

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Process Modeling & Simulation	Subject Code	CL20811CL
Semester	B. Tech. – 8 th Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit-I

Introduction: Uses of mathematical models, Scope of coverage, Principles of formulations. Introduction of Matlab and use of the language to solve modeling problems.

Unit-II

Mathematical Modeling in Chemical Reaction Engineering: CSTR, PFR, Batch reactor, semibatch reactor, Series of isothermal CSTR, constant hold-up CSTR's, CSTR's with variable hold ups, gas phase pressurized CSTR, non isothermal CSTR, Bioreactor, trickle bed reactor. Simulation, program development and numerical solutions of above processes.

Unit-III

Mathematical Modeling in Mass Transfer: Ideal binary distillation column, multicomponent non ideal distillation column, batch distillation with hold up, steam distillation, Multisolute batch liquid- liquid extraction, continuous extraction, multistage countercurrent extraction, plug flow type liquid- liquid extraction, reactor with mass transfer, Absorption, Adsorption. Simulation, program development and numerical solutions of above processes.

Unit-IV

Mathematical Modeling in Heat transfer: Two heated tanks, single component vaporizer, double pipe heat exchanger, shell and tube heat exchanger, multicomponent flash drum, cooling towers. Simulation, program development and numerical solutions of above processes.

Unit-V

Mathematical Modeling in other chemical processes: Interacting and non-interacting systems with and without heaters, isothermal hydraulic system, forward and backward feed triple effect evaporator, melting, batch reverse osmosis Unit, Real CSTR modeled with an exchange volume, Real CSTR modeled using by passing and dead space, Two CSTR's with interchange. Simulation, program development and numerical solutions of above processes.

Name of Text Books:

1. Process Modeling and Simulation Control for Chemical Engineers by Luyben, McGraw Hill.
2. Elements of Chemical Reaction Engineering by Fogler, Prentice Hall of India.

Name of Reference Books:

1. Process Optimization in Chemical Engineering by Edger Himmelblau.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Fluidization Engineering	Subject Code	CL20812CL
Semester	B. Tech. – 8 th Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit-I

Introduction: Importance of fluidization in process industry, comparison of fluidized beds with other modes of contacting, advantages and disadvantages, industrial applications.

Unit-II

Fluidization and Mapping of Regimes: Fixed bed of particles of one and mixed sizes, fluidization with and without carryover of particles, minimum fluidization, terminal velocity of particles, pneumatic transport of solids, mapping of regimes Distributors for dense beds, types and design, power consumption for fluidized beds.

Unit-III

Bubble Behavior and Bed Properties: Single rising bubble models, wake region and solids within bubbles, interaction and coalescence of bubbles, bubble formation, slug flow. **Bubbling Fluidized Beds:** Emulsion phase, gas flow, bubble properties, physical and flow models. **Entrainment and Elutriation From Fluidized Beds:** Free boards behavior, gas outlet location, entertainment from tall and short vessels.

Unit-IV

High Velocity Fluidization: Turbulent fluidized beds, fast fluidization, pressure drop in turbulent and fast fluidization. **Solid movement:** Vertical and horizontal movement of solids, dispersion model, based on Davidson bubble. **Gas dispersion and Gas Interchange in Bubble Bed:** Dispersion of gas in beds, gas interchange between bubble and emulsion, estimation of gas interchange coefficients.

Unit-V

Particle to Gas Heat and Mass Transfer: Interpretation of mass and heat transfer coefficients.

Name of Text Books:

1. Kunii D. and Levenspiel O., “Fluidization Engineering”, 2nd Ed., Butterworth-Heinemann.
2. Davidson D. and Harrison J. F., “Fluidization Engineering”, 2nd Ed., Academic Press.
3. Yang W. C., “Handbook of Fluidization and Fluid Particle Systems”, 3rd Ed., CRC.

Name of Reference Books:

1. J.H. Perry, Chemical Engineering Hand Book, 3rd Edition.
2. McCabe & Smith, Unit operation of Chemical Engineering.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Process Equipment Design-III	Subject Code	CL20813CL
Semester	B. Tech. – 8 th Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit-I

Design of distillation columns: Sieve plate, bubble cap, valve tray, packed bed: Component balance, Design of plate, Down comers, Weir height, Gas velocity from nozzle, tray hydraulics of sieve, valve, bubble cap trays, Plate efficiency; No of plates. Detailed internal designs of all the contacting medium. Drawing of distillation column.

Packed column: Selection of material for packed bed distillation, Material balance, Number of transfer Units, Velocity of gas, Diameter of tower, Wetting characteristics, Height of rectification and stripping section, Pressure drop on rectification and stripping section, Total pressure drop, Internal designs.

