ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
GUWAHATI

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH

CHEMICAL ENGINEERING

8TH SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati
Course Structure

(From Academic Session 2018-19 onwards)

B. Tech 8th Semester: Chemical Engineering

Semester VIII/ B. TECH/ChE

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	CHE181801	Transport Phenomena	3	1	0	4	30	70
2	CHE181802	Process Equipment Design-II	3	1	0	4	30	70
3	CHE1818PE4*	Programme Elective – 4	3	0	0	3	30	70
Practical								
1	CHE181822	Project-II	0	0	8	4	100	200
TOTAL			**9**	**2**	**8**	**15**	**190**	**410**
Total Contact Hours per week : 19								
Total Credits: 15								

PROGRAMME ELECTIVE – 4 SUBJECTS		
Sl. No	**Subject Code**	**Subject**
1	CHE1818PE41	Advanced Separation Processes
2	CHE1818PE42	Safety in Chemical Industry
3	CHE1818PE4*	Any other subject offered from time to time with the approval of the University

Course Code	Course Title	Hours per week L-T-P	Credit C
CHE181801	**Transport Phenomena**	**3-1-0**	**4**

MODULE 1: Introduction

a. Transport phenomena and Unit Operation

b. Equilibrium and rate processes

c. Role of intermolecular forces

MODULE 2: Molecular Transport Mechanisms

a. Heat, mass and momentum transport by molecular mechanism.

b. The Analogy – Case of Heat Transfer, Case of Mass Transfer, Case of Momentum

c. Transfer, the analogous forms.

d. Heat Transfer.

e. Mass Transfer – Equimolar Counter Diffusion, Partial Pressure.

f. Momentum transfer.

MODULE 3: General Property Balance

a. The balance or conservation concept- input-output balance, generation, accumulation, the balance equation in differential form.

b. The one directional balance equation including molecular and convective transport.

c. The three-dimensional balance equation.

d. The continuity equation.

e. The general property balance equation for an incompressible fluid.

MODULE 4: Molecular Transport and the General Property Balance

a. Steady transport in one dimension involving input-output with no generation (constant area and variable area transport).

b. Steady transport with generation (Heat and mass transport with constant generation, momentum transfer with generation at steady state – laminar flow in a tube, Hagen- Poisseuille Equation, laminar flow between parallel plates)

MODULE 5: Transport with Net Convective Flux

a. Convective flux caused by forced convection.
b. Relation between shear stress and shear rate.
c. Navier- Stoke's Equation.
d. Fick's Law.

Textbooks/ Reference Books:

1. Brodkey, R.S. & Hershey, H.C., Transport Phenomena – An Unified Approach, McGraw-Hill.
2. Bird, Stewert& Lightfoot, Transport Phenomena, John Wiley.
3. Bodhraj, Introduction to Transport Phenomena: Momentum, Heat & Mass

Course Code	Course Title	Hours per week L-T-P	Credit C
CHE181802	**Process Equipment Design- II**	**3-1-0**	**4**

MODULE 1: Design of Mass Transfer Equipment
Design and Drawing of mass transfer equipment such as distillation columns, absorption columns, extraction columns, dryers and cooling towers.

MODULE 2: Targetting
Heat exchanger networks, targeting, energy targeting, area targeting, unit targeting, shell targeting, and cost targeting.

MODULE 3: Design of Heat Transfer Equipment
Design and drawing of multiple effects Evaporator.

MODULE 4: Principle of Mass Transfer Equipment
Principles of multi-component distillation.

Textbooks / Reference Books:

1. R.H. Perry, "Chemical Engineers' Hand Book", 6" Edn., McGraw Hill Company, 1984
2. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. 6, Pergamon Press, 1993.
3. Uday V. Shenoy Gulb "Heat Exchanger Network Synthesis", by Publishing Co. USA, 1995.
4. R. Smith, "Chemical Process Design", McGraw Hill Book Co., New York 1997
5. B.K. Datta, Mass Transfer Operation,
6. L.E. Brownell and E.H. Young, "Process Equipment Design Vessel Design' Wiley Eastern Edn. New York, 1968.
7. M. V. Joshi, "Process Equipment Design and Drawing", Mac Millan Press, New Delhi, 1996

Course Code	Course Title	Hours per week L-T-P	Credit C
CHE1818PE41	**Advanced Separation Processes**	**3-0-0**	**3**

MODULE 1: Introduction
Separation processes in chemical industries, categorization of separation processes, equilibrium and rate governed processes.

