NPTEL : Advanced Chemical Reaction Engineering (PG) (Chemical Engineering)

Co-ordinators : Prof. H.S. Shankar

Lecture 1 - Course Overview - I

Lecture 2 - Course Overview - II

Lecture 3 - Design Equations - I

Lecture 4 - Design Equations - Illustrative Examples

Lecture 5 - Design Equations - II : Plug Flow Recycle Reactors

Lecture 6 - Illustrative Examples : 1) Plug Flow Recycle 2) Multiple reactions - I

Lecture 7 - Illustrative Examples : 1) Recycle Reactor with Condenser 2) CSTR with Recycle

Lecture 8 - Multiple Reactions - II

Lecture 9 - Modelling Multiple Reactions in Soil Environment - III

Lecture 10 - Semi Continuous Reactor Operation

Lecture 11 - Catalyst Deactivation - I

Lecture 12 - Catalyst Deactivation - II

Lecture 13 - Illustrative Example : 1) Determination of deactivation Parameters 2) Design for Deactivating Catalyst

Lecture 14 - Energy Balance - I

Lecture 15 - Energy Balance - II

Lecture 16 - Reacting Fluids as Energy Carrier

Lecture 17 - Illustrative Example : Energy Balance in Stirred Vessels

Lecture 18 - Energy Balance - III : Design for Constant T Operation

Lecture 19 - Energy Balance - IV : Temperature Effects on Rate & Equilibria

Lecture 20 - Energy Balance - V : Stability Analysis of Exothermic Stirred Tank

Lecture 21 - Illustrative Example : Stability of Exothermic Stirred Tank

Lecture 22 - Energy Balance - VI : 1) Tubular Reactor Heated/Cooled from Wall 2) Transient Behavior of CSTR

Lecture 23 - Illustrative Example : 1) Plug Flow with Heat Effects 2) Multiple Reactions

Lecture 24 - Illustrative Example : 1) Further Considerations in Energy Balance 2) Multiple Reactions

Lecture 25 - Illustrative Example : 1) Hot Spot as Design Basis 2) Design for Instantaneous Reactions

Lecture 26 - Residence Time Distribution Methods

Lecture 27 - Residence Time Distribution Models

Lecture 28 - Shrinking core Gas-Solid reactions Model

Lecture 29 - Shrinking core Ash Diffusion Model & Combination of Resistances

Lecture 30 - 1) Gas Solid Reactions Temperature Effects on Rate & Equilibria 2) Introduction to Population Balance - I

Lecture 31 - Illustrative Example : Temperature Effects on Rate & Equilibria

Lecture 32 - Population Balance Modelling - II

Lecture 33 - Population Balance Modelling - III

Lecture 34 - Illustrative Examples : Population Balance Models

Lecture 35 - Introduction to Environmental Reactions

Lecture 36 - Reaction Engineering Examples in Biochemical & Environmental Engineering

Lecture 37 - Illustrative Examples : 1) Biomethanation 2) Alcohol via Fermentation 3) Natural Selection

Lecture 38 - Illustrative Examples : 1) Enzyme Reaction 2) Microbial Reaction 3) Waste Treatment

Lecture 39 - Oxygen Sag Analysis in Rivers

Lecture 40 - Illustrative Examples : 1) Oxygen Sag Analysis 2) Population Balance Modelling of Forest 3) Sponge Iron Process

Lecture 41 - Illustrative Example : Gas- Solid Reaction RTD Models Reaction Network

NPTEL : Advanced Process Control (Chemical Engineering)

Co-ordinators : Prof. Sachin C. Patwardhan

Lecture 1 - Introduction and Motivation

Lecture 2 - Linearization of Mechanistic Models

Lecture 3 - Linearization of Mechanistic Models (Continued...)

Lecture 4 - Introduction to z-transforms and Development of Grey-box models

Lecture 5 - Introduction to Stability Analysis and Development of Output Error Models

Lecture 6 - Introduction to Stochastic Processes

Lecture 7 - Introduction to Stochastic Processes (Continued...)

Lecture 8 - Development of ARX models

Lecture 9 - Statistical Properties of ARX models and Development of ARMAX models

Lecture 10 - Development of ARMAX models (Continued...) and Issues in Model Development

Lecture 11 - Model Structure Selection and Issues in Model Development (Continued...)

Lecture 12 - Issues in Model Development (Continued...) and State Realizations of Transfer Function Models

Lecture 13 - Stability Analysis of Discrete Time Systems

Lecture 14 - Lyapunov Functions and Interaction Analysis and Multi-loop Control

Lecture 15 - Interaction Analysis and Multi-loop Control (Continued...)

Lecture 16 - Multivariable Decoupling Control and Soft Sensing and State Estimation

Lecture 17 - Development of Luenberger Observer

Lecture 18 - Development of Luenberger Observer (Continued...) and Introduction to Kalman Filtering

Lecture 19 - Kalman Filtering

Lecture 20 - Kalman Filtering (Continued...)

Lecture 21 - Kalman Filtering (Continued...)

Lecture 22 - Pole Placement State Feedback Control Design and Introduction to Linear Quadratic Gaussian (LQG) Control

Lecture 23 - Linear Quadratic Gaussian (LQG) Regulator Design

Lecture 24 - Linear Quadratic Gaussian (LQG) Controller Design

Lecture 25 - Model Predictive Control (MPC)

Lecture 26 - Model Predictive Control (Continued...)

NPTEL : Chemical Reaction Engineering II (Chemical Engineering)

Co-ordinators : Prof. A.K. Suresh, Prof. Ganesh A. Viswanathan, Prof. Sanjay M. Mahajani

Lecture 1 - Introduction to catalysts and catalysis

Lecture 2 - Steps in catalytic reaction: adsorption, desorption and reaction

Lecture 3 - Derivation of the rate equation

Lecture 4 - Heterogenous data analysis for reactor design - I

Lecture 5 - Heterogenous data analysis for reactor design - II

Lecture 6 - Catalyst deactivation and accounting for it in design - I

Lecture 7 - Catalyst deactivation and accounting for it in design - II

Lecture 8 - Synthesize the rate equation

Lecture 9 - Introduction to intraparticle diffusion

Lecture 10 - Intraparticle diffusion: Thiele modulus and effectiveness factor Part - I

Lecture 11 - Intraparticle diffusion: Thiele modulus and effectiveness factor Part - II

Lecture 12 - Intraparticle diffusion: Thiele modulus and effectiveness factor Part - III

Lecture 13 - Effectiveness factor and Introduction to external mass transfer

Lecture 14 - External Mass Transfer

Lecture 15 - Implications to rate data interpretation and design - I

Lecture 16 - Implications to rate data interpretation and design - II

Lecture 17 - Packed-bed reactor design

Lecture 18 - Fluidized bed reactor design - I

Lecture 19 - Fluidized bed reactor design - II

Lecture 20 - Gas-liquid reactions-1: Theories of mass transfer into agitated liquids

Lecture 21 - GLR-2: Effect of chemical reaction on mass transfer: the slow reaction regime

Lecture 22 - GLR-3: Transition to fast reaction, and the Fast reaction regime

Lecture 23 - GLR-4: Fast reaction example; Instantaneous reaction regime

Lecture 24 - GLR-5: Transition to Instantaneous reaction; Reaction regimes in surface renewal theories

Lecture 25 - GLR-6: Reaction regimes in surface renewal theories (Continued..)

Lecture 26 - GLR-7: Surface renewal theories: Instantaneous reaction and Summing up

Lecture 27 - Fluid-solid non-catalytic reactions - I

Lecture 28 - Fluid-solid non-catalytic reactions - II

Lecture 29 - Fluid-solid non-catalytic reactions - III

Lecture 30 - Distribution of residence time

Lecture 31 - Measurement of residence time distribution

Lecture 32 - Residence time distribution function

Lecture 33 - Reactor diagnostics and troubleshooting

Lecture 34 - Modeling non-ideal reactors

Lecture 35 - Residence time distribution: Performance of non-ideal reactors

Lecture 36 - Non-ideal Reactors: Tanks-in-series model

Lecture 37 - Non-ideal Reactors: Dispersion model

Lecture 38 - Non-ideal Reactors: Dispersion model and introduction to multiparameter models

Lecture 39 - Non-ideal Reactors: Multiparameter models

NPTEL : Advanced Numerical Analysis (Chemical Engineering)

Co-ordinators : Prof. Sachin C. Patwardhan

Lecture 1 - Introduction and Overview

Lecture 2 - Fundamentals of Vector Spaces

Lecture 3 - Basic Dimension and Sub-space of a Vector Space

Lecture 4 - Introduction to Normed Vector Spaces

Lecture 5 - Examples of Norms,Cauchy Sequence and Convergence, Introduction to Banach Spaces

Lecture 6 - Introduction to Inner Product Spaces

Lecture 7 - Cauchy Schwaz Inequality and Orthogonal Sets

Lecture 8 - Gram-Schmidt Process and Generation of Orthogonal Sets

Lecture 9 - Problem Discretization Using Appropriation Theory

Lecture 10 - Weierstrass Theorem and Polynomial Approximation

Lecture 11 - Taylor Series Approximation and Newton's Method

Lecture 12 - Solving ODE - BVPs Using Firute Difference Method

Lecture 13 - Solving ODE - BVPs and PDEs Using Finite Difference Method

Lecture 14 - Finite Difference Method (Continued...) and Polynomial Interpolations

Lecture 15 - Polynomial and Function Interpolations,Orthogonal Collocations Method for Solving ODE -BVPs

Lecture 16 - Orthogonal Collocations Method for Solving ODE - BVPs and PDEs

Lecture 17 - Least Square Approximations, Necessary and Sufficient Conditions for Unconstrained Optimization

Lecture 18 - Least Square Approximations -Necessary and Sufficient Conditions for Unconstrained Optimization Least Square Approximations (Continued....)

Lecture 19 - Linear Least Square Estimation and Geometric Interpretation of the Least Square Solution

Lecture 20 - Geometric Interpretation of the Least Square Solution (Continued...) and Projection Theorem in a Hilbert Spaces

Lecture 21 - Projection Theorem in a Hilbert Spaces (Continued...) and Approximation Using Orthogonal Basis

Lecture 22 - Discretization of ODE-BVP using Least Square Approximation

Lecture 23 - Discretization of ODE-BVP using Least Square Approximation and Gelarkin Method

Lecture 24 - Model Parameter Estimation using Gauss-Newton Method

Lecture 25 - Solving Linear Algebraic Equations and Methods of Sparse Linear Systems

Lecture 26 - Methods of Sparse Linear Systems (Continued...) and Iterative Methods for Solving Linear Algebraic Equations

Lecture 27 - Iterative Methods for Solving Linear Algebraic Equations

Lecture 28 - Iterative Methods for Solving Linear Algebraic Equations: Convergence Analysis using Eigenvalues

Lecture 29 - Iterative Methods for Solving Linear Algebraic Equations: Convergence Analysis using Matrix Norms

Lecture 30 - Iterative Methods for Solving Linear Algebraic Equations: Convergence Analysis using Matrix Norms (Continued...)

Lecture 31 - Iterative Methods for Solving Linear Algebraic Equations: Convergence Analysis (Continued...)

Lecture 32 - Optimization Based Methods for Solving Linear Algebraic Equations: Gradient Method

Lecture 33 - Conjugate Gradient Method, Matrix Conditioning and Solutions of Linear Algebraic Equations

Lecture 34 - Matrix Conditioning and Solutions and Linear Algebraic Equations (Continued...)

Lecture 35 - Matrix Conditioning (Continued...) and Solving Nonlinear Algebraic Equations

Lecture 36 - Solving Nonlinear Algebraic Equations: Wegstein Method and Variants of Newton's Method

Lecture 37 - Solving Nonlinear Algebraic Equations: Optimization Based Methods

Lecture 38 - Solving Nonlinear Algebraic Equations: Introduction to Convergence analysis of Iterative Solution Techniques

Lecture 39 - Solving Nonlinear Algebraic Equations: Introduction to Convergence analysis (Continued...) and Solving ODE-IVPs

Lecture 40 - Solving Ordinary Differential Equations - Initial Value Problems (ODE-IVPs) : Basic Concepts

Lecture 41 - Solving Ordinary Differential Equations - Initial Value Problems (ODE-IVPs) : Runge Kutta Methods

Lecture 42 - Solving ODE-IVPs : Runge Kutta Methods (Continued...) and Multi-step Methods

Lecture 43 - Solving ODE-IVPs : Generalized Formulation of Multi-step Methods

Lecture 44 - Solving ODE-IVPs : Multi-step Methods (Continued...) and Orthogonal Collocations Method

Lecture 45 - Solving ODE-IVPs: Selection of Integration Interval and Convergence Analysis of Solution Schemes

Lecture 46 - Solving ODE-IVPs: Convergence Analysis of Solution Schemes (Continued...)

Lecture 47 - Solving ODE-IVPs: Convergence Analysis of Solution Schemes (Continued...) and Solving ODE-BVP using Single Shooting Method

Lecture 48 - Methods for Solving System of Differential Algebraic Equations

Lecture 49 - Methods for Solving System of Differential Algebraic Equations (Continued...) and Concluding Remarks

NPTEL : NOC:Introduction to Evolutionary Dynamics (Chemical Engineering)

Co-ordinators : Prof. Supreet Saini

Lecture 1 - History of the theory of Natural Selection - 1

Lecture 2 - History of the theory of Natural Selection - 2

Lecture 3 - Exponential growth models

Lecture 4 - Logistic Growth Models - 1

Lecture 5 - Logistic Growth Models - 2

Lecture 6 - Modelling selection - 1

Lecture 7 - Modelling Selection - 2 : Two species

Lecture 8 - Modelling Selection - 3 : Two and more species

Lecture 9 - Modelling Mutations - 1

Lecture 10 - Modelling Mutations - 2

Lecture 11 - Modelling Mutations - 3

Lecture 12 - Genetic Code and Sequence Spaces

Lecture 13 - Sequence Spaces as Networks

Lecture 14 - Sequence Space to Fitness Landscape

Lecture 15 - Properties of Fitness Landscapes and Quasi-species

Lecture 16 - Integrating Reproduction, Selection and Mutation

Lecture 17 - Obtaining Fitness Landscapes Experimentally

Lecture 18 - NK Model of Fitness Landscape

Lecture 19 - Modelling Evolution on Fitness Landscapes - 1

Lecture 20 - Modelling Evolution on Fitness Landscapes - 2

Lecture 21 - Modelling Evolution on Fitness Landscapes - 3

Lecture 22 - Role of Randomness in Evolution

Lecture 23 - Genetic Drift in Evolution of Microbial Populations

Lecture 24 - Dynamics of a Moran Process without Selection

Lecture 25 - Dynamics of a Moran Process without Selection

Lecture 26 - Evolution, Selection, and Genetic Drift

Lecture 27 - Representing Microbial Evolution

Lecture 28 - Estimating Timescales of Evolution

Lecture 29 - Estimating the Speed of Microbial Evolution

Lecture 30 - Evolutionary Dynamics when Mutations are Rare

Lecture 31 - Evolutionary Dynamics when Mutations are Rapid - 1

Lecture 32 - Evolutionary Dynamics when Mutations are Rapid - 2

Lecture 33 - Evolutionary Dynamics when Mutations are Rapid - 3

Lecture 34 - Evolutionary Game Theory - 1

Lecture 35 - Evolutionary Game Theory - 2

Lecture 36 - Evolutionary Game Theory - 3

Lecture 37 - Evolutionary Game Theory - 4

Lecture 38 - Evolutionary Game Theory Applied to Moran Process

Lecture 39 - Evolutionary Games During Weak Selection

Lecture 40 - Evolutionary Dynamics of HIV

NPTEL : NOC:Heat Transfer (Chemical Engineering)

