22BT202 CHEMICAL ENGINEERING PRINCIPLES IN BIOTECHNOLOGY

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Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Engineering Physics and Chemistry.

COURSE DESCRIPTION AND OBJECTIVES:

The main objective of the course is to familiarize students about process calculations, fluid dynamics and fluid flow calculations. The course enlightens about basics and fundamentals of process calculations, nature of fluids and fluid flow characterization. It also enables students to acquaint with fluid flow measurements and friction factor calculations in pipes, packed and fluidized beds.

MODULE-1

UNIT-1 **6L+0T+6P=12 Hours**

FUNDAMENTALS OF FLUID FLOW

Units and dimensions, conversion of units, chemical reaction stoichiometry, material and energy balances, nature of fluids, Newton's law of viscosity, concept of Newtonian and Non - Newtonian fluids, boundary layer formation and separation, Reynolds number.

UNIT-2 **10L+0T+10P=20 Hours**

PROCESS AND FLUID FLOW CALCULATIONS

Material balances for fluid flow, Bernoulli's equation and its applications, calculation of power required for pumping fluids, flow through pipes, average velocity, pressure drop due to skin friction and foam friction, Hagen-Poiseuille equation.

PRACTICES:

- Identification of various flow patterns (laminar and turbulent) using Reynolds apparatus.
- Verification of Bernoulli's equation for variable cross-sectional pipe.
- Friction factor in flowt hrough pipes.
- Frictional losses due to sudden contraction, expansion and fittings.

MODULE-2

UNIT-1 **6L+0T+6P=12 Hours**

FLOW MEASUREMENT OF PAST IMMERSED BODIES

Definition of drag and drag co-efficient, packed bed sand fluidized beds, Flow measuring devices: orificemeter, venturimeter and rota meter.

UNIT-2 **10L+0T+10P=20 Hours**

FRICTION AND VELOCITY CALCULATIONS

Derivation of friction factor equations and pressure drop expressions and applications, minimum fluidization velocity.

SKILLS:

- ✓ *Solving material and energy balance problems.*
- ✓ *Calculation of fluid flow rates and fluid velocity and pressure drop in pipe flow.*
- ✓ *Estimation of power requirement for pumping of fluids.*
- ✓ *Determination of frictional losses due to flow immersed bodies.*

PRACTICES:

- Determination of co efficient of discharge for venturi meter.
- Estimation of co efficient of discharge for or ifice meter.
- Assessment of pressure drop for packed bed reactor.
- Determination of pressure drop for fluidized bed reactor.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Solve mass and energy balance problems using reaction stoichiometry.	Apply	1	1,2,4,5,9,10
2	Characterize the fluid flow behaviour by applying principles of fluid dynamics.	Apply	1	1,2,5,9,10
3	Determine velocity, pressure drop and frictional losses for fluid flow in closed channels.	Evaluate	1	1,2,3,4,5,9,10
4	Design and evaluate flow measuring devises.	Design	2	1,3,4,5,9,10
5	Calculate the pressure drop and friction factor in packed and fluidized beds.	Analyze	2	1,2,3,4,5,9,10

TEXT BOOKS:

1. Warren L.McCabe, Julian C. Smithand Peter Harriot,“Unit Operations of Chemical Engineering”, 7th edition, Mc Graw Hill, 2021.
2. Paulin M. Doran, “Bio-Process Engineering Principles”, 2nd edition, Elsevier, 2012.

REFERENCE BOOKS:

1. Salil K. Ghosal, Shyamal K. Sanyal and Siddhartha Dutta, “Introduction to Chemical Engineering”, 1st edition, McGraw Hill, 2021.
2. S Pushpavanam, “Introduction to Chemical Engineering”, 1st edition, PHI Learning, 2012.
3. D G Rao, “Introduction to Biochemical Engineering”, 2nd edition, McGraw Hill, 2009.