Plank's law III. Stefan boltzman law. IV. Wein's law. • Simple quantities calculations of radiation between black surfaces based on standard formulas. • Direct formula application to solve problems.
7.	Evaporation : <ul style="list-style-type: none"> • Introduction • Liquid characteristics • Single and multi effect evaporation • Types of evaporators <ol style="list-style-type: none"> 1. short tube evaporation 2. Agitated film evaporators

	<p>3. Long tube vertical evaporators.</p> <ol style="list-style-type: none"> forced circulation Upward flow.(climbing film) Downward flow.(Falling film) <ul style="list-style-type: none"> Evaporator capacity and economy. Direct use of formula for solving the problems. Duhring's rule and its importance.
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Reference Books:

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| 1. Unit operation in chemical engineering | Mc. Cabe and smith |
| 2. Introduction to chemical engineering | Walter L. Badger. |
| 3. A text book of heat transfer | Gupta & prakash |
| 4. Principle of unit operations | Foust and wenzel. |
| 5. Unit operations of chemical engg. Vol –1 | P. Chatopadhyay |
| 6. A text book of heat transfer | S.P. Sukhatme |
| 7. Process heat transfer. | D. Q. Kern. |