Co-ordinators : Prof. Ganesh A. Viswanathan

Lecture 1 - Introduction

Lecture 2 - Introduction to Conduction

Lecture 3 - Energy Balance

Lecture 4 - 1D Steadystate Conduction - Resistance Concept

Lecture 5 - Resistances in Composite Wall Case

Lecture 6 - Resistances in Radial Systems

Lecture 7 - Heat Generation - I Plane and Cylindrical Wall

Lecture 8 - Heat Generation - II Problem; Introduction to Extended Surfaces

Lecture 9 - Extended Surfaces I - General Formulation

Lecture 10 - Extended Surfaces II - Fixed Cross-section Area

Lecture 11 - Extended Surfaces III - Varying Cross-section Area

Lecture 12 - 2D Plane Wall

Lecture 13 - Transient Analyses I : Lumped Capacitance Method

Lecture 14 - Transient Analyses II : Full Method

Lecture 15 - Transient Analyses : Semi-infinite Case

Lecture 16 - Introduction to Convective Heat Transfer

Lecture 17 - Heat and Mass Transport Coefficients

Lecture 18 - Boundary Layer : Momentum, Thermal and Concentration

Lecture 19 - Laminar and Turbulent Flows; Momentum Balance

Lecture 20 - Energy and Mass Balances; Boundary Layer Approximations

Lecture 21 - Order of Magnitude Analysis

Lecture 22 - Transport Coefficients

Lecture 23 - Relationship between Momentum, Thermal and Concentration Boundary Layer

Lecture 24 - Reynolds and Chilton-Colburn Analogies

Lecture 25 - Forced Convection : Introduction

Lecture 26 - Flow Past Flat Plate I - Method of Blasius

Lecture 27 - Flow Past Flat Plate II - Correlations for Heat and Mass Transport

Lecture 28 - Flow Past Cylinders

Lecture 29 - Flow through Pipes - I

Lecture 30 - Flow through Pipes - II

Lecture 31 - Flow through Pipes - III

Lecture 32 - Flow through Pipes - IV - Mixing-cup Temperature

Lecture 33 - Flow through Pipes - V - Log mean Temperature Difference

Lecture 34 - Flow through Pipes - VI - Correlations for Laminar and Turbulent Conditions

Lecture 35 - Example problems : Forced Convection

Lecture 36 - Introduction to Free/Natural Convection

Lecture 37 - Heated Plate in a Quiescent Fluid - I

Lecture 38 - Heated Plate in a Quiescent Fluid - II

Lecture 39 - Boiling - I

Lecture 40 - Boiling - II

Lecture 41 - Condensation - I

Lecture 42 - Condensation - II

Lecture 43 - Radiation : Introduction

Lecture 44 - Spectral Intensity

Lecture 45 - Radiation : Spectral properties, Blackbody

Lecture 46 - Properties of a Blackbody

Lecture 47 - Surface Adsorption

Lecture 48 - Kirchoffâ€™s Law

Lecture 49 - Radiation Exchange - View Factor

Lecture 50 - View Factor Examples

Lecture 51 - View Factor - Inside Sphere Method, Blackbody Radiation Exchange

Lecture 52 - Diffuse, Gray Surfaces in an Enclosure

Lecture 53 - Resistances - Oppenheim Matrix Method

Lecture 54 - Resistances - Examples

Lecture 55 - More Examples: Volumetric Radiation

Lecture 56 - Introduction and Examples

Lecture 57 - Parallel Flow Heat Exchangers

Lecture 58 - LMTD I

Lecture 59 - Shell and Tube Heat Exchangers

Lecture 60 - Epsilon-NTU Method

NPTEL : NOC:Chemical Reaction Engineering-II (Chemical Engineering)

Co-ordinators : Prof. Ganesh Vishwanathan

Lecture 1 - Introduction

Lecture 2 - Introduction to catalysis and catalytic processes

Lecture 3 - Catalyst properties and classification

Lecture 4 - Steps in catalysis

Lecture 5 - Adsorption isotherm

Lecture 6 - Surface reaction

Lecture 7 - Rate controlling steps and Rate law

Lecture 8 - Rate law: Pseudo-steady state hypothesis

Lecture 9 - Heterogeneous data analysis for reactor design - I

Lecture 10 - Heterogeneous data analysis for reactor design - II

Lecture 11 - Design of reactors: PBR and CSTR

Lecture 12 - Case study: Chemical Vapor Deposition

Lecture 13 - Catalyst deactivation - I

Lecture 14 - Catalyst deactivation - II

Lecture 15 - Catalyst deactivation - III

Lecture 16 - Catalyst deactivation - IV : Reactor design

Lecture 17 - Diffusional effects: Introduction

Lecture 18 - Internal diffusion effects: Model development

Lecture 19 - Non-dimensionalization: Thiele modulus

Lecture 20 - Concentration profile

Lecture 21 - Internal effectiveness factor - I

Lecture 22 - Internal effectiveness factor - II

Lecture 23 - Internal effectiveness factor - III: Exothermic and endothermic reactions

Lecture 24 - Falsification of kinetics

Lecture 25 - External mass transport limitations: Mass transfer coefficient

Lecture 26 - Estimation of mass transfer coefficient

Lecture 27 - Mass transfer to a single particle with reaction

Lecture 28 - Packed-bed reactor design: External mass transfer limitations

Lecture 29 - Mass transfer coefficient in Packed-beds

Lecture 30 - Estimation of conversion in Packed-bed reactor: Example problem

Lecture 31 - Overall effectiveness factor - I

Lecture 32 - Overall effectiveness factor - II

Lecture 33 - Identification of internal diffusion and reaction-limited regimes

Lecture 34 - Packed-bed reactor design

Lecture 35 - Generalized criterion for diffusion and reaction-limited conditions

Lecture 36 - Network of first order reactions

Lecture 37 - Use of experimental data

Lecture 38 - Packed-bed reactor design: External and Internal resistances

Lecture 39 - Fluidized bed reactor design - I

Lecture 40 - Fluidized bed reactor design - II

Lecture 41 - Fluidized bed reactor design - III

Lecture 42 - Fluidized bed reactor design - IV

Lecture 43 - Fluid-solid noncatalytic reactions - I

Lecture 44 - Fluid-solid noncatalytic reactions - II

Lecture 45 - Fluid-solid noncatalytic reactions - III

Lecture 46 - Fluid-solid noncatalytic reactions - IV

Lecture 47 - Fluid-solid noncatalytic reactions - V

Lecture 48 - Fluid-solid noncatalytic reactions - VI

Lecture 49 - Residence time distribution (RTD): Introduction

Lecture 50 - RTD: Non-ideal reactors

Lecture 51 - Measurement of RTD - I

Lecture 52 - Measurement of RTD - II

Lecture 53 - RTD function

Lecture 54 - Properties of RTD function

Lecture 55 - Reactor diagnostics and troubleshooting - I

Lecture 56 - Reactor diagnostics and troubleshooting - II

Lecture 57 - Modeling nonideal reactors - I

Lecture 58 - Modeling nonideal reactors - II

Lecture 59 - Non-ideal reactors: Zero parameter models - I

Lecture 60 - Non-ideal reactors: Zero parameter models - II

NPTEL : NOC:Chemical Process Control (Chemical Engineering)

Co-ordinators : Prof. Sujit Jogwar

Lecture 1 - Motivation for process control

Lecture 2 - Functions of process control system

Lecture 3 - Common control strategies

Lecture 4 - Components of process control system

Lecture 5 - Introduction to process dynamics

Lecture 6 - First principle dynamic models

Lecture 7 - Empirical and gray box models

Lecture 8 - Degree of freedom analysis

Lecture 9 - Introduction to first order dynamical systems

Lecture 10 - Linearization of process dynamics

Lecture 11 - Response to step input

Lecture 12 - Response to sinusoidal input

Lecture 13 - Introduction to second order dynamical systems

Lecture 14 - Examples of second order dynamical systems

Lecture 15 - Response to step input

Lecture 16 - Effect of damping coefficient

Lecture 17 - Higher order dynamics

Lecture 18 - Approximation as FOPDT model

Lecture 19 - Numerator dynamics

Lecture 20 - Prediction of step response

Lecture 21 - Block diagram representation

Lecture 22 - ON-OFF control

Lecture 23 - Proportional control

Lecture 24 - Proportional-Integral control

Lecture 25 - PID control

Lecture 26 - Limitations of PID controllers

Lecture 27 - Stability of dynamical processes

Lecture 28 - Laplace domain analysis - Part I

Lecture 29 - Laplace domain analysis - Part II

Lecture 30 - Frequency response

Lecture 31 - Frequency domain analysis

Lecture 32 - Synthesis problem

Lecture 33 - Selection problem

Lecture 34 - Criteria-based controller tuning

Lecture 35 - Heuristics-based controller tuning

Lecture 36 - Direct synthesis-based controller tuning

Lecture 37 - Frequency response-based controller tuning

Lecture 38 - Cascade control

Lecture 39 - Split range control and override control

Lecture 40 - Auctioneering, ratio and inreferential control

Lecture 41 - Openloop control and Internal model control

Lecture 42 - Dynamic Matrix and Model predictive control

Lecture 43 - Introduction to multivariable control

Lecture 44 - Input-output pairing

Lecture 45 - Tuning of multi-loop SISO controller

Lecture 46 - Introduction to batch process control

Lecture 47 - Programmable logic control

Lecture 48 - Batch to batch control

NPTEL : NOC:Introduction to Interfacial Waves (Chemical Engineering)

Co-ordinators : Prof. Ratul Dasgupta

Lecture 1 - Introduction

Lecture 2 - Coupled, linear, spring-mass systems

Lecture 3 - Coupled, linear, spring-mass systems (Continued...)

Lecture 4 - Coupled, linear, spring-mass systems (Continued...)

Lecture 5 - Coupled, linear, spring-mass system: continuum limit

Lecture 6 - Normal modes of a string fixed at both ends

Lecture 7 - Vibrations of clamped membranes

Lecture 8 - Vibrations of clamped membranes (Continued...)

Lecture 9 - Introduction to Jacobian elliptic functions

Lecture 10 - The non-linear pendulum

Lecture 11 - The non-linear pendulum (Continued...)

Lecture 12 - Time period of the non-linear pendulum

Lecture 13 - Introduction to perturbation methods

Lecture 14 - Perturbation methods (Continued...)

Lecture 15 - Non-dimensionalisation

Lecture 16 - Perturbative solution to the projectile equation

Lecture 17 - Perturbative solution to the nonlinear pendulum

Lecture 18 - Lindstedt-Poincare technique

Lecture 19 - Method of multiple scales

Lecture 20 - Method of multiple scales (Continued...)

Lecture 21 - Multiple scale analysis for damped-harmonic oscillator

Lecture 22 - Duffing equation using multiple scales

Lecture 23 - Duffing equation (Continued...)

Lecture 24 - Kapitza pendulum

Lecture 25 - Introduction to Floquet theory

Lecture 26 - Floquet theorem (Continued...)

Lecture 27 - Floquet analysis of the Mathieu equation

Lecture 28 - Introduction to waves on an interface

Lecture 29 - Linearized wave equations in deep water

Lecture 30 - Linearized wave equations in deep water: dispersion relation

Lecture 31 - Linearised deep-water surface gravity waves (Continued...)

Lecture 32 - Standing and travelling waves in deep water

Lecture 33 - Cauchy-Poisson initial value problem for surface-gravity waves in deep water

Lecture 34 - Cauchy-Poisson problem (Continued...)

Lecture 35 - Cauchy-Poisson problem in cylindrical geometry

Lecture 36 - Cauchy-Poisson problem in cylindrical geometry (Continued...)

Lecture 37 - Group-velocity and the Cauchy-Poisson problem

Lecture 38 - Cauchy-Poisson problem for delta function initial condition

Lecture 39 - Cauchy-Poisson problem for delta function initial condition (Continued...)

Lecture 40 - Capillary-gravity waves

Lecture 41 - Waves on a pool of finite depth

Lecture 42 - Axisymmetric Cauchy-Poisson problem visualisation: the pebble in the deep pond problem

Lecture 43 - Rayleigh-Plateau capillary instability

Lecture 44 - Rayleigh-Plateau capillary instability (Continued...)

Lecture 45 - Rayleigh-Plateau capillary instability on thin film coating a rod

Lecture 46 - Rayleigh-Plateau capillary instability of a cylindrical air column in a liquid

Lecture 47 - Mechanism of the Rayleigh-Plateau instability

Lecture 48 - Shape oscillations of a spherical interface

Lecture 49 - Shape oscillations of a spherical interface (Continued...)

Lecture 50 - Shape oscillations of a spherical interface (Continued...)

Lecture 51 - Analysis of l=0 and l=1 modes for a spherical drop

Lecture 52 - Faraday waves on an interface - stability of time dependent base states

Lecture 53 - Mathieu equation for Faraday waves

Lecture 54 - Applications of Faraday waves - atomisation and spray formation

Lecture 55 - Waves and instability on density stratified shear flows - the KH model

Lecture 56 - Limits of KH dispersion relation: Rayleigh-Taylor instability

Lecture 57 - KH dispersion relation : model of wind wave generation

Lecture 58 - Helmholtz instability of a vortex sheet and summary

Lecture 59 - Derivation of the Stokes travelling wave

Lecture 60 - Derivation of the Stokes travelling wave (Continued...)

Lecture 61 - Derivation of the Stokes travelling wave (Continued...)

NPTEL : NOC:Hydrogen Energy: Production, Storage, Transportation and Safety (Chemical Engineering)

Co-ordinators : Prof. Pratibha Sharma

Lecture 1 - Properties of Hydrogen

Lecture 2 - Status of Hydrogen Supply and Demand

Lecture 3 - Methods of Hydrogen Production

Lecture 4 - Steam Methane Reforming - Part 1

Lecture 5 - Steam Methane Reforming - Part 2

Lecture 6 - Steam Reforming of Higher Hydrocarbons

Lecture 7 - Tutorial-1

Lecture 8 - Advanced Methods of Steam Reforming

Lecture 9 - Partial Oxidation Method for Hydrogen Production

Lecture 10 - Autothermal Reforming

Lecture 11 - Combined, Dry, Bi and Tri Reforming

Lecture 12 - Reforming using Alternate Energy Sources

Lecture 13 - Tutorial-2

Lecture 14 - Hydrogen Production by Methane Decomposition

Lecture 15 - Hydrogen Production from Biomass - Part 1

Lecture 16 - Hydrogen Production from Biomass - Part 2

Lecture 17 - Hydrogen Production from Biomass - Part 3

Lecture 18 - Hydrogen Production from Coal

Lecture 19 - Tutorial-3

Lecture 20 - Hydrogen Separation and Purification - Part 1

Lecture 21 - Hydrogen Separation and Purification - Part 2

Lecture 22 - Thermochemical Cycles for Hydrogen Production

Lecture 23 - Electrolysis of Water for Hydrogen Production

Lecture 24 - Fundamental of Electrolysis of Water

Lecture 25 - Electrolytic Cell Components and Electrolyzer stack

Lecture 26 - Different Types of ElectrolyzerTechnologies

Lecture 27 - Photoelectrochemical Hydrogen Production

Lecture 28 - Tutorial-4

Lecture 29 - Technical Comparison of Various Hydrogen Production Routes

Lecture 30 - Economics and Status of Various Hydrogen Production Routes

Lecture 31 - Introduction to Hydrogen Storage

Lecture 32 - Underground Hydrogen Storage

Lecture 33 - Fundamentals of Hydrogen Compression and Expansion

Lecture 34 - Thermodynamics of Hydrogen Compression - Part 1

Lecture 35 - Thermodynamics of Hydrogen Compression - Part 2

Lecture 36 - Reciprocating and Diaphragm compressors for Hydrogen Compression

Lecture 37 - Linear and Liquid Hydrogen Compressors

Lecture 38 - Cryogenic and Metal Hydride based Hydrogen Compressors

Lecture 39 - Electrochemical and Adsorption based Compressors

Lecture 40 - Compressed Hydrogen Tanks

Lecture 41 - Tutorial-5

Lecture 42 - Hydrogen Liquefaction

Lecture 43 - Liquid State Hydrogen Storage

Lecture 44 - Fundamentals of Adsorption based Materials for Hydrogen Storage

Lecture 45 - Adsorption based Solid State Hydrogen Storage Materials

Lecture 46 - Metal Hydrides for Solid State Hydrogen Storage - Part 1

Lecture 47 - Fundamentals of Metal hydrides for Solid State Hydrogen Storage - Part 1

Lecture 48 - Fundamentals of Metal Hydrides for Solid State Hydrogen Storage - Part 2

Lecture 49 - Different Types of Hydrides for Hydrogen Storage

Lecture 50 - Tailoring Metal Hydrides for Practical Applications: Nanostructure - Part 1

Lecture 51 - Tailoring Metal Hydrides for Practical Applications: Nanostructure - Part 2

Lecture 52 - MH System Design and Experimental Facilities on SolidState Hydrogen Storage