Unit-II

Design of absorption columns - Plate and packed columns: *Sieve tray column:* Material balance, Minimum liquid to gas ratio, Absorption factor, No of ideal tray, Flow parameters, Capacity parameters, Tray design, Tower diameter, Flooding check, Calculation of entrainment, Plate efficiency, No of overall transfer Unit, Height of column.

Packed column: Selection of Packing material, Material balance, Design of packing support, Design of liquid distributor, Liquid hold up, Pressure drop, Height of one transfer Unit, Height of tower

Unit III

Design of extraction equipments – plate, packed, spray columns: Design of dispersed gas distributor/ plate, Velocity of gas through distributor/orifice, calculation of droplet diameter, No of orifice, Tower diameter, Mass transfer coefficient, Height of one transfer Unit, Height of extraction tower.

Note: The paper will be of **four** hours duration. The Candidate will be allowed to use the following in the examination hall.

1. Chemical Engineering Handbook – J.H. Perry.
2. Data file supplied by the examination center or own data file approved by department. Candidates may bring their own copy of the Chemical Engineering Handbook- J. H. Perry. It will not be supplied by the examination center.

Name of Text Books:

1. Ludwig E - Petrochemical Plant Design, Volume II.
2. Perry J.H.- Chemical Engineering Handbook, McGraw-Hill: New York
3. Backhaust, Process equipment design of mass transfer equipment

Name of Reference Books

1. Ullman - Chemical Engineering and Plant Design, Wiley-vch, John Wiley & Sons
2. Speight J. G. - Chemical Process and Design Hand book, McGraw-Hill publication
3. Treybal R.E., Mass Transfer Operations, McGraw-Hill, publication

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Environmental Pollution & Control	Subject Code	CL20814CL
Semester	B. Tech. – 8 th Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit-I

Air Pollution and Meteorology, Air Pollution from major industrial operations And some typical chemical industries, Air Pollution control methods and Equipments.

Unit-II

Air Pollution sampling and measurement, Analytical methods, Air Pollution Legislation and regulation.

Unit-III

Water Pollution-sources of water pollutants, Classification and characteristics of waste water, Water Pollution control methods and equipment, Primary, Secondary and tertiary treatment of waste water, Legislation regarding, Prevention and control of Water Pollution.

Unit-IV

Nuclear waste materials and their disposal, Hazards of radioactive materials and their handling, Treatment and disposal of nuclear waste materials, source reduction and recycling of solid wastes.

Unit-V

Noise Pollution- evaluation and international standards for control, Noise control Criteria, Administrative and engineering control, Effects of noise in Communication, working efficiency, industrial accidents etc, monitoring and Control of Noise Pollution, Noise measuring instruments.

Name of Text books:

1. M.N Rao and H.V.N. Rao, Air Pollution, Tata McGraw Hill
2. C.S. Rao, Environmental Pollution control engineering, Wiley Eastern Ltd.
3. S.P. Singal, Noise Pollution and control, Narosa publishing House, New Delhi.

Name of Reference Books.

1. G.N. Pandey and G.C. Carney Environmental engineering, Tata McGraw Hill.
2. A. Parker, Air Pollution Handbook, Tata McGraw Hill.
3. P.L. McGill, F.R. Haldan, Air Pollution Handbook, Edited By Tata McGraw Hill
4. "Pollution Control Acts, Rules, Notification issued there under" CPCB, Ministry of Environment and Forest G.O.I. 3rd Ed. 2006.
5. Eckenfelder W.W. "Industrial Water Pollution Control" 2nd Ed. McGraw Hill 1999.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Modeling & Simulation Lab.	Subject Code	CL20821CL
Semester	B. Tech. – 8 th Semester	Board of Studies	Chemical Engg.
Maximum Marks	20	Minimum marks	10
		Practical Periods/Week	Credits
		3	2

Details of Course:

List of experiments to be performed:

1. Modeling and simulation of Chemical reaction processes
2. Modeling and simulation of mass transfer processes
3. Modeling and simulation of heat transfer processes
4. Modeling and simulation of fluidized process
5. Modeling and simulation of flash evaporator
6. Modeling and simulation of linear and non linear systems

Name of Text Books:

1. Process Modeling and Simulation Control for Chemical Engineers by Luyben, McGraw Hill.
2. Elements of Chemical Reaction Engineering by Fogler, Prentice Hall of India.

Name of Reference Books:

1. Process Optimization in Chemical Engineering by Edger Himmelblau.