

Department of Chemical Engineering

List of Minor Courses

S.N.	Sem	Name of equivalent NPTEL course	NPTEL Sem (Even/Odd)	Instructor's Name	Duration (weeks)	Credits
1	V	Fluid and particle mechanics	odd	Prof. Basavraju and Prof Sumesh IIT Madras	12	4
2	V	Heat Transfer	odd	Prof. Sunando Dasgupta IIT Kharagpur	12	4
3	VI	Chemical Engineering Thermodynamics	Even	Prof. Sasidhar Gumma IIT Guwahati	12	4
4	VI	Mass Transfer Operations I	Even	Prof. Bishnupada Mandal IITGuwahati	12	4
5	VII	Chemical Reaction Engineering I	Odd	Prof. Bishnupada Mandal IITGuwahati	12	4

Note to Students : The sequence of subjects, choice of semester is suggestive, tentative and depends upon availability of NPTEL course at that time.

Syllabus for Minor Courses

1. Subject: Fluid and Particle mechanics

Syllabus:

Unit 1:

Introduction to Navier Stokes equations and their solutions, Poiseuille flow, Taylor Couette flow, Rheology

Unit 2 :

Dimensional analysis, turbulent flow, friction losses, Moody's chart

Unit 3 :

Boundary layer theory, introduction to particles and their characterization

Unit 4 :

Particulate phenomena-Brownian motion and phoresis, Motion of particles in a fluid, terminal velocity, particle separation, sedimentation of dilute, concentrated and flocculated dispersions

Unit 5 :

Packed and fluidized beds, filtration

2. Heat Transfer

Syllabus:

Unit 1 :

Conduction, energy balance, resistances in composite wall case and radial systems, heat generation : plane and cylindrical wall, extended surfaces with general formulation and for uniform and varying cross-sectional area

Unit 2 :

2D plane wall, Transient analyses: lumped capacitance method, full method and semi-infinite case, convective heat transfer, heat and mass transfer coefficients, boundary layer, laminar and turbulent flows, momentum , energy and mass balance, order of magnitude analysis, relation between momentum, thermal and concentration boundary layer, forced convection

Unit 3 :

Flow past flat plate: method of Blasius, correlations for heat and mass transport, flow past cylinders and through pipes, mixing cup temperature, LMTD, correlations for laminar and turbulent conditions,

Unit 4 :

Free/natural convection, heated plate in quiescent fluid, boiling and condensation, introduction to radiation, blackbody and its properties, surface adsorption , Kirchoff law

Unit 5:

View factor, inside sphere method, blackbody radiation exchange, Diffuse, gray surfaces in enclosure, resistances, parallel flow and shell and tube heat exchangers , Epsilon-NTU method

3. Chemical Engineering Thermodynamics

Syllabus

Unit 1 :

First law and its applications, entropy and second law

Unit 2 :

Equations of state, generalized correlations, solution thermodynamics

Unit 3 :

Ideal solutions, Excess properties, Phase equilibria and Raoult's law properties

Unit 4 :

Gamma-Phi formulation, Thermodynamic consistency

Unit 5 :

Reaction Equilibria, Multireaction Equilibria, Reaction Equilibria in heterogeneous systems

4. Mass Transfer Operations I

Syllabus

Unit 1 :

Diffusion mass transfer, Fick's laws, molecular and Eddy diffusion, gas phase diffusion coefficient measurement, multicomponent diffusion, diffusivity in solids

Unit 2:

Mass transfer coefficients, correlations for convective mass transfer, mass transfer in laminar flow, boundary layer theory, interphase mass transfer

Unit 3:

Equipments for gas-liquid operations, sparged vessels, sieve tray tower, absorption, packed bed absorber, HETP, plate tower calculations

Unit 4:

Distillation , relative volatility, nonideal systems, flash distillation, batch distillation, McCabe Thiele method

Unit 5:

Pinch points in distillation, minimum reflux, multiple feed and multiple withdrawal, Ponchon Savarit method, packed distillation, multicomponent batch distillation

5. Chemical Reaction Engineering I

Syllabus:

Unit 1 :

Kinetics of homogeneous reactions, stoichiometry, interpretation of batch reactor data

Unit 2 :

Ideal reactor design, design for single reaction

Unit 3 :

Design for multiple reactions

Unit 4 :

Temperature and pressure effects

Unit 5 :

Residence time distribution(RTD), reactor modeling with RTD