Lecture 53 - Tutorial-6 (MH systems design)

Lecture 54 - Novel Materials and Overall Storage

Lecture 55 - Overview of Storage Methods and Economics

Lecture 56 - Hydrogen Transportation via H2 Pipelines

Lecture 57 - Other Options for Long Distance Hydrogen Transmission

Lecture 58 - Hydrogen Transport via Road

Lecture 59 - Hydrogen Refuelling Stations

Lecture 60 - Use of Hydrogen in Internal Combustion Engines - Part 1

Lecture 61 - Use of Hydrogen in Internal Combustion Engines - Part 2

Lecture 62 - Use of Hydrogen in Fuel Cells

Lecture 63 - Hydrogen Sensing - Part 1

Lecture 64 - Hydrogen Sensing - Part 2

Lecture 65 - Properties of Hydrogen Associated with Accidents

Lecture 66 - Classification of Hydrogen related Hazards

Lecture 67 - Compressed and Liquid Hydrogen Related Hazards

Lecture 68 - Regulations, Codes and Standards

Lecture 69 - Utilisation in Different Sectors, Global Status and Future Directions

NPTEL : NOC:Modeling Stochastic Phenomena for Engineering Applications: Part-1 (Chemical Engineering)

Co-ordinators : Prof. Yelia Shankaranarayana Mayya

Lecture 1 - Stirling's Approximation

Lecture 2 - Fourier Transforms and characteristic function

Lecture 3 - Dirac Delta function

Lecture 4 - Applications of delta function and Generating functions

Lecture 5 - Laplace Transforms and Convolution theorem

Lecture 6 - Generating function for discrete variables and Binomial distribution

Lecture 7 - Bernoulli and Poisson distributions

Lecture 8 - Waiting time distributions; Gaussian approximation to Poisson distribution

Lecture 9 - Introduction to Central Limit Theorem

Lecture 10 - Proof of Central Limit Theorem (CLT)

Lecture 11 - Universality of Normal distribution and Exceptions

Lecture 12 - Introduction to Random Walk: Extension of Central Limit Theorem

Lecture 13 - Random walk and Diffusion coefficient: Conditional and Transition

Lecture 14 - Characteristics of Stochastic Phenomena: Markov Processes

Lecture 15 - Propagating Markov processes via Transition Probability Matrix with

Lecture 16 - Chapman-Kolmogorov Equation for Multistep Transition probability and solution

Lecture 17 - Transient solutions and Continuous time Markov process

Lecture 18 - Exact solution to Symmetric (or unbiased) one-dimensional Random walk (1-D RW)

Lecture 19 - Properties of the solution for 1-D unbiased RW

Lecture 20 - 1-D unbiased RW: Asymptotic form of occupancy probability and transition

Lecture 21 - Solution to the problem of 1-D Random Walk with Bias

Lecture 22 - Generalized Random Walk with Bias and Pausing

Lecture 23 - Effect of Pausing on Mean and Variance of Random walk

Lecture 24 - Random-walk in the presence of reflecting barrier

Lecture 25 - Boundary conditions for reflected Random-Walk and formulating absorbing

Lecture 26 - The survival probability and first-passage time distribution for Random walker

Lecture 27 - Random Walk with Bias and Absorber

Lecture 28 - Drift and Survival probability for Random walk with bias and absorber

Lecture 29 - Introduction to gambler's ruin problem

Lecture 30 - Solution for ultimate winning probability in Gambler's ruin problem

Lecture 31 - Solution to gambler's ruin problem with site dependent jump probabilities

Lecture 32 - Fourier transform method of solving lattice Random walks

Lecture 33 - Two and higher dimensional Random walks

Lecture 34 - Formulating the problem of Probability of Return to the origin

Lecture 35 - Relationship between occupancy probability and first-time-return probability

Lecture 36 - Proof of PolyaÃ¢â‚¬â„¢s theorem on the probability of return

Lecture 37 - Return probability estimates in various dimensions and effect of bias in 1-D

Lecture 38 - Dependence of first time return probability (Fk) on steps

Lecture 39 - Equilibrium solutions in lattice random walk models

Lecture 40 - Equilibrium solution to Ehrenfest's flea model

Lecture 41 - Differential equation formulation of stochastic phenomena

Lecture 42 - Derivation of Fokker-Planck equation

Lecture 43 - Generalized transition probability functions for Fokker-Planck equation

Lecture 44 - Solution to 1-D Fokker-Planck equation for free particle: Method of Fourier

Lecture 45 - General non-gaussian solution to translationally invariant Chapman-Kolmogorov

Lecture 46 - Cauchy distribution, power-law and other non-gaussian solutions

Lecture 47 - Wiener process and solution to absorbing barrier problems from Fokker-Planck

Lecture 48 - Application of Fourier Sine transform for single absorber problem

Lecture 49 - Setting up Langevin equation for velocity fluctuations of Brownian particles

Lecture 50 - Understanding the origin of systematic and random parts of force from kinetic

Lecture 51 - Kinetic derivation of a formula for delta-correlated random force

Lecture 52 - Mean square velocity, thermal equilibrium and relationship between relaxation

Lecture 53 - Velocity autocorrelation in Brownian motion

Lecture 54 - Derivation of Stokes-Einstein relationship between diffusion coefficient and

Lecture 55 - Alternative derivation of Stokes-Einstein relationship and Brownian motion with

Lecture 56 - Numerical simulation of the Langevin equation

Lecture 57 - Derivation of Klein-Kramers equation from Langevin equation for joint

Lecture 58 - Illustrative solutions to the Klein-Kramers equation

Lecture 59 - Numerical simulation: Sampling from general distributions and Central

Lecture 60 - Numerical simulation of Random walk trajectories and method of solving Fokker

NPTEL : NOC:Computational Quantum Chemistry (Chemical Engineering)

Co-ordinators : Prof. Achintya Kumar Dutta

Lecture 1 - Why Computational Chemistry

Lecture 2 - Revisiting Quantum Mechanics - I

Lecture 3 - Revisiting Quantum Mechanics - II

Lecture 4 - Introduction to ORCA, Quantum Chemistry Package

Lecture 5 - The Hartree-Fock Approximation

Lecture 6 - Introduction to GUI - I

Lecture 7 - Introduction to GUI - II

Lecture 8 - Introduction to GUI - III

Lecture 9 - Open-Shell Systems - I

Lecture 10 - Open-Shell Systems - II

Lecture 11 - Open-Shell Systems - III

Lecture 12 - Solving Homework Problems of HF

Lecture 13 - Solving Homework Problems of Open-Shell

Lecture 14 - Introduction to Basis set - I

Lecture 15 - Introduction to Basis set - II

Lecture 16 - Introduction to Basis set - III

Lecture 17 - Basis Set Superposition Error and Counterpoise Correction

Lecture 18 - Introduction to Electron Correlation

Lecture 19 - MÃ¸ller Plesset Perturbation Theory

Lecture 20 - Configuration Interaction

Lecture 21 - Coupled Cluster Theory

Lecture 22 - Solving Homework Problems of MP2

Lecture 23 - Solving Homework Problems of Coupled Cluster

Lecture 24 - Lower Scaling Approximation - I (Density Fitting and Chain of Sphere)

Lecture 25 - Lower Scaling Approximation - II (Local Orbital and Natural Orbital)

Lecture 26 - Complete Basis Set Extrapolation

Lecture 27 - Exact Density Functional Theory - I

Lecture 28 - Exact Density Functional Theory - II

Lecture 29 - Practical Density Functional Theory - I

Lecture 30 - Practical Density Functional Theory - II

Lecture 31 - Hybrid Density Functional Theory - I

Lecture 32 - Hybrid Density Functional Theory - II

Lecture 33 - Hybrid Density Functional Theory - III

Lecture 34 - Hybrid Density Functional Theory - IV

Lecture 35 - Homework Problem of DFT

Lecture 36 - Potential Energy Surface - I

Lecture 37 - Potential Energy Surface - II

Lecture 38 - Potential Energy Surface - III

Lecture 39 - IR and Raman Spectroscopy - I

Lecture 40 - IR and Raman Spectroscopy - II

Lecture 41 - Homework problem of Potential Energy Surface

Lecture 42 - Thermochemistry - I

Lecture 43 - Thermochemistry - II

Lecture 44 - Thermochemistry - III

Lecture 45 - Transition state search - I

Lecture 46 - Transition state search - II

Lecture 47 - Transition state search - III

Lecture 48 - Transition state search - IV

Lecture 49 - Homework problem of Transition State Search

Lecture 50 - Multi-layer Modelling - Molecular Mechanics

Lecture 51 - QM/MM - I

Lecture 52 - QM/MM - II

Lecture 53 - QM/MM - III

Lecture 54 - QM/MM - IV

Lecture 55 - QM/MM - V

Lecture 56 - Homework problem of QM/MM

Lecture 57 - Excited state methods - CIS and TDDFT

Lecture 58 - Excited state methods (Continued...)

Lecture 59 - Excited state method - EOMCCSD

Lecture 60 - Charge transfer excitation

Lecture 61 - X-Ray Spectroscopy

Lecture 62 - Homework problem of Excited State Spectra

Lecture 63 - Solvation models - I

Lecture 64 - Solvation models - II

Lecture 65 - Solvation models - III

Lecture 66 - Explicit solvation - I

Lecture 67 - Explicit solvation - II

Lecture 68 - Additional Homework Problem of Week 7

Lecture 69 - NMR

Lecture 70 - Relativistic Quantum Chemistry

Lecture 71 - CASSCF - I

Lecture 72 - CASSCF - II

Lecture 73 - CASSCF - III

NPTEL : Heterogeneous Catalysis and Catalytic Processes (Chemical Engineering)

Co-ordinators : Dr. K.K. Pant

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

NPTEL : Interfacial Engineering (Chemical Engineering)

Co-ordinators : Prof. A.N. Bhaskarwar

Lecture 1 - General Introduction Definitions

Lecture 2 - General Introduction, Definitions, Surface Tension

Lecture 3 - Surface Tension Free Energies and Adsorption

Lecture 4 - Properties over Curved Surfaces

Lecture 5 - Total Surface Energy

Lecture 6 - Interfacial Tension Entropy, Cohesion, Adhesion

Lecture 7 - Cohesion, Adhesion and Spreading

Lecture 8 - Spreading from Liquids and Solids

Lecture 9 - Spreading, Interfacial Tensions, Surface Tensions

Lecture 10 - Spreading, Contact Angles Free Energies

Lecture 11 - Spreading/Contact Angles Rough Surfaces, Free Energies

Lecture 12 - Spreading/Contact Angles Work of Adhesion, De-wetting

Lecture 13 - Work of Adhesion, Surface and Interfacial Tensions

Lecture 14 - Surface and Interfacial Tensions: Drop Weight and Wilhelmy Plate Methods

Lecture 15 - Surface and Interfacial Tensions: Wilhelmy Plate, Pendant Drop and Maximum Bubble Pressure Methods

Lecture 16 - Wetting Balance Method Spreading Coefficient Work of Adhesion Sessile Drop Method, Positive S

Lecture 17 - Indirect and Direct Methods for Positive S, Adhesion Energies Interfacial Potentials

Lecture 18 - Surface and Interfacial Potentials Distribution and Contact Potentials

Lecture 19 - Diffusion Potential Surface and Interfacial Potentials Components of Contact Potential

Lecture 20 - Electrically Charged Monolayers Gouy Theory

Lecture 21 - Equations of State, Cohesion Repulsion, Limiting Area

Lecture 22 - Condensed and Liquid Expanded Monolayers Phase Transformations

Lecture 23 - Films of Polymers Molecular Weight, Surface Viscosity Drag, Canal Method

Lecture 24 - Canal Method Joly's Semi-Empirical Correction Rotational Torsional Surface Viscometer Compressional Moduli

Lecture 25 - Magnitudes of Surface Compressional Moduli Surface Waves and Ripples

Lecture 26 - Surface waves and Ripples, Velocity Effect of Surface Tension and Surface Compressional Modulus Rates of adsorption and absorption Damping

Lecture 27 - Surface waves and ripples,velocity effect of surface tension and surface compressional modulus damping for clean and contaminated,surfaces,fiber from monolayers

Lecture 28 - Shear Elastic Moduli,Yield Stress Fibres from MLs, Surface Reactions

Lecture 29 - Surface Reactions, Comparison with Bulk-Phase Reactions Steric Factors, Inhibition

Lecture 30 - Hydrolyses of Esters by Alkali Acid or Enzyme Photochemical Reactions in Monolayers Polymerization in MLs,

Lactonization

Lecture 31 - Catalytic Effects Reactions in Emulsions Complex Formation

Lecture 32 - Complex Formation Penetration into Monolayers Thermodynamics of Penetration Adsorption from Vapour Phase Mass Transfer

Lecture 33 - Introductory Concepts Resistances and their Magnitudes Evaporation and its Retardation

Lecture 34 - Evaporation and its Retardation Resistances and their Analysis Diffusional Resistance in Gas Phase

Lecture 35 - Resistances in Liquid Phase and Interface and Their Importance Some Effects and Applications, Theory

Lecture 36 - Surface Instability Theories of Mass Transfer Experiments on static and Dynamic Systems

Lecture 37 - Colloida, Aerosols, Emulsions Foams, Coagulation Smoluchowski's Theory

NPTEL : NOC:Fluid Mechanics and its Applications (Chemical Engineering)

Co-ordinators : Prof. Vijay Gupta

Lecture 1 (1)

Lecture 2 (1A)

Lecture 3 (2)

Lecture 4 (2A)

Lecture 5 (3)

Lecture 6 (3A)

Lecture 7 (4)

Lecture 8 (4A)

Lecture 9 (5)

Lecture 10 (5A)

Lecture 11 (6)

Lecture 12 (6A)

Lecture 13 (7)

Lecture 14 (7A)

Lecture 15 (8)

Lecture 16 (8A)

Lecture 17 (8B)

Lecture 18 (9)

Lecture 19 (9A)

Lecture 20 (10)

Lecture 21 (10A)

Lecture 22 (10B)

Lecture 23 (11)

Lecture 24 (12)

Lecture 25 (12A)

Lecture 26 (12B)

Lecture 27 (13)

Lecture 28 (13A)

Lecture 29 (14)

Lecture 30 (14A)

Lecture 31 (15)

Lecture 32 (15A)

Lecture 33 (16)

Lecture 34 (16A)

Lecture 35 (17)

Lecture 36 (17A)

Lecture 37 (18)

Lecture 38 (18A)

Lecture 39 (19)

Lecture 40 (19A)

Lecture 41 (20)

Lecture 42 (20A)

Lecture 43 (20B)

Lecture 44 (21)

Lecture 45 (21A)

Lecture 46 (22)

Lecture 47 (22A)

Lecture 48 (23)

Lecture 49 (23A)

Lecture 50 (24)

Lecture 51 (24A)

Lecture 52 (25)

Lecture 53 (25A)

Lecture 54 (26)

Lecture 55 (26A)

Lecture 56 (25)

Lecture 57 (27)

Lecture 58 (28)

Lecture 59 (28A)

Lecture 60 (29)

Lecture 61 (29A)

Lecture 62 (30)

Lecture 63 (30A)

Lecture 64 (31)

Lecture 65 (31A)

NPTEL : NOC:Computational Process Design (Chemical Engineering)

Co-ordinators : Prof. Manojkumar Ramteke, Prof. Hariprasad Kodamana

Lecture 1 - Flowsheet Synthesis - I

Lecture 2 - Flowsheet Synthesis - II

Lecture 3 - Mass Balance - I

Lecture 4 - Mass Balance - II

Lecture 5 - Mass and Energy Balance of Complete Flowsheet

Lecture 6 - Equipment Sizing and Costing

Lecture 7 - Economic Evaluation

Lecture 8 - Design of Batch Plants

Lecture 9 - Simulations for Process Flowsheet

Lecture 10 - Optimization Methods used for Designing

Lecture 11 - Heat Exchanger Network Design - 1

Lecture 12 - Heat Exchanger Network Design - 2

Lecture 13 - Geometric Methods for Reactor Network Synthesis

Lecture 14 - Optimization Methods for Process Design - 1

Lecture 15 - Optimization Methods for Process Design - 2

Lecture 16 - Quantifying Sustainability for Design

Lecture 17 - Process Network Analysis and Footprint Assessment

Lecture 18 - Energy, Exergy and Emergy

Lecture 19 - Ecosystems in Sustainability Assessment

NPTEL : Heat Transfer (Chemical Engineering)

