

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E Semester: 4

BIO-TECHNOLOGY

Subject Name: PRINCIPLES OF PROCESS ENGINEERING – I

Sr. No.	Course content
	Part [A] Process Heat Transfer
1.	Modes of Heat Transfer <ul style="list-style-type: none">• Introduction to three modes of heat transfer Conduction, Convection & Radiation, General laws of heat transfer <ul style="list-style-type: none">• Conduction Thermal conductivity, Fourier's law of conduction, Temperature depending of thermal conductivity, composite wall, Heat transfer rate for cylinder, sphere & composite cylinder, Concept of critical thickness of insulation <ul style="list-style-type: none">• Convection natural convection & forced convection, Empirical equation for individual coefficients, significance of Prandtl No, Grashoff no, Nusselt no, Peclet no, etc... <ul style="list-style-type: none">• Radiation Wave & quantum theory of radiation heat transfer, Black body, Gray body, Transmissivity, absorptivity, reflectivity, emissivity, etc., Derivation of Stefan Boltzmann's law, Wien's law, Practical example of black body, Kirchhoff's law, Radiation heat transfer between gray surfaces.
2.	Heat Exchangers <p>Types of heat exchangers, LMTD, Heat transfer area requirement, overall heat transfer coefficient.</p>

	Course content
	Part [B] Fluid Flow Operations
3.	Introduction to Engg. Calculation <ul style="list-style-type: none">➤ Dimensional Analysis➤ Units➤ Transport Properties➤ Fluid Mechanics• Fluid Statics• Reynold's number & its significance• Boundary layer formation & separation➤ Flow of Incompressible Fluid<ul style="list-style-type: none">• Flow between two plates and pipes• Mass velocity, average velocity, potential flow, streamlines etc.• Equation of Continuity Bernoulli's equation etc.

4.	Flow Passed Bodies <ul style="list-style-type: none"> • Drag Force • Fluidization etc.
5.	Transportation of Fluids <ul style="list-style-type: none"> • Pumps • Valves • Metering devices ➤ Momentum Transfer in Biotechnology <ul style="list-style-type: none"> • Rheological Behaviour of fermentation broth, two-parameter, three parameter models etc.

List of Practical

1. Bernoulli's Theorem
2. Metering Devices (Orificemeter, Venturimeter & Rotameter)
3. Centrifugal Pump & its Characteristic curves
4. Losses in pipe friction
5. Reynolds Apparatus to study laminar & turbulent flow
6. Shell & Tube heat exchanger
7. Finned tube heat exchanger
8. Plate type heat exchanger
9. Thermal conductivity metal rod
10. Emissivity measurement Apparatus

REFERENCEBOOKS:

- [1] Bioprocess Engineering Principles, 2nd Edition, Paulin M Doran
- [2] Unit operation in Chemical Engineering, McCabe and Smith.
- [3] Heat Transfer, Donald Q Kern