MODULE 2: Membrane Processes and Their Applications
Microfiltration, Ultrafiltration, Nano filtration, Reverse Osmosis, Pervaporation, Gas separation, Dialysis and Electro dialysis, Liquid Membranes, Facilitated Transport; Concentration polarisation and fouling.

MODULE 3: Adsorption
Concepts and definitions in adsorption; types of adsorbents; their preparation and properties; different types of adsorption isotherms and their importance; Introduction to thermal swing, pressure swing, and moving bed adsorption.

MODULE 4: Chromatographic Separations
Principles of chromatographic separation; criteria for effective separation; methodology and process design.

MODULE 5: Special Processes
Supercritical fluid extraction, Microwave extraction, Reactive distillation, Bio filtration

Textbooks/ Reference Books:

1. Seader J. D. and Henley E. J. "Separation Process Principles", 2nd Ed., Wiley-India
2. King C. J., "Separation Processes", Tata McGraw Hill
3. P.C. Wankat, "Large Scale Adsorption and Chromatography", CRC Press, Boca Raton, 1986.
4. McHugh and V. J. Krukonis, Supercritical fluid extraction, Butterworths, Boston, 1985.
5. Kaushik Nath "Membrane Separation Processes", PHI, India
6. C.J. Geankoplis, "Transport Processes and Separation Process Principles", Prentice-Hall
7. B.K. Dutta, "Principles of Mass Transfer and Separation Processes"
8. J.M. Coulson, J.F. Richardson, "Chemical Engineering, Volume 2"

Course Code	Course Title	Hours per week L-T-P	Credit C
CHE1818PE42	**Safety in Chemical Industry**	**3-0-0**	**3**

MODULE 1: Review of Industry Accidents
Concept and definition & safety culture; Major Accidents of Oil and Chemical Industry

MODULE 2: Basic Laboratory Safety & Personal Protective Equipment
Risk, Hazard, Chemical Hazard Symbols, Incompatible chemicals, Fire Classification; Occupational Health and Safety Administration, The Factories Act, Personal Protective Equipment (PPE)

MODULE 3: Toxic Substance
Definition, Classes of Toxicity, Entry Points for Toxic Agents, Effects of Toxic Substance, Relationship of Doses and Responses, Threshold Limiting Values, Exposure Thresholds, Airborne Contaminants, Confined Spaces Hazards, Respiratory Protection, Prevention and Control

MODULE 4: Fire and Explosion
Work Place Hazard, Dangerous Substance Fire triangle, Effective Ignition Source, Static Electricity, Flammability Limits, Flash point, Flammability Diagram, Flammable and Combustible Liquids.

MODULE 5: Safety Hazards
Fire and Explosion; Storage of dangerous materials

MODULE 6: Chemical Process Safety
Decomposition & Runaway Reactions, Initiating factors Reactive Chemical Hazard, Case Studies, Assessing Reaction Hazard; Tools for evaluating thermal explosion, steps to Reduce Reactive Hazards. Passive protection, Active Protection, Safety Integrity Level, Inherent Safety Techniques.

MODULE 7: Nuclear Safety
Fundamental Nuclear safety; Radiation protection

Textbooks / Reference Books:

1. "Industrial Safety Management", L M Deshmukh, TATA McGraw Hill, 2010
2. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
3. W.E Baker, Explosion Hazards and Evolution, Elsevier, Amsterdam, 1983
4. Accident Prevention Manual for Industrial Operations", N. S. C. Chicago, 1982
5. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980.

Course Code	Course Title	Hours per week L-T-P	Credit C
CHE181822	**Project - II**	**0-0-8**	**4**

In this course each student is required to submit a Project Report on the designing of a Chemical Plant.

The Report will consist of important chapters such as the following:

1. Introduction
2. Literature Survey
3. Selection of the Process and Process Details with justification of selection.
4. Thermodynamic and kinetic Considerations
5. Material Balances with Flow Sheet
6. Physico-Chemical data and Properties
7. Energy Balance with Flow Sheets
8. Process Design of Equipments and Optimum Conditions of Operation (Design of a minimum of two process equipments must be undertaken)
9. Fabrication drawing of one of the major equipment
10. Instrumentation & Process Control, Plant Layout, Safety, Precaution, etc.
11. Cost Estimation
12. Site Selection and Conclusion.

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