Co-ordinators : Prof. A.K. Ghoshal

Lecture 1 - Introduction to heat transfer

Lecture 2 - General heat conduction equation

Lecture 3 - One dimensional steady state conduction in rectangular coordinate

Lecture 4 - One dimensional steady state conduction in cylindrical and spherical coordinate

Lecture 5 - Critical and optimum insulation

Lecture 6 - Extended surface heat transfer - 1

Lecture 7 - Extended surface heat transfer - 2

Lecture 8 - Analysis of lumped parameter model

Lecture 9 - Transient heat flow in semi infinite solid

Lecture 10 - Infinite body subjected to sudden convective

Lecture 11 - Graphical solutions of unsteady state heat conduction problem

Lecture 12 - Dimensional analysis for forced convection

Lecture 13 - Dimensional analysis for free convection

Lecture 14 - Heat transfer co-relations for laminar and internal flows

Lecture 15 - Heat transfer co-relations for turbulent and internal flows

Lecture 16 - Co-relation for turbulent and external flows

Lecture 17 - Heat transfer co-relations for flow across tube banks

Lecture 18 - Momentum and heat transfer analogies

Lecture 19 - Boundary layer heat transfer

Lecture 20 - Boundary layer equations

Lecture 21 - Approximate analysis in boundary layer

Lecture 22 - Theoretical concepts of natural / free convention heat transfer

Lecture 23 - Emperical relations for free convention heat transfer

Lecture 24 - Condensation heat transfer over vertical plate

Lecture 25 - Condensation heat transfer for various conditions and geometries

Lecture 26 - Fundamentals of boiling heat transfer

Lecture 27 - Boiling heat transfer co-relations

Lecture 28 - Classification of heat exchangers

Lecture 29 - Various types of shell and tube heat exchangers

Lecture 30 - Various types of compact heat exchangers

Lecture 31 - Effectiveness-NTU, method of heat exchanger analysis

Lecture 32 - Design of double pipe heat exchanger

Lecture 33 - Design of shell and tube heat exchanger

Lecture 34 - Introduction to evaporation and evaporators

Lecture 35 - Evaporation principles and evaporator performance

Lecture 36 - Evaporator calculations

Lecture 37 - Introduction to radiation heat transfer

Lecture 38 - Radiation intensity and radiation view factor

Lecture 39 - Radiation heat exchange

Lecture 40 - Radiation shield and gas radiation

NPTEL : Mass Transfer Operations I (Chemical Engineering)

Co-ordinators : Dr. B. Mandal

Lecture 1 - Introduction to Mass Transfer

Lecture 2 - Molecular Diffusion

Lecture 3 - Fickâ€™s Law of Diffusion

Lecture 4 - Steady state molecular diffusion in fluids - Part I

Lecture 5 - Steady state molecular diffusion in fluids - Part II

Lecture 6 - Diffusion coefficient: Measurement and Prediction - Part I

Lecture 7 - Diffusion Coefficient: Measurement and Prediction - Part II

Lecture 8 - Multicomponent Diffusion and Diffusivity in Solids

Lecture 9 - Concept of Mass Transfer Coefficient

Lecture 10 - Dimensionless Groups and Co-relations for Convective

Lecture 11 - Mass Transfer co-efficient in Laminar Flow Condition

Lecture 12 - Boundary Layer Theory and Film Theory in Mass Transfer

Lecture 13 - Mass Transfer Coefficients in Terbulant Flow

Lecture 14 - Interphase Mass Transfer and Mass Transfer Theories - Part I

Lecture 15 - Interphase Mass Transfer and Mass Transfer Theories - Part II

Lecture 16 - Interphase Mass Transfer and Mass Transfer Theories - Part III

Lecture 17 - Agitated and Sparged Vassels

Lecture 18 - Tray Column - Part I

Lecture 19 - Tray Column - Part II

Lecture 20 - Packed Tower

Lecture 21 - Introduction to Absorption and Solvent selection

Lecture 22 - Packed Tower Design - Part I

Lecture 23 - Packed Tower Design - Part II

Lecture 24 - Packed Tower Design - Part III

Lecture 25 - Mass Transfer Coefficients Correlation and HETP Concept

Lecture 26 - Tray Tower Design and Introduction to Multicomponent System

Lecture 27 - Introduction to Distillation and Phas diagrams

Lecture 28 - Azeotropes and Enthalpy Concentration Diagrams

Lecture 29 - Flash Distillation

Lecture 30 - Batch and Steam Distillation

Lecture 31 - Fractional Distillation

Lecture 32 - Fractional Distillation: McCabe Thiele Method

Lecture 33 - Fractional Distillation: Minimum Reflux and Pinch Point

Lecture 34 - Fractional Distillation: Subcooled Reflux ,Tray Efficiency and Use of Open Steam

Lecture 35 - Fractional Distillation: Multiple Feeds and Side Stream

Lecture 36 - Multistage Batch Distillation with Reflux

Lecture 37 - Fractional Distillation: Ponchan and Savarit Method

Lecture 38 - Ponchan and Savarit Method and Packed Tower Distillation

Lecture 39 - Multicomponent Distillation

NPTEL : Process Design Decisions and Project Economics (Chemical Engineering)

Co-ordinators : Dr. Vijay S. Moholkar

Lecture 1 - General Introduction to the Course and Syllabus

Lecture 2 - Hierarchical Approach to Process Design - I

Lecture 3 - Hierarchical Approach to Process Design - Examples

Lecture 4 - Input Information and Design Aspects of Batch vs. Continuous Process

Lecture 5 - Input / Output Structure of Flowsheet - Part I

Lecture 6 - Input / Output Structure of Flowsheet - Part II

Lecture 7 - Input / Output Structure of Flowsheet - Part III and Recycle Structure of Flowsheet - Part I

Lecture 8 - Recycle Structure of Flowsheet - Part II

Lecture 9 - Recycle Structure of Flowsheet - Part III

Lecture 10 - Recycle Structure of Flowsheet - Part IV and Tutorial - Part I

Lecture 11 - Tutorial - Part II

Lecture 12 - Tutorial - Part III

Lecture 13 - Algorithm and Basic Principles of Reactor Design

Lecture 14 - Reactor Non-ideality, Residence Time Distribution (RTD) and Types of Chemical Reactions & Catalysts

Lecture 15 - Types of Reactors and Selection Criteria

Lecture 16 - Tutorial on Reactor Design and Cost Estimation

Lecture 17 - General Introduction (Types of Separation Processes and Criteria for Selection of the Processes)

Lecture 18 - Guidelines for Design of Separation Systems

Lecture 19 - Design of Distillation Columns - Part I (Sequencing of Columns, Energy Integration / Thermal Coupling of the Columns)

Lecture 20 - Design of Distillation Columns - Part II (Plate and Packed Towers, Number of Plates, Diameter and Height of the Column)

Lecture 21 - Tutorial - Part I (Design of Absorption Column)

Lecture 22 - Tutorial - Part II (Design of Distillation Column)

Lecture 23 - Concepts and Basic Principles of Energy (or Heat) Integration - Part 1 (Composite Curves and ?Tmin)

Lecture 24 - Concepts and Basic Principles of Heat Integration - Part 2 (Problem Table Algorithm and Identification of Energy Targets)

Lecture 25 - Identification of Area and Cost Targets

Lecture 26 - Pinch Technology for Heat Exchanger Network Design

Lecture 27 - Tutorial - I (Composite Curves, Problem Table Algorithm and Enthalpy Intervals)

Lecture 28 - Tutorial - II (Heat Exchanger Network Synthesis Using Pinch Technology)

Lecture 29 - Selection of Process, Design of Flowsheet and Materials Balance

Lecture 30 - Energy Balance, Process Alternatives and Design of the Absorber

Lecture 31 - Rules of Thumb & Their Limitations and Tutorial

Lecture 32 - General Concepts & Principles and Cost Allocation Procedure

Lecture 33 - Lumped Cost Diagram and Cost Allocation Diagram (Case Study of Hydro-dealkylation Process)

Lecture 34 - Assessment of Process Alternatives with Cost Allocation Diagram (Case Study of Hydrodealkylation Process)

Lecture 35 - Tutorial on Lumped Cost Diagram and Cost Allocation Diagram

Lecture 36 - Introduction to Chemical Projects and Their Economic Aspects

Lecture 37 - Selection of the Process and Project Site - Part I

Lecture 38 - Selection of the Process and Project Site - Part II

Lecture 39 - Project Cost Estimation - Part I

Lecture 40 - Project Cost Estimation - Part II

Lecture 41 - Simplified Cost Model and Depreciation

Lecture 42 - Time Value of Money

Lecture 43 - Measures of Profitability and Project Evaluation - Part I

Lecture 44 - Measures of Profitability and Project Evaluation - Part II

Lecture 45 - Tutorial on Project Economics - Part I

Lecture 46 - Tutorial on Project Economics - Part II

NPTEL : NOC:Fluidization Engineering (Chemical Engineering)

Co-ordinators : Dr. S.K. Majumder

Lecture 1 - Introduction

Lecture 2 - Particle properties

Lecture 3 - Particle / Powder Classifications

Lecture 4 - Minimum Fluidization Velocity: Fluid-solid System

Lecture 5 - Minimum Fluidization Velocity: Liquid-solid and gas-liquid-solid System

Lecture 6 - Flow regime and its map: Gas-solid Fluidization

Lecture 7 - Flow regime and its map: Liquid-solid and Gas-liquid-solid Fluidization

Lecture 8 - Frictional pressure drop in fluidized bed-fluid-solid system

Lecture 9 - Frictional pressure drop in fluidized Bed-Gas-liquid-solid system

Lecture 10 - Analysis of Frictional Pressure Drop in Fluidized Bed By Different Models

Lecture 11 - Gas Distribution Through Distributor

Lecture 12 - Calculation of gas pumping power consumption in fluidized bed

Lecture 13 - Bubbling Fluidization Part 1: Bubble Characteristics

Lecture 14 - Bubbling Fluidization Part 2: Bubble Characteristics (Continued...)

Lecture 15 - Bubbling Fluidization Part 3: Bubble coalescence in three-phase fluidization

Lecture 16 - Bubbling Fluidization Part 4: Bubble breakup in three-phase fluidization

Lecture 17 - Bubbling Fluidization Part 5: Gas and solid movements at bubble

Lecture 18 - Bubbling Fluidization Part 6: Slugging Bed

Lecture 19 - Entrainment Characteristics (Part 1) : Entrainment Characteristics

Lecture 20 - Entrainment Characteristics (Part 2) : Fast fluidization condition

Lecture 21 - Entrainment Characteristics (Part 2) : Elutriation Characteristics

Lecture 22 - Entrainment Characteristics (Part 2) : Attrition in Fluidized Bed (Part 1)

Lecture 23 - Attrition in Fluidized Bed (Part 2)

Lecture 24 - Solid movement, mixing: Gas-fluidized Bed

Lecture 25 - Solid segregation: Gas-fluidized bed

Lecture 26 - Solid mixing and segregation: Liquid-solid fluidized bed

Lecture 27 - Gas Dispersion and Interchange

Lecture 28 - Mass transfer in fluidized Bed-Gas-solid system

Lecture 29 - Mass transfer in fluidized Bed-Gas-liquid-solid system (Continued...)

Lecture 30 - Heat transfer Characteristics

Lecture 31 - Fluidized bed reactor design and its performance

NPTEL : NOC:An Introduction to Cardiovascular Fluid Mechanics (Chemical Engineering)

Co-ordinators : Dr. Raghvendra Gupta

Lecture 1 - An Introduction

Lecture 2 - Fluid Mechanics: A Review

Lecture 3 - Solid Mechanics: A Review

Lecture 4 - Rheology of blood

Lecture 5 - Blood morphology

Lecture 6 - Blood flow in a channel

Lecture 7 - Viscometers and Rheometers

Lecture 8 - Viscoelasticity

Lecture 9 - Flow Bifurcation

Lecture 10 - Pulsatile Flow 1

Lecture 11 - Pulsatile Flow 2

Lecture 12 - Flow in Elastic Tubes

NPTEL : NOC:Multiphase Microfluidics (Chemical Engineering)

Co-ordinators : Dr. Raghvendra Gupta

Lecture 1 - An Introduction

Lecture 2 - Interface and Surface Tension

Lecture 3 - Flow Regimes 1

Lecture 4 - Flow Regimes 2

Lecture 5 - Taylor Flow 1

Lecture 6 - Taylor Flow 2

Lecture 7 - Computational Techniques

Lecture 8 - Bubble and Droplet Generation

Lecture 9 - Interface and Surface tension 2

Lecture 10 - Void Fraction and Pressure Drop

Lecture 11 - Liquid-Liquid Flow: Flow Regimes

Lecture 12 - Ideal annular Flow

Lecture 13 - Taylor Flow : Heat transfer 1

Lecture 14 - Taylor Flow : Heat transfer 2

Lecture 15 - Taylor Flow : Meat Transfer 1

Lecture 16 - Taylor Flow : Meat Transfer 2

Lecture 17 - Flow boiling in microchannels

Lecture 18 - Flow boiling in microchannels (Continued...)

Lecture 19 - Flow Measurement Techniques

Lecture 20 - Particle image Velocimetry

Lecture 21 - Inertial Microfluidics

Lecture 22 - Microfluidic applications

Lecture 23 - Microfluidic applications (Continued...)

Lecture 24 - Concluding Remarks

NPTEL : NOC:Measurement Technique in Multiphase Flows (Chemical Engineering)

Co-ordinators : Prof. Rajesh Kumar Upadhyay

Lecture 1 - Introduction to Multiphase flow Measurement Techniques

Lecture 2 - Invasive and Non-invasive Techniques

Lecture 3 - Hot Wire Anemometry

Lecture 4 - Optical Fiber Probe

Lecture 5 - Laser Doppler Anemometry (LDA)

Lecture 6 - LDA Post Processing and Particle Image Velocimetry (PIV)

Lecture 7 - PIV and Positron Emission Particle Tracking

Lecture 8 - Radioactive Particle Tracking - I

Lecture 9 - Radioactive Particle Tracking - II

Lecture 10 - Capacitance Probe, Optical Fiber Probe and ECT

Lecture 11 - Gamma-ray and X-ray Tomography, MRI

Lecture 12 - Summary

NPTEL : NOC:Multiphase Flows (Chemical Engineering)

Co-ordinators : Prof. Rajesh Kumar Upadhyay

Lecture 1 - Multiphase flow introduction

Lecture 2 - Fundamental definitions and terminology used in Multiphase - I

Lecture 3 - Fundamental definitions and terminology used in Multiphase - II

Lecture 4 - Flow Regime Map for Gas-Liquid System

Lecture 5 - Flow Regime Map for Fluid-Solid System

Lecture 6 - Pneumatic Conveying

Lecture 7 - Momentum Equation through Reynolds Transport Theorem

Lecture 8 - Lockhart Martinelli Correlation

Lecture 9 - Pressure Drop Calculation for Homogeneous Flow

Lecture 10 - Pressure Drop Calculation for Separated and Annular Flow Regime

Lecture 11 - Lagrangian Tracking of Single Particle Under Different Forces

Lecture 12 - Multiphase Interactions: Drag Force

Lecture 13 - Multiphase Interactions: Multi-particle Drag, Virtual Mass Force, Basset Force and Lift Force

Lecture 14 - Introduction to Multiphase Flow Modeling

Lecture 15 - Algebraic Slip Method and Euler-Euler Method

Lecture 16 - KTGF and Euler-Lagrangian Model

Lecture 17 - Measurement Techniques: Velocity Measurement

Lecture 18 - Measurement Techniques: Phase Fraction Measurement

Lecture 19 - Bubble Column

Lecture 20 - Packed Bed Reactor

Lecture 21 - Fluidized Bed Reactor

Lecture 22 - Summary

NPTEL : NOC:Introduction to Polymer Physics (IIT-G) (Chemical Engineering)

Co-ordinators : Prof. Amit Kumar

Lecture 1 - Introduction to Polymers

Lecture 2 - Ideal Chain Models

Lecture 3 - Ideal and Real Chains

Lecture 4 - Thermodynamics of Polymer Solutions - I

Lecture 5 - Thermodynamics of Polymer Solutions - II

Lecture 6 - Thermodynamics of Polymer Solutions - III

Lecture 7 - Phase Behaviour of Polymer Solutions and Blends

Lecture 8 - Phase Behaviour of Polymer Blends and Copolymers

Lecture 9 - Determination of Polymer Molar Mass: Osmometry

Lecture 10 - Determination of Polymer Molar Mass: Static Light Scattering - I

Lecture 11 - Determination of Polymer Molar Mass: Static Light Scattering - II

Lecture 12 - Determination of Polymer Molar Mass: Viscometry and GPC

Lecture 13 - Branching: Hyperbranched Polymers

Lecture 14 - Branching, Network Formation and Gelation

Lecture 15 - Gelation and Swelling of Network Polymers

Lecture 16 - Amorphous State of Polymers

Lecture 17 - Crystalline State of Polymers

Lecture 18 - Mechanical Properties of Polymers

Lecture 19 - Viscoelasticity: Mechanical Models

Lecture 20 - Viscoelasticity, Dynamic Mechanical Analysis and Rheology

Lecture 21 - Rubber Elasticity

Lecture 22 - Unentangled Polymer Dynamics

Lecture 23 - Entangled Polymer Dynamics

Lecture 24 - Review

NPTEL : NOC:Natural Gas Engineering (Chemical Engineering)

Co-ordinators : Prof. Pankaj Tiwari

Lecture 1 - Introduction to Natural Gas - I

Lecture 2 - Introduction to Natural Gas - II

Lecture 3 - Introduction to Natural Gas - III

Lecture 4 - Wellbore Performance Relationship (WPR)

Lecture 5 - Choke Performance Relationship (CPR)

Lecture 6 - Nodal Analysis

Lecture 7 - Inflow Performance Relationship (IPR) - I

Lecture 8 - Inflow Performance Relationship (IPR) - II

Lecture 9 - Gas Well Testing

Lecture 10 - Wellbore Performance Relationship (WPR)

Lecture 11 - Choke Performance Relationship (CPR)

Lecture 12 - Nodal Analysis

Lecture 13 - Natural Gas Separation - I

Lecture 14 - Natural Gas Separation - II

Lecture 15 - Dehydration of Natural Gas

Lecture 16 - Sweeting of Natural Gas

Lecture 17 - Compressor Design

Lecture 18 - Measurement of Natural Gas

Lecture 19 - Transportation of Natural Gas - I

Lecture 20 - Transportation of Natural Gas - II

Lecture 21 - Unconventional production of Natural Gas

Lecture 22 - Review: Concluding Remarks

NPTEL : NOC:Chemical Engineering Thermodynamics (Chemical Engineering)

Co-ordinators : Prof. Sasidhar Gumma

Lecture 1 - Introduction

Lecture 2 - First law for closed systems

Lecture 3 - First law for open systems

Lecture 4 - Simple processes

Lecture 5 - Processes involving liquids and ideal gases

Lecture 6 - Temperature dependency of Cp in an ideal gas

Lecture 7 - Efficiency of Heat engines and Statement of Second Law

Lecture 8 - Entropy

Lecture 9 - Lost Work

Lecture 10 - Maxwell's Relations

Lecture 11 - Thermodynamic Diagrams

Lecture 12 - Thermodynamic Tables, Residual Properties

Lecture 13 - Virial Equation of State

Lecture 14 - Residual property relations from EoS

Lecture 15 - Cubic Equation of State

Lecture 16 - Cubic Equation of State

Lecture 17 - Thermodynamic Tables

Lecture 18 - Correlations for Liquids

Lecture 19 - Process Involving Phase Changes

Lecture 20 - Chemical potential

Lecture 21 - Partial molar properties

Lecture 22 - Examples

Lecture 23 - Ideal Solutions

Lecture 24 - Excess Properties

Lecture 25 - Fugacity

Lecture 26 - Calculation of Fugacity using EoS - Part 1

Lecture 27 - Calculation of Fugacity using EoS - Part 2

Lecture 28 - Calculation of Fugacity in Mixtures using Cubic EoS

Lecture 29 - Fugacity in Liquids, Activity Coeffcient

Lecture 30 - Models for Excess Gibbs free energy - Part 1

Lecture 31 - Models for Excess Gibbs free energy - Part 2

Lecture 32 - Vapor Liquid Equilibrium - Part 1

Lecture 33 - Vapor Liquid Equilibrium - Part 2

Lecture 34 - Azeotropes

Lecture 35 - Gamma/Phi Formulation

Lecture 36 - LLE

Lecture 37 - VLLE

Lecture 38 - Enthalpy changes upon reaction

Lecture 39 - Reaction coordinate

Lecture 40 - Equilibrium constant

Lecture 41 - Examples

Lecture 42 - Conclusion

NPTEL : NOC:Mass Transfer Operations-I (Chemical Engineering)

Co-ordinators : Dr. B. Mandal

Lecture 1 - Introduction and Overview of Mass Transfer Operation

Lecture 2 - Molecular and Eddy Diffusion, Diffusion Velocities and Fluxes

Lecture 3 - Fick's First and Second Law

Lecture 4 - Steady State Molecular Diffusion in fluids under stagnant and laminar flow conditions

Lecture 5 - Diffusion through variable cross-sectional area

Lecture 6 - Gas Phase Diffusion Coefficient measurement

Lecture 7 - Gas Phase Diffusion Coefficient prediction and liquid phase diffusion coefficient measurement and prediction

Lecture 8 - Multicomponent diffusion and diffusivity in solids

Lecture 9 - Mass transfer coefficient concept and classifications

Lecture 10 - Dimensionless groups and correlations for convective mass transfer coefficients

Lecture 11 - Mass transfer coefficient in laminar flow

Lecture 12 - Boundary Layer Theory and mass transfer coefficients in turbulent flow

Lecture 13 - Mass transfer theories

Lecture 14 - Interphase mass transfer

Lecture 15 - Interphase mass transfer and material balance for operating line

Lecture 16 - Number of ideal stages in counter current operation: graphical and algebraic methods

Lecture 17 - Introduction, classification, Sparged and agitated vessels design

Lecture 18 - Gas dispersed: Tray tower

Lecture 19 - Sieve Tray

Lecture 20 - Liquid dispersed: Venture scrubber, wetted wall column, Packed tower

Lecture 21 - Introduction to absorption, Equilibrium in gas-liquid system, and minimum liquid rate

Lecture 22 - Design of packed column absorber based on the Individual Mass Transfer Coefficient

Lecture 23 - Design of packed column absorber based on the Overall Mass Transfer Coefficient

Lecture 24 - Height Equivalent to a Theoretical Plate (HETP), Design of packed column absorber for dilute and concentrated gases

Lecture 25 - Absorption in plate column: Method of McCabe and Thiele-graphical determination of ideal trays and Introduction to multicomponent absorption

Lecture 26 - Introduction to distillation, binary equilibrium diagrams and concept of relative volatility

Lecture 27 - Distillation in non-ideal systems and concept of enthalpy-concentration diagram

Lecture 28 - Flash distillation

Lecture 29 - Batch and steam distillation

Lecture 30 - Continuous multistate fractionation

Lecture 31 - Number of trays by McCabe and Thiele for distillation

Lecture 32 - Pinch Points and minimum reflux

Lecture 33 - Reflux below its bubble point: Sub-cooled reflux and use of open steam

Lecture 34 - Multiple feeds, multiple product withdrawal or side streams

Lecture 35 - Multistage batch distillation with reflux

Lecture 36 - The Ponchon-Savarit method

Lecture 37 - The Ponchon-Savarit method

Lecture 38 - Packed Distillation

Lecture 39 - Introduction to multicomponent distillation and multicomponent flash distillation

Lecture 40 - Minimum stages and minimum reflux in multicomponent distillation

Lecture 41 - Multicomponent batch distillation

NPTEL : NOC:Transport Phenomena of Non-Newtonian Fluids (Chemical Engineering)

Co-ordinators : Prof. N. Kishore

Lecture 1 - Introduction and Basic Concepts

Lecture 2 - Classification of Non-Newtonian Fluids

Lecture 3 - Mathematical Models for Non-Newtonian Fluids

Lecture 4 - Viscoelastic Non-Newtonian Fluids

Lecture 5 - Capillary Viscometers: Sources of Errors and Correction Methods

Lecture 6 - Rotational Viscometers

Lecture 7 - Capillary Viscometers - Errors and Corrections II

Lecture 8 - Equation of Change for Non-Isothermal Systems

Lecture 9 - Rotational Viscometers - II

Lecture 10 - Rotational Viscometers - III

Lecture 11 - Transition from Laminar to Turbulent Flow in Pipes for GNF

Lecture 12 - Equations of Change for Isothermal Systems

Lecture 13 - Equations of Change for Non-Isothermal Systems

Lecture 14 - Power-law Fluids Flow in Concentric Annulus

Lecture 15 - Power-law and Ellis Model Fluids Flow Through Pipes

Lecture 16 - Bingham Plastic Fluids Flow through Pipes

Lecture 17 - Herschel Bulkley Fluids Flow through Pipes

Lecture 18 - Transition and Turbulent Flow of GNF in Pipes - I

Lecture 19 - Transition and Turbulent Flow of GNF in Pipes - II

Lecture 20 - Laminar flow of GNFs between Parallel Plates and along Inclined Surface

Lecture 21 - Laminar flow of GNFs along Inclined Surface and Concentric Annulus

Lecture 22 - Flow of Non-Newtonian Fluids through Packed Beds

Lecture 23 - Dispersion in Packed Beds: Non-Newtonian Effects

Lecture 24 - Liquid-Solid Fluidization by Power-law Liquids

Lecture 25 - Free Convection between Two Vertical Plates

Lecture 26 - Viscous Heat Generation

Lecture 27 - Temperature distribution in fluids confined between co-axial cylinders

Lecture 28 - Temperature distribution for FDF of Newtonian fluids in tubes

Lecture 29 - Heat Transfer Combined with Chemical Reactions

Lecture 30 - Transpiration Cooling

Lecture 31 - Basics of MT; Diffusion Through Stagnant Gas Film

Lecture 32 - Non-Isothermal Diffusive MT and Forced Convective MT

Lecture 33 - Simultaneous Heat and Mass Transfer

Lecture 34 - Mass Transfer Combined with Chemical Reactions

Lecture 35 - Quasi-Steady Analysis of Simultaneous HT, MT and Chemical Reaction

Lecture 36 - Quasi-Steady Analysis of Simultaneous HT and MT - I

Lecture 37 - Quasi-Steady Analysis of Simultaneous HT and MT - II

Lecture 38 - Quasi-Steady Analysis of Simultaneous HT and MT - III

Lecture 39 - Momentum and Thermal Boundary Layer Flows

Lecture 40 - Momentum Boundary Layer Thickness of Non-Newtonian Fluids

Lecture 41 - Thermal and Concentration Boundary Layer Thickness of Non-Newtonian Fluids

NPTEL : NOC:Fluid Flow Operations (Chemical Engineering)

Co-ordinators : Dr. S.K. Majumder

Lecture 1 - Introduction

Lecture 2 - Characteristics of fluid (Continued...)

Lecture 3 - Fluid Statics

Lecture 4 - Fluid Statics (Continued...)

Lecture 5 - Fundamentals of flow - Part 1

Lecture 6 - Fundamentals of flow - Part 2

Lecture 7 - One dimensional flow - Part 1

Lecture 8 - One dimensional flow - Part 2

Lecture 9 - One dimensional flow - Part 3

Lecture 10 - Flow of Viscous fluid - Introduction

Lecture 11 - Velocity distribution in laminar flow

Lecture 12 - Velocity distribution in turbulent flow

Lecture 13 - Boundary layer theory

Lecture 14 - Theory of lubrication

Lecture 15 - Frictional resistance

Lecture 16 - Losses in gematric change

Lecture 17 - Losses in geometric change (Continued...)

Lecture 18 - Flow Velocity and Optimum Shape

Lecture 19 - Equation of Energy and Discharge of Water Channel

Lecture 20 - Drag

Lecture 21 - Lift and Cavitation

Lecture 22 - Dimensional Analysis

Lecture 23 - Dimensional Analysis: BuckinghamÃ¢â,¬â„¢s PI Theorem

Lecture 24 - Law of Similarity and Significant Dimensionless Number

Lecture 25 - Compressible Flow - Part 1

Lecture 26 - Compressible Flow - Part 2

Lecture 27 - Measurement of Flow - Part 1

Lecture 28 - Measurement of Flow - Part 2

Lecture 29 - Measurement of Flow - Part 3

Lecture 30 - Introduction to multiphase flow

Lecture 31 - Hydrodynamics in multiphase flow

Lecture 32 - Hydrodynamics in multiphase flow (Continued...)

Lecture 33 - Applications of multiphase flow

NPTEL : NOC:Chemical Process Intensification (Chemical Engineering)

Co-ordinators : Dr. S.K. Majumder

Lecture 1 - History, Philosophy and Concept

Lecture 2 - Principle Features

Lecture 3 - Strategies and domain based techniques

Lecture 4 - Intensification by fluid flow process

Lecture 5 - Mechanism of Intensification by mixing

Lecture 6 - Intensification in Reactive system

Lecture 7 - Problems leading to sustainable development

Lecture 8 - Concept, Issues and Challenges

Lecture 9 - Strategies in process design

Lecture 10 - Scales and stages of process intensification

Lecture 11 - Methods and Tools for Achieving sustainable design

Lecture 12 - Multi-level Computer aided tools

Lecture 13 - Introduction on Stochastic Optimization

Lecture 14 - Optimization Algorithms

Lecture 15 - Applications of Optimization Algorithms

Lecture 16 - Introduction and Mechanism of Cavitation-based PI

Lecture 17 - Cavitational Reactor Configurations and activity

Lecture 18 - Parametric effects on cavitation

Lecture 19 - Introduction of monolith reactor

Lecture 20 - Preparation of monolithic catalyst

Lecture 21 - Application of monolithic catalyst

Lecture 22 - Hydrodynamics, transport of monolithic reactor

Lecture 23 - Overview of interfacial area based processes

Lecture 24 - Ejector induced downflow system for PI

Lecture 25 - Hydrodynamics and transport in downflow system

Lecture 26 - Introduction and Principles

Lecture 27 - Types of Intensified Distillation Units

Lecture 28 - Design of membrane-assisted distillation

Lecture 29 - Introduction and Principles

Lecture 30 - Supercritical extraction for process intensification

Lecture 31 - Introduction to membrane and its principles

Lecture 32 - Membrane engineering in process intensification

Lecture 33 - Introduction to microprocess technology

Lecture 34 - Process Intensification by Microreactors

Lecture 35 - Hydrodynamics and transport in microchannel based microreactor

NPTEL : NOC:Chemical Reaction Engineering-I (Chemical Engineering)

Co-ordinators : Dr. B. Mandal

Lecture 1 - Introduction and Overview on Reaction Engineering

Lecture 2 - Kinetics of Homogeneous Reactions

Lecture 3 - Kinetic Model and Temperature Dependency

Lecture 4 - Introduction and Stoichiometry for the Batch System

Lecture 5 - Stoichiometry for Constant Volume Flow and Variable Volume Batch Systems

Lecture 6 - Stoichiometry for Variable Volume Flow System

Lecture 7 - Analysis of Batch Reactor Kinetic Data

Lecture 8 - Intregal Method of Analysis of Batch Reactor Data - Part 1

Lecture 9 - Intregal Method of Analysis of Batch Reactor Data - Part 2

Lecture 10 - Differential Method of Analysis and Variable Volume Batch Reactor Data

Lecture 11 - Introduction and Ideal Batch Reactor Design

Lecture 12 - Ideal Mixed Flow Reactor Design

Lecture 13 - Ideal Plug Flow Reactor Design

Lecture 14 - Size Comparisn of Single and Multiple Reactors

Lecture 15 - Size Comaprison Multiple Reactors

Lecture 16 - Recycle and Autocatalytic Reactors

Lecture 17 - Design for Parallel Reactions

Lecture 18 - Design for Series Reactions

Lecture 19 - Design for Series-Parallel Reactions

Lecture 20 - Denbigh Reactions and Their Special Cases

Lecture 21 - Heats of Reaction and Equilibrium Conversion from Thermodynamics

Lecture 22 - General Graphical Reactor Design Procedure

Lecture 23 - Material and Energy Balances in Batch Reactor

Lecture 24 - Optimum Temperature Progression in Batch Reactor

Lecture 25 - Material and Energy Balances in Flug Flow and Mixed Flow Reactors

Lecture 26 - Ideal and Non-Ideal Mixed Flow Reactor Design and Multiple Steady States

Lecture 27 - Non-Ideal Reactors and Residence Time Distribution

Lecture 28 - RTD Measurement and Moments of RTD

Lecture 29 - RTD in Ideal Reactors

Lecture 30 - Reactor Modeling using the RTD

NPTEL : NOC:Mass Transfer Operations-II (Chemical Engineering)

Co-ordinators : Dr. Chandan Das

Lecture 1 - Basic concepts, Adiabatic saturation temperature

Lecture 2 - Design calculations of cooling tower

Lecture 3 - Design of cooling tower

Lecture 4 - Design of cooling tower

Lecture 5 - Air conditioning, Example problems on dehumidification

Lecture 6 - Mechanism of drying and drying equilibria, drying rate curve

Lecture 7 - Drying: rate of drying for batch dryers

Lecture 8 - Drying: rate of drying for continuous dryers

Lecture 9 - Drying time calculation from drying rate curve

Lecture 10 - Introduction to liquid-liquid extraction, liquid-liquid equilibria

Lecture 11 - Effect of temperature on LLE and Design of single stage extraction

Lecture 12 - Design Calculation of Multistage Operation

Lecture 13 - Design calculation of multistage cross-current extraction

Lecture 14 - Design calculation of multistage counter-current extraction, Selection of extractors

Lecture 15 - Leaching: single stage operation

Lecture 16 - Leaching: multistage operation

Lecture 17 - Supercritical Fluid Extraction, equipmet for leaching

Lecture 18 - Fundamentals of membrane separation processes

Lecture 19 - Manufacturing of membranes,advantages and limitations

Lecture 20 - Various models and applications: design aspects

Lecture 21 - Various models and applications: design aspects

Lecture 22 - Electric field enhanced membrane separation processes

Lecture 23 - Micellar-enhanced ultrafiltration

Lecture 24 - Adsorption: types and nature, isotherm

Lecture 25 - Stage wise and continuous adsorption

Lecture 26 - Fluidized bed and teeter bed

Lecture 27 - Unsteady state fixed bed adsorbers, ion exchange

Lecture 28 - Crystallization, types of crystal geometry

Lecture 29 - Solid-liquid phase equilibrium, Theory of crystallization

Lecture 30 - Design of crystallizer, crystallization equipment

Lecture 31 - Concluding remarks - Part 1

Lecture 32 - Concluding remarks - Part 2

NPTEL : NOC:Mechanical Unit Operations (Chemical Engineering)

Co-ordinators : Prof. Nanda Kishore

Lecture 1 - Introduction of Particulate Solids

Lecture 2 - Particle Size

Lecture 3 - Particle Shape and Density

Lecture 4 - Screening

Lecture 5 - Size Analysis by Screening

Lecture 6 - Screening Equipment, Effectiveness and Capacity

Lecture 7 - Methods of Size Reduction

Lecture 8 - Equipment for Size Reduction - Crushers

Lecture 9 - Equipment for Size Reduction - Gridners

Lecture 10 - Equipment for Size Reduction - Ultrafine Grinders and Cutting Machines

Lecture 11 - Storage of Bulk Solids

Lecture 12 - Solids Flow Out and their Flow Patterns

Lecture 13 - Conveying of Bulk Solids

Lecture 14 - Size Enlargement Methods

Lecture 15 - Size Enlargement Equipment - 1

Lecture 16 - Size Enlargement Equipment - 2

Lecture 17 - Flow past Immersed Solid Objects

Lecture 18 - Motion of Particles through Fluids - 1

Lecture 19 - Motion of Particles through Fluids - 2

Lecture 20 - Motion of Particles through Fluids - 3

Lecture 21 - Flow through Beds of Solids - 1

Lecture 22 - Flow through Beds of Solids - 2

Lecture 23 - Flow through Fluidized Beds - 1

Lecture 24 - Flow through Fluidized Beds - 2

Lecture 25 - Filtration

Lecture 26 - Principles of Cake Filtration - 1

Lecture 27 - Principles of Cake Filtration - 2

Lecture 28 - Filtration Equipment

Lecture 29 - Cross Flow Filtration - 1

Lecture 30 - Cross Flow Filtration - 2

Lecture 31 - Gravity Sedimentation - Classifiers

Lecture 32 - Gravity Sedimentation - Design of Thickeners - 1

Lecture 33 - Gravity Sedimentation - Design of Thickeners - 2

Lecture 34 - Centrifugal Separations - 1

Lecture 35 - Centrifugal Separations - 2

Lecture 36 - Floatation - 1

Lecture 37 - Floatation - 2

NPTEL : NOC:Advanced Thermodynamics (Chemical Engineering)

Co-ordinators : Prof. Nanda Kishore

Lecture 1 - Introduction of Phase Equilibrium

Lecture 2 - Classical Thermodynamics of Phase Equilibria - 1

Lecture 3 - Classical Thermodynamics of Phase Equilibria - 2

Lecture 4 - Thermodynamic Properties from Volumetric Data

Lecture 5 - Fugacity from Volumetric Data - 1

Lecture 6 - Fugacity from Volumetric Data - 2

Lecture 7 - Intermolecular Forces and Non-Ideal Behaviour

Lecture 8 - Intermolecular Forces-Potential Energy Functions

Lecture 9 - Molecular Theory of Corresponding States - 1

Lecture 10 - Molecular Theory of Corresponding States - 2

Lecture 11 - Intermolecular Potential and EoS

Lecture 12 - Virial Coefficients from Potential Functions

Lecture 13 - Virial Coefficients from Corresponding States Theory

Lecture 14 - Fugacities in Gaseous Mixtures - 1

Lecture 15 - Fugacities in Gaseous Mixtures - 2

Lecture 16 - Fugacities in Gaseous Mixtures - 3

Lecture 17 - Liquid Mixtures and Excess Functions

Lecture 18 - Excess Functions and Activity Coefficients

Lecture 19 - Activity Coefficients and Thermodynamic Consistency

Lecture 20 - Models for Excess Gibbs Energy - 1

Lecture 21 - Models for Excess Gibbs Energy - 2

Lecture 22 - Models for Excess Gibbs Energy - 3

Lecture 23 - Vapour-Liquid Equilibrium - 1

Lecture 24 - Vapour-Liquid Equilibrium - 2

Lecture 25 - Vapour-Liquid Equilibrium - 3

Lecture 26 - Liquid-Liquid Equilibrium - 1

Lecture 27 - Liquid-Liquid Equilibrium - 2

Lecture 28 - Vapour-Liquid-Liquid Equilibrium - 1

Lecture 29 - Vapour-Liquid-Liquid Equilibrium - 2

Lecture 30 - Solid-Liquid Equilibrium - 1

Lecture 31 - Solid-Liquid Equilibrium - 2

NPTEL : NOC:Membrane Technology (Chemical Engineering)

Co-ordinators : Prof. Kaustubha Mohanty

Lecture 1 - Separation Processes, Historical Development, Definition and Types of Membranes

Lecture 2 - Membrane Processes and Classifications, Advantages, Disadvantages, Applications

Lecture 3 - Polymer Basics, Polymers used in Membrane Preparation and their Properties

Lecture 4 - Inorganic Materials for Membrane Preparation, their Advantages and Disadvantages

Lecture 5 - Membrane Modules and Selection, Flow Types

Lecture 6 - Preparation of Synthetic Membrane, Phase Inversion Membranes

Lecture 7 - Composite membranes: Interfacial polymerization, dip-coating, plasma polymerization

Lecture 8 - Inorganic membranes: Sol-Gel process, ceramic membrane preparation, membrane modification

Lecture 9 - Porous and non-porous membranes, characterization of porous membranes and MF membrane

Lecture 10 - MF membrane characterization: Bubble point,Mercury intrusion, Permeability method

Lecture 11 - UF membrane characterization: Gas adsorption-desorption, Thermoporometry, MWCO method

Lecture 12 - Passive transport, active transport, description of transport process

Lecture 13 - Transport through porous membrane and nonporus membrane

Lecture 14 - Concept of osmosis and reverse osmosis, thermodynamic analysis

Lecture 15 - Revision of concepts and fundaments

Lecture 16 - HP and LP RO, membrane materials, modules, models for RO transport

Lecture 17 - Advantages of RO, fouling, RO applications, Pressure retarded osmosis

Lecture 18 - Nanofiltration basics, transport mechanism, fouling model and applications

Lecture 19 - Basic principles of UF, membranes and modules, UF configurations

Lecture 20 - Models for UF transport, mass transfer coefficient, membrane rejection and sieving coefficient

Lecture 21 - Factors affecting UF performance, fouling and permeate flux enhancement, UF applications1

Lecture 22 - Micellar-enhanced UF, affinity UF, UF based bioseparation

Lecture 23 - Basic principles, advantages of MF, cross-flow and dead-end MF, membranes and modules

Lecture 24 - Models for MF transport, plugging and throughput, fouling in MF, MF applications

Lecture 25 - Problems and solutions based on RO and MF

Lecture 26 - Problems and solutions based on UF

Lecture 27 - Dialysis, membranes and modules, mass transport in dialysis, diffusion analysis, applications

Lecture 28 - Ion-exchange membranes, ED process, energy requirement, applications, reverse ED

Lecture 29 - PV principle, advantages, mass transfer and applications, hybrid distillation/PV

Lecture 30 - Problems and solutions based on ED and PV

Lecture 31 - Concept, types of LM, mechanism of mass transfer in LM, choice of solvent and carrier, applications

Lecture 32 - Basic principle of gas separation, transport mechanism, factors affecting gas separation, applications

Lecture 33 - Basic principle of MD, mechanism, process parameters, membranes, applications

Lecture 34 - Mechanism, coupled transport, carrier agent, active and passive transport, applications

Lecture 35 - Gas-liquid and liquid-liquid contactors, membrane reactors and bioreactors, PEM hydrogen fuel cell

Lecture 36 - Perstraction, membrane chromatography and controlled drug delivery

NPTEL : NOC:Computer Aided Applied Single Objective Optimization (Chemical Engineering)

Co-ordinators : Prof. Prakash Kotecha

Lecture 1 - Introduction to Optimization

Lecture 2 - Linear Regression

Lecture 3 - Multiple, Polynomial and General Linear Least Square Regression

Lecture 4 - Nonlinear Regression

Lecture 5 - Regression : MATLAB Implementation

Lecture 6 - Teaching Learning Based Optimization

Lecture 7 - Implementation of TLBO in MATLAB

Lecture 8 - Supplementary: Preliminary Statistical analysis for metaheuristic techniques

Lecture 9 - Supplementary: Preliminary Statistical analysis - MATLAB implementation

Lecture 10 - Particle Swarm Optimization

Lecture 11 - Implementation of Particle Swarm Optimization using MATLAB

Lecture 12 - Differential Evolution

Lecture 13 - Implementation of Differential Evolution using MATLAB

Lecture 14 - Binary Coded Genetic Algorithm

Lecture 15 - Real Coded Genetic Algorithm

Lecture 16 - Implementation of Real Coded Genetic Algorithm using MATLAB

Lecture 17 - Artificial Bee Colony Algorithm

Lecture 18 - Working of Artificial Bee Colony Algorithm

Lecture 19 - Implementation of Artificial Bee Colony using MATLAB

Lecture 20 - Comparison of Variation Operators and Survival Strategies

Lecture 21 - Black-Box Optimization Problems

Lecture 22 - Constraint-Handling in Metaheuristic Techniques

Lecture 23 - Case Study: Production planning

Lecture 24 - Case Study: Production planning MATLAB Implementation

Lecture 25 - Parallelization and Vectorization of Fitness Function

Lecture 26 - Constraint-Handling using Correction Approach

Lecture 27 - MATLAB inbuilt functions: Linear and Mixed Integer Linear Programming

Lecture 28 - MATLAB inbuilt functions: Nonlinear and Mixed Integer Nonlinear Programming

Lecture 29 - MATLAB Optimization Tool: Options, Output Function, Vectorization, Parallelization

Lecture 30 - MATLAB inbuilt functions: Multi-objective Optimization

Lecture 31 - Simplex Method for LP

Lecture 32 - Branch and Bound Method for MILP

Lecture 33 - MILP formulation of Production Planning Problem

Lecture 34 - Generalized Algebraic Modelling System

Lecture 35 - Solution of Production Planning Problem using GAMS and NEOS, MIRO

Lecture 36 - IBM ILOG CPLEX Optimization Studio

Lecture 37 - Constraint Programming Applications in IBM ILOG CPLEX Optimization Studio

NPTEL : NOC:Basic Principles and Calculations in Chemical Engineering (Chemical Engineering)

Co-ordinators : Prof. Subrata Kumar Majumdar

Lecture 1 - Definition, History, Role of Chemical Engineer

Lecture 2 - Basic Features of Chemical Process

Lecture 3 - Unit systems and dimensions

Lecture 4 - Variables and Properties of Material in System

Lecture 5 - Pressure and Temperature of Flow Process

Lecture 6 - Rate of Process

Lecture 7 - Principles of material balance and calculation

Lecture 8 - Material Balances on Processes with Recycle and Bypass

Lecture 9 - Material balances on reactive processes

Lecture 10 - Material balances on combustion reactions

Lecture 11 - State Equation of Ideal Gas and Calculation

Lecture 12 - State Equation of non-Ideal Gas and Calculation

Lecture 13 - Phase equilibrium

Lecture 14 - Equilibrium Laws, Humidity and Saturation

Lecture 15 - Humidity, Saturation Psychrometric chart

Lecture 16 - Process of phase change: Condensation and vaporization

Lecture 17 - Principles of Energy

Lecture 18 - Laws and properties of thermodynamics

Lecture 19 - Standard Heat of Formation

Lecture 20 - The mechanical energy balance

Lecture 21 - Enthalpy balances without reaction

Lecture 22 - Energy balance with multiplle streams without reaction

Lecture 23 - Energy balance on heat of solution

Lecture 24 - Energy balance with heat of reaction

Lecture 25 - Energy balance with heat of reaction (Continued...)

Lecture 26 - Energy balance with heat of combustion

Lecture 27 - Material balance of transient process

Lecture 28 - Unsteady state energy balance

Lecture 29 - Least Square Method Linear equation fitting

Lecture 30 - Non-linear algebraic equation system

Lecture 31 - Numerical Integration

Lecture 32 - Process Degrees of Freedom

Lecture 33 - Process Flowsheeting and codes

Lecture 34 - Case Study: Cumene Production

Lecture 35 - Case Study: Cumene Production (Continued...)

NPTEL : NOC:Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems (Chemical Engineering)

Co-ordinators : Prof. R. Anandalakshmi, Prof. Vaibhav Vasant Goud

Lecture 1 - Solar Energy: An overview of thermal applications

Lecture 2 - Solar radiation

Lecture 3 - Practice problems - Part I

Lecture 4 - Practice problems - Part II

Lecture 5 - Non-concentrating solar collectors - Part I

Lecture 6 - Non-concentrating solar collectors - Part II

Lecture 7 - Non-concentrating solar collectors - Part III

Lecture 8 - Practice problems - Part I

Lecture 9 - Practice problems - Part II

Lecture 10 - Practice problems - Part III

Lecture 11 - Parabolic solar collectors

Lecture 12 - Practice problems

Lecture 13 - Thermal energy storage systems - Part I

Lecture 14 - Thermal energy storage systems - Part II

Lecture 15 - Solar energy utilization methods

Lecture 16 - Classification of energy resources

Lecture 17 - Broad classification and compositional analysis

Lecture 18 - Characteristics and properties of biomass

Lecture 19 - Properties and structural components of biomass

Lecture 20 - Biomass residues and energy conversion routes

Lecture 21 - Utilisation of biomass through bio-chemical and thermo-chemical routes

Lecture 22 - Conversion mechanism of biomass to biogas and its properties

Lecture 23 - Classification of biogas plants

Lecture 24 - Practice problems - I

Lecture 25 - Practice problems - II

Lecture 26 - Practice problems - III

Lecture 27 - Bioconversion of substrates into alcohol

Lecture 28 - Thermo-chemical conversion, torrefaction and combustion processes

Lecture 29 - Thermo-chemical conversion of biomass to solid, liquid and gaseous fuels

Lecture 30 - Gasification process

Lecture 31 - Thermo-chemical conversion processes: pyrolysis, liquefaction and conversion processes

Lecture 32 - Practice problems - I

Lecture 33 - Practice problems - II

Lecture 34 - Turbine terms, types and theories - Part I

Lecture 35 - Turbine terms, types and theories - Part II

Lecture 36 - Characteristics and Power Generation from Wind Energy - Part I

Lecture 37 - Characteristics and Power Generation from Wind Energy - Part II

Lecture 38 - Practice problems

NPTEL : NOC:Biomass Conversion and Biorefinery (Chemical Engineering)

Co-ordinators : Prof. Kaustubha Mohanty

Lecture 1 - Energy and Environment scenario

Lecture 2 - Need for biomass based industries

Lecture 3 - Biomass basics

Lecture 4 - Dedicated energy crops

Lecture 5 - Oil cropns and microalgae

Lecture 6 - Enhancing biomass properties

Lecture 7 - Basic concepts and types

Lecture 8 - Feedstocks and properties

Lecture 9 - Economics and LCA

Lecture 10 - Barriers and Types

Lecture 11 - Dilute acid, alkali, ozone

Lecture 12 - Hybrid methods

Lecture 13 - Physical Processes

Lecture 14 - Gasification and Pyrolysis

Lecture 15 - Products and Commercial Success Stories

Lecture 16 - Types, fundamentals, equipments, applications

Lecture 17 - Details of various processes

Lecture 18 - Products and Commercial Success Stories

Lecture 19 - Diesel from vegetable oils, microalgae and syngas

Lecture 20 - Transesterification; FT process, catalysts

Lecture 21 - Biodiesel purification, fuel properties

Lecture 22 - Biooil and biochar production, reactors

Lecture 23 - Factors affecting biooil, biochar production, fuel properties characterization

Lecture 24 - Biooil upgradation technologies

Lecture 25 - Microorganisms, current industrial ethanol production technology

Lecture 26 - Cellulase production, SSF and CBP

Lecture 27 - ABE fermentation pathway and kinetics, product recovery technologies

Lecture 28 - Biohydrogen production, metabolics, microorganisms

Lecture 29 - Biogas technology, fermenter designs, biogas purification

Lecture 30 - Methanol production and utilization

Lecture 31 - Biomass as feedstock for synthetic organic chemicals, lactic acid, polylactic acid

Lecture 32 - Succinic acid, propionic acid, acetic acid, butyric acid

Lecture 33 - 1,3-propanediol, 2,3-butanedioil, PHA

Lecture 34 - Concept, lignocellulosic biorefinery

Lecture 35 - Aquaculture and algal biorefinery, waste biorefinery

Lecture 36 - Techno-economic evaluation

Lecture 37 - Life-cycle assessment

NPTEL : NOC:Aspen PlusÂ® Simulation Software - A basic course for beginners (Chemical Engineering)

Co-ordinators : Prof. Prabirkumar Saha

Lecture 1 - Significance of software with example - Simulation on pen and paper vs simulation on Aspen Plus

Lecture 2 - Understanding Resources and My Exchange, Start using Aspen Plus

Lecture 3 - Overview of setting up of property environment

Lecture 4 - Using Model Pallete - Mixers/Splitters, Separators

Lecture 5 - Using Model Pallete - Exchangers

Lecture 6 - Using Model Pallete - Columns

Lecture 7 - Using Model Palette - Reactors

Lecture 8 - Using Model Palette - Pressure Changers

Lecture 9 - Example: Hydrocarbon Treatment - Part 1

Lecture 10 - Example: Hydrocarbon Treatment - Part 2

Lecture 11 - Setup, Components

Lecture 12 - Property Methods

Lecture 13 - Property Methods and Propeety Sets with example

Lecture 14 - Analysis tools (Pure Components and Binary mixtures)

Lecture 15 - Analysis tools (Ternary mixtures), Data and Regression (Part 1)

Lecture 16 - Data and Regression (Part 2), Property Estimation

Lecture 17 - Practice problems on pure components

Lecture 18 - Practice problems on binary mixtures

Lecture 19 - Miscellaneous practice problems and case studies

Lecture 20 - Model Analysis Tools

Lecture 21 - Separation of Hydrocarbon Mixture

Lecture 22 - Synthesis of Acetaldehyde from Ethanol

Lecture 23 - BTX Separation through Distillation

Lecture 24 - Synthesis of Methanol from Syngas

Lecture 25 - Synthesis of Dimethyl Ether from Carbon Dioxide and Hydrogen

Lecture 26 - Synthesis of Ammonia in Cryogenic Process

Lecture 27 - Production of Cumene

Lecture 28 - Design, Rating and Simulation of Heat Exchanger

Lecture 29 - Absorption and Distillation - Part 1

Lecture 30 - Absorption and Distillation - Part 2

Lecture 31 - Hydrodealkylation of Toluene

Lecture 32 - Isobutene Production Plant

Lecture 33 - Nitric Oxide Production Plant

Lecture 34 - Plant Economy and Utilities

Lecture 35 - Plant Dynamics and Control

NPTEL : NOC:Physical and Electrochemical Characterizations in Chemical Engineering (Chemical Engineering)

Co-ordinators : Prof. Tamal Banerjee

Lecture 1 - Introduction of Characterization Techniques - Part 1

Lecture 2 - Introduction to Characterization Techniques - Part 2

Lecture 3 - Infrared Spectroscopy: Fundamentals

Lecture 4 - Infrared Spectroscopy: IR Bands and Applications

Lecture 5 - Infrared Spectrophotometer Instrumentation

Lecture 6 - Raman Spectroscopy

Lecture 7 - NMR: Concepts and Fundamentalsâ€‹

Lecture 8 - Chemical Shifts

Lecture 9 - Factors Affecting Chemical Shift and 2D NMRâ€‹

Lecture 10 - Physisorption: Surface Area and Pore Analysis

Lecture 11 - Physisorption Measurements

Lecture 12 - Chemisorption

Lecture 13 - Surface Tension and its Measurement - Part 1

Lecture 14 - Surface Tension and its Measurement - Part 2

Lecture 15 - Interfacial Tension and its Application

Lecture 16 - Interfacial Tension and Influence of Surface Curvatureâ€‹

Lecture 17 - Rheology: Fundamentals and Principlesâ€‹

Lecture 18 - Complex Fluids and their Propertiesâ€‹

Lecture 19 - Rheology: Case Study on Hydrogel Synthesis

Lecture 20 - Electron Spectroscopy for Surface Analysisâ€‹

Lecture 21 - Quantification in XRF and XPS Spectroscopyâ€‹

Lecture 22 - XPS Instrument and Applicationâ€‹

Lecture 23 - Introduction to Electrochemical Characterization Techniquesâ€‹

Lecture 24 - Electrode Potential, Kinetics and Mass Transfer Resistanceâ€‹

Lecture 25 - Voltammetry and Galvanostatic Charge-Dischargeâ€‹

NPTEL : NOC:Chemical Process Technology (Chemical Engineering)

Co-ordinators : Prof. Tamal Banerjee

Lecture 1 - Important Steps for Process Development

Lecture 2 - Structure of Chemical Industry

Lecture 3 - Safety and Loss Prevention

Lecture 4 - Sulfuric Acid: Reactions and Thermodynamics

Lecture 5 - SO2 Conversion Reactor and Sulfuric Acid Production Process

Lecture 6 - Sulfur Production: Claus Process

Lecture 7 - Synthesis Gas Production

Lecture 8 - Coal Gasification

Lecture 9 - Coal Gasifiers

Lecture 10 - Gasification Technology and Applications

Lecture 11 - Thermodynamics of Ammonia Synthesis

Lecture 12 - Integrated Ammonia Plant and Hydrogen Recovery - I

Lecture 13 - Integrated Ammonia Plant and Hydrogen Recovery - II

Lecture 14 - Urea Production

Lecture 15 - Nitric acid: Reactions and Thermodynamics

Lecture 16 - Production of Phosphoric Acid: Dihydrate Process

Lecture 17 - Production of Phosphoric Acid: Hemihydrate Process

Lecture 18 - Emission Abatement in Phosphoric Acid Plants

Lecture 19 - Chlorine Production

Lecture 20 - Soda Ash Process

Lecture 21 - Heterogeneous Catalysis

Lecture 22 - Catalysis with Zeolites and production of Iso-butene

Lecture 23 - Production of Ethylbenzene

Lecture 24 - Periodic Flow Reversal and Production of Styrene

Lecture 25 - Selective Oxidation Processes and Ethene Production

Lecture 26 - Monolith Reactors for Automotive Emission

Lecture 27 - Methanol Production

Lecture 28 - Methanol and Formaldehyde Production

Lecture 29 - Fischer-Tropsch Synthesis

Lecture 30 - Fischer Tropsch Process: SASOL and SDMS

Lecture 31 - Methanol to Gasoline: Haldor Topsoe and TIGAS

Lecture 32 - Fuel Additives

Lecture 33 - Homogenous Catalysis

Lecture 34 - Methanol Carbonylation for Acetic Acid Production

Lecture 35 - Hydroformylation Reactions

Lecture 36 - Hydroformylation of Propene and Higher Alkenes

Lecture 37 - Ethene Oligomerization

Lecture 38 - Dimethyl Terephthalate and Terephthalic Acid Production

Lecture 39 - Bio-refinery products and Process Design

Lecture 40 - Optimal Synthesis of Sustainable Bio-refineries

Lecture 41 - Bio-based Fuels

Lecture 42 - Bio-based Chemicals

Lecture 43 - Bio-refinery Feedstock: Food Waste as a Renewable Raw Material

NPTEL : NOC:Inorganic Chemical Technology (Chemical Engineering)

Co-ordinators : Prof. Nanda Kishore

Lecture 1 - Introduction and Unit Processes

Lecture 2 - Introduction of Unit Operations

Lecture 3 - Unit Operations and Other General Principles

Lecture 4 - General Principles and Chemical Plant Design

Lecture 5 - Fuel Gases

Lecture 6 - Natural Gas, LPG and Syngas

Lecture 7 - Synthesis gas

Lecture 8 - Industrial Gases

Lecture 9 - Industrial Gases - Carbon Dioxide

Lecture 10 - Industrial Gases - Hydrogen

Lecture 11 - Sulfur Industry

Lecture 12 - Sulfur and sulfuric acid

Lecture 13 - Sulfuric Acid

Lecture 14 - Nitrogen Industries - Ammonia

Lecture 15 - Nitrogen Industries - Nitric Acid

Lecture 16 - Nitrogen Industries - Urea

Lecture 17 - Nitrogen Industries - Ammonium Nitrate

Lecture 18 - Phosphorus Industries - Phosphorus and Phosphoric Acid Production

Lecture 19 - Phosphorus Industries - Phosphoric Acid Production by Wet Processes

Lecture 20 - Phosphorus Industries - Phosphates

Lecture 21 - Potassium Industries - 1

Lecture 22 - Potassium Industries - 2

Lecture 23 - Chlor-Alkali Industry - Soda Ash

Lecture 24 - Chlor-Alkali Industry - Chlorine and Caustic Soda

Lecture 25 - Cement and Lime Industry - Cement

Lecture 26 - Cement and Lime Industry - Lime

Lecture 27 - Glass Industries

Lecture 28 - Surface Coating Industry

Lecture 29 - Paints and Pigments

Lecture 30 - Varnishes, Lacquers and Industrial Coatings

Lecture 31 - Raw Materials and Basic Ceramic Chemistry

Lecture 32 - Whitewares and Structural Clay Products

Lecture 33 - Refractories, Specialized Ceramic Products and Vitreous Enamel

Lecture 34 - Metallurgical Industries - I

Lecture 35 - Metallurgical Industries - II

NPTEL : NOC:Organic Chemical Technology (Chemical Engineering)

Co-ordinators : Prof. Nanda Kishore

Lecture 1 - Introduction to Organic Chemical Technology

Lecture 2 - Basic Unit Processes and Unit Operations of OCT

Lecture 3 - Introduction to Chemical Plant Design

Lecture 4 - Edible and Essential Oils

Lecture 5 - Vegetable Oils and Processing

Lecture 6 - Processing of Oils and Waxes

Lecture 7 - Soaps and Glycerine Manufacture

Lecture 8 - Detergents Manufacture

Lecture 9 - Carbohydrates Industry - Sugar

Lecture 10 - Carbohydrates Industry - Refined Sugar

Lecture 11 - Carbohydrates Industry - Beet Sugar and Starch

Lecture 12 - Fermentation Industry

Lecture 13 - Fermentation Industry â€“ Ethanol

Lecture 14 - Fermentation Industry â€“ Citric Acid and Penicillin

Lecture 15 - Pulp and Paper Industry

Lecture 16 - Pulp and Paper Industry - 2

Lecture 17 - Pulp and Paper Industry - 3

Lecture 18 - Petroleum Industry

Lecture 19 - Petroleum Refinery Products, Characteristics and Processes

Lecture 20 - Petroleum Refinery Processes

Lecture 21 - Petroleum Refinery Processes - 2

Lecture 22 - Chemicals from C1 Compounds: Methanol and Formaldehyde

Lecture 23 - Chemicals from C1 and C2 Compounds

Lecture 24 - Chemicals from C2 Compounds

Lecture 25 - Chemicals from C2 Compounds - 2

Lecture 26 - Chemicals from C3 Compounds

Lecture 27 - Chemicals from C3 Compounds - 2

Lecture 28 - Chemicals from C4 Compounds

Lecture 29 - Chemicals from Aromatic Compounds

Lecture 30 - Chemicals from Aromatic Compounds - Phenol

Lecture 31 - Chemicals from Aromatic Compounds - 3

Lecture 32 - Polymer Industry

Lecture 33 - Polymer Industry - 2

Lecture 34 - Rubber Industry

Lecture 35 - Rubber Industry - 2

NPTEL : NOC:Solid-Fluid Operations (Chemical Engineering)

Co-ordinators : Prof. Subrata Kumar Majumder

Lecture 1 - Introduction to Solid-Fluid Operations

Lecture 2 - Characteristics of Single particle

Lecture 3 - Particle size and Its distribution in mixture

Lecture 4 - Mechanism of Size Reduction

Lecture 5 - General Machines for Size Reduction

Lecture 6 - Laws of Energy for Size Reduction

Lecture 7 - Introduction on Size Enlargement

Lecture 8 - Mechanism of Size Enlargement

Lecture 9 - Equipment for Size Enlargement

Lecture 10 - Flow Past a Cylinder and Spherical Particle

Lecture 11 - Terminal velocity of single particle

Lecture 12 - Multiple particle Interaction/Sedimentation: Hindered settling velocity

Lecture 13 - Basic law and terminology of flow through granular bed

Lecture 14 - General expressions for flow through packed beds-Ergun Equation

Lecture 15 - Two-phase flow through packed bed

Lecture 16 - Mixing of Solids: Introduction

Lecture 17 - Degree of mixing and Its Assessment

Lecture 18 - Mixing and agitation of fluids/slurries

Lecture 19 - Basic understandings and applications of fluidization

Lecture 20 - Minimum Fluidization Velocity

Lecture 21 - Basic understanding of froth flotation

Lecture 22 - Separation of particles by Screening

Lecture 23 - Particulate Matter Separation by Gravity Settling Chamber

Lecture 24 - Particle Separation by Cyclone and Centrifuge

Lecture 25 - Particle Separation by Electrostatic Precipitator

Lecture 26 - Separation by Industrial Fabric (Bag) Filters

Lecture 27 - Wet Scrubber for Particle Removal

Lecture 28 - Filtration

Lecture 29 - Dead-End and Continuous Filtration

Lecture 30 - Reverse Osmosis

Lecture 31 - Introduction to Nanoparticles

Lecture 32 - Synthesis of Nanoparticles - Physical Method

Lecture 33 - Synthesis of Nanoparticles (Chemical Methods)

Lecture 34 - Adsorption: Principle and Applications

Lecture 35 - Analysis of Adsorption by Isotherms

Lecture 36 - Adsorption Kinetics

NPTEL : NOC:Energy Conversion Technologies (Biomass and Coal) (Chemical Engineering)

Co-ordinators : Prof. Vaibhav V. Goud

Lecture 1 - Sources of energy

Lecture 2 - Sources of energy

Lecture 3 - Energy scenario

Lecture 4 - Environmental aspects of energy

Lecture 5 - Environmental aspects of energy

Lecture 6 - Environmental aspects of energy

Lecture 7 - Environmental aspects of energy

Lecture 8 - Solid fuels - Part I

Lecture 9 - Solid fuels - Part II

Lecture 10 - Liquid fuels - Part I

Lecture 11 - Liquid fuels - Part II

Lecture 12 - Practice problems - Part I

Lecture 13 - Practice problems - Part II

Lecture 14 - Energy from Bio-based Feedstock

Lecture 15 - Thermal/Thermochemcial processes

Lecture 16 - Practice problems (Pelletization)

Lecture 17 - Practice problems (Torrefaction Mass and Energy Yield)

Lecture 18 - Pyrolysis and Hydrothermal Liquefaction

Lecture 19 - Gasification

Lecture 20 - Practice examples (Pyrolysis, Gasification)

Lecture 21 - Biochemical conversion processes - Anaerobic Digestion in Landfills

Lecture 22 - Bioethanol Production

Lecture 23 - Practice examples (Biogas and Bio-ethanol production)

Lecture 24 - Chemical Conversion Processes - Types of Feedstock and Pretreatment

Lecture 25 - Mechanism of trans-esterification and biodiesel production

Lecture 26 - Green diesel synthesis from bio-based feedstocks

Lecture 27 - Energy from Coal (Carbonization, Gasification and Liquefaction)

Lecture 28 - Practice Example (Combustion of Biomass and Coal)

Lecture 29 - Combustion Process (Biomass and Coal)

Lecture 30 - Concept of integration of energy system

NPTEL : NOC:Petroleum Reservoir Engineering (Chemical Engineering)

Co-ordinators : Dr. Pankaj Tiwari

Lecture 1 - Introduction to Petroleum Reservoir Engineering

Lecture 2 - Petroleum Reserves

Lecture 3 - Petroleum Geology

Lecture 4 - Well Drilling Methods

Lecture 5 - Thermodynamics of Hydrocarbons

Lecture 6 - Natural Gas Properties

Lecture 7 - Properties of Crude Oil

Lecture 8 - Reservoir Rock Properties

Lecture 9 - Relative Permeability

Lecture 10 - Primary Drive Mechanisms

Lecture 11 - General Material (Volumetric) Balance

Lecture 12 - Volumetric Balance in Oil and Gas Reservoir

Lecture 13 - Fundamentals of Reservoir Fluid Flow

Lecture 14 - General Equations for radial Flow in Reservoir

Lecture 15 - Inflow Performance Relationship for Reservoir Fluids

Lecture 16 - Well Testing and Performance - I

Lecture 17 - Well Testing and Performance - II

Lecture 18 - Secondary Oil Recovery Methods

Lecture 19 - Enhanced Oil Recovery Methods

Lecture 20 - Introduction to Reservoir Simulation

Lecture 21 - Unconventional Natural Gas Production

NPTEL : NOC:Applied Statistical Thermodynamics (Chemical Engineering)

Co-ordinators : Prof. Tamal Banerjee

Lecture 1 - Introduction to Statistical Thermodynamics

Lecture 2 - Postulates and Boltzmann Distribution

Lecture 3 - Properties of Canonical Partition Function

Lecture 4 - Canonical Partition Function and Thermodynamic Properties

Lecture 5 - Thermodynamic Properties of Ideal Monoatomic Gases

Lecture 6 - Monoatomic Gases and Gibbs Entropy Equation

Lecture 7 - Energy Fluctuations for Monoatomic Gases

Lecture 8 - Partition Function for Diatomic Gases

Lecture 9 - Vibrational Partition Function

Lecture 10 - Partition Function for Ideal Polyatomic Gas

Lecture 11 - Normal Mode Analysis

Lecture 12 - Illustrations

Lecture 13 - Non-reacting Ideal Gas Mixture

Lecture 14 - Chemically Reacting Gas Mixture

Lecture 15 - Degree of Ionization of Gas Molecules

Lecture 16 - Problems on Ionization of Gas Molecules

Lecture 17 - Microcanonical and Grand Canonical Ensemble

Lecture 18 - Isobaric Isothermal Ensemble

Lecture 19 - Fluctuations in Grand canonical and Isothermal Isobaric Ensembles

Lecture 20 - Semi Grand Canonical Ensemble and Comparison of Ensembles

Lecture 21 - Problems and Adsorbtion Isotherms

Lecture 22 - Virial Equation of State for Polyatomic Molecules

Lecture 23 - Virial Equation of State

Lecture 24 - Virial Equation of State with Higher Order Terms

Lecture 25 - Thermodynamic Properties from Virial Equation of State

Lecture 26 - Interaction Potentials for Spherical Molecules

Lecture 27 - Inferences from Intermolecular Potentials

Lecture 28 - Engineering Application of Virial Equation of State

Lecture 29 - Einstein Model

Lecture 30 - Einstein Model (Continued...)

Lecture 31 - Debye Model

Lecture 32 - Sublimation Pressure and Enthalpy of Crystals

Lecture 33 - Flory Huggin's Model

Lecture 34 - Ising Model

Lecture 35 - Radial Distribution Function

Lecture 36 - Radial Distribution Function

Lecture 37 - Molecular Dynamics Simulations

Lecture 38 - Square well Potential and Barker Henderson Pertubation Theory

NPTEL : Fluid Mechanics (Chemical Engineering)

Co-ordinators : Dr. V. Shankar

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27

Lecture 28

Lecture 29

Lecture 30

Lecture 31

Lecture 32

Lecture 33

Lecture 34

Lecture 35

Lecture 36

Lecture 37

Lecture 38

Lecture 39

Lecture 40

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Mass Transfer II (Chemical Engineering)

Co-ordinators : Prof. Nishith Verma

Lecture 1

Lecture 2

Lecture 3

Lecture 4

Lecture 5

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

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Lecture 32

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Lecture 40

NPTEL : Plantwide Control of Chemical Processes (Chemical Engineering)

Co-ordinators : Dr. Nitin Kaistha

Lecture 1 - Introduction to the course

Lecture 2 - Process Dynamics and Negative Feedback

Lecture 3 - PID control

Lecture 4 - Common Industrial Control Loops and advanced loops

Lecture 5 - Advanced loops (Continued...) and multivariable systems

Lecture 6 - Systematic Tuning Using Frequency Domain Analysis

Lecture 7 - Frequency Domain Analysis

Lecture 8 - Multivariable Systems

Lecture 9 - RGA and dynamic decoupling

Lecture 10 - Model based control

Lecture 11 - Dynamic Matrix Control

Lecture 12 - Control of Distillation Columns

Lecture 13 - Temperature inferential distillation control

Lecture 14 - Considerations in temperature inferential control

Lecture 15 - Control of Complex Column Configurations

Lecture 16 - Control of Heat Integrated Columns

Lecture 17 - Homogenous extractive distillation

Lecture 18 - More on complex columns and reactive distillation

Lecture 19 - Control of reactors

Lecture 20 - PFR controls (Continued..) & CSTRs

Lecture 21 - CSTR heat management

Lecture 22 - Heat Exchangers and Miscellaneous Systems

Lecture 23 - Degrees of freedom analysis

Lecture 24 - Degrees of freedom (Continued...)

Lecture 25 - Illustration of considerations in control structure synthesis

Lecture 26 - Two column recycle process

Lecture 27 - Throughput manipulator selection

Lecture 28 - Plantwide control structure design

Lecture 29 - Systematizing plantwide control design

Lecture 30 - The Luyben design procedure

Lecture 31 - Role of equipment capacity constraints

Lecture 32 - Recycle process case study

Lecture 33 - Recycle process case study (Continued...)

Lecture 34 - C4 isomerization process case study

Lecture 35 - C4 isomerization process case study (Continued...)

Lecture 36 - C4 isomerization process case study

Lecture 37 - Systematic economic plantwide control design procedure

Lecture 38 - Ethyl benzene process case study

Lecture 39 - C4 isomerization process revisited

Lecture 40 - Contrasting conventional and top-down approach

Lecture 41 - Cumene process plantwide control

NPTEL : NOC:Thermodynamics Of Fluid Phase Equilibria (Chemical Engineering)

Co-ordinators : Dr. Jayant K. Singh

Lecture 1 - Review - 1

Lecture 2 - Review - Temperature and Pressure

Lecture 3 - Review - Energy Conservation

Lecture 4 - Properties - Part 1

Lecture 5 - Properties - Part 2

Lecture 6 - Mass-energy analysis of open system

Lecture 7 - Energy analysis of closed system

Lecture 8 - The Second Law of Thermodynamics

Lecture 9 - Entropy

Lecture 10 - Thermodynamic Calculus - 1

Lecture 11 - Thermodynamic Calculus - 2

Lecture 12 - Thermodynamic Calculus - 3

Lecture 13 - Thermodynamic Calculus - 4

Lecture 14 - Legendre Transformation and Free-energy

Lecture 15 - Criteria for phase equilibria

Lecture 16 - Maxwell Relation

Lecture 17 - Stability Criteria

Lecture 18 - Thermodynamics of phase equilibrium

Lecture 19 - Chemical potential and fugacity

Lecture 20 - General discussion on fugacity

Lecture 21 - Ideal Gas Mixture - Part 1

Lecture 22 - Ideal Gas Mixture - Part 2

Lecture 23 - Partial Molar Properties

Lecture 24 - Partial Molar Properties from experimental data

Lecture 25 - Thermodynamics properties from volumetric data - 1

Lecture 26 - Thermodynamics properties from volumetric data - 2

Lecture 27 - Fugacity of pure liquids and solids

Lecture 28 - Thermodynamics properties from volumetric data: effect of V and T

Lecture 29 - Approaches to phase equilibria calculation

Lecture 30 - Traditional Approaches to phase equilibria calculations

Lecture 31 - Algorithms for vapor-liquid equilibria

Lecture 32 - Probability and Multiplicity

Lecture 33 - Multiplicity and maximising the multiplicity

Lecture 34 - Introduction to statistical mechanics

Lecture 35 - Partition function for independent particles

Lecture 36

Lecture 37 - Models of Molecular Pair Potentials

Lecture 38 - Molecular Theory of Corresponding States

Lecture 39 - Molecular Interactions in Dense Fluid Media

Lecture 40 - Models for Electrolyte Systems

Lecture 41 - Membrane Osmometry

Lecture 42 - Fugacity of liquid mixture - 1

Lecture 43 - Fugacity of liquid mixture - 2

Lecture 44 - Models for fugacity of liquid mixtures - 1

Lecture 45 - Models for fugacity of liquid mixtures - 2

Lecture 46 - Examples of Fugacity of liquids

Lecture 47 - Stability of the Fluid Phases

Lecture 48 - Theories of Solution - I

Lecture 49 - Theories of Solution - II

Lecture 50 - Polymer Solutions

Lecture 51 - Example Problems on Polymer Solutions

NPTEL : NOC:Chemical Engineering Thermodynamics (2019) (Chemical Engineering)

Co-ordinators : Dr. Jayant K. Singh

Lecture 1 - Introduction

Lecture 2 - Measurability and controllability of energy

Lecture 3 - Postulates of thermodynamics - I

Lecture 4 - Postulates of thermodynamics - II

Lecture 5 - Definition of intensive variables and driving forces for temperature and pressure flow

Lecture 6 - Driving force for the matter flow

Lecture 7 - Basic properties, phase diagram, and thermodynamic table

Lecture 8 - Work, and heat

Lecture 9 - First law of thermodynamics for closed system: Ideal gas behavior

Lecture 10 - First law of thermodynamics: Example 1

Lecture 11 - First law of thermodynamics for open system

Lecture 12 - First law of thermodynamics: Example 2

Lecture 13 - The second law of the thermodynamics: Review

Lecture 14 - Carnot cycle and thermodynamic temperature

Lecture 15 - The concept of entropy

Lecture 16 - Maximum work and entropy of ideal gas

Lecture 17 - Power cycles and examples

Lecture 18 - Mathematical properties of fundamental equations

Lecture 19 - Generalized thermodynamic potential - I

Lecture 20 - Generalized thermodynamic potential - II

Lecture 21 - Multivariable Calculus

Lecture 22 - Maxwell's relations and examples

Lecture 23 - Jacobian method and its applications

Lecture 24 - Equilibrium and stability - I

Lecture 25 - Equilibrium and stability - II

Lecture 26 - Stability criteria

Lecture 27 - Intrinsic stability of thermodynamic system

Lecture 28 - Phase transitions

Lecture 29 - Clapeyron Equation and Vapour Pressure Correlations

Lecture 30 - Equation of state

Lecture 31 - Equation of state (Continued...)

Lecture 32 - Repulsive Interaction

Lecture 33 - Fugacity

Lecture 34 - Thermodynamics of mixtures

Lecture 35 - Partial molar properties and examples

Lecture 36 - Examples of partial molar properties for real processes

Lecture 37 - Obtaining the partial molar properties from experimental data

Lecture 38 - Partial molar properties of ideal gas mixtures

Lecture 39 - Chemical potential of ideal gas mixtures

Lecture 40 - Fugacity coefficient in terms of measurable properties

Lecture 41 - Fugacity coefficient for mixtures

Lecture 42 - Fugacity coefficient for ideal mixtures

Lecture 43 - Activity coefficient for mixtures

Lecture 44 - Gibbs - Duhem relations and its impacts on the activity

Lecture 45 - Excess Gibbs free energy model - I

Lecture 46 - Two suffix Margules equation

Lecture 47 - Excess Gibbs free energy model - II

Lecture 48 - Vapor Liquid Equilibria

Lecture 49 - Vapor Liquid Equilibria (examples)

Lecture 50 - Vapor Liquid Equilibria (non-ideal mixtures - I)

Lecture 51 - Vapor Liquid Equilibria (non-ideal mixtures - II)

Lecture 52 - Azeotropes

Lecture 53 - Azeotrope (binary mixture)

Lecture 54 - Liquid-Liquid equilibria - 1

Lecture 55 - liquid-liquid equilibria (Continued...) and solid-liquid equilibria

Lecture 56 - Solid-liquid equilibria (Continued...)

Lecture 57 - Solid-liquid equilibria examples and properties

Lecture 58 - Examples of boiling point elevation

Lecture 59 - Solubility of gases in the liquid

Lecture 60 - Chemical reaction equilibria - I

Lecture 61 - Chemical reaction equilibria - II

Lecture 62 - Chemical reaction equilibria - III

Lecture 63 - Chemical reaction equilibria - IV

NPTEL : NOC:Methods of Adhesion Measurement for Pressure Sensitive Adhesives: Theory and Practice (Chemical Engineering)

Co-ordinators : Prof. Animangsu Ghatak

Lecture 1 - Introduction of Strain and Stress Equilibrium

Lecture 2 - Introduction of Strain and Stress Equilibrium (Continued...)

Lecture 3 - Stress-Strain Relation

Lecture 4 - Plane Strain and Plane Stress Approximations

Lecture 5 - Introduction to Contact Mechanics

Lecture 6 - Loading on Elastic Half-Space

Lecture 7 - Distributed Normal Load and Shear Load on an elastic half space

Lecture 8 - Uniformly Distributed normal load on an elastic half space

Lecture 9 - Indentation on an elastic half-space using a curved bottom punch

Lecture 10 - Spatially varying normal load on an elastic half-space

Lecture 11 - Axi-symmetric loading on an elastic half space

Lecture 12 - Axi-symmetric loading on an elastic half space (Continued...)

Lecture 13 - Axi-symmetric loading on an elastic half space (Continued...)

Lecture 14 - Uniform loading on a triangular area of contact

Lecture 15 - Hertzian Mechanics

Lecture 16 - Hertzian Mechanics (Continued...)

Lecture 17 - Concepts of Surface and interfacial energy

Lecture 18 - Estimation of Surface and interfacial energy

Lecture 19 - Estimation of Surface and interfacial energy (Continued...)

Lecture 20 - Estimation of Surface and interfacial energy (Continued...)

Lecture 21 - Surface tension of liquid using Young's Equation

Lecture 22 - Indentation of an elastic half space with interaction

Lecture 23 - JKR contact mechanics between two spheres with adhesion

Lecture 24 - JKR contact mechanics between two spheres with adhesion (Continued...)

Lecture 25 - JKR contact mechanics between two spheres with adhesion (Continued...)

Lecture 26 - JKR contact mechanics between two cylinders

Lecture 27 - JKR contact mechanics between two cylinders (Continued...)

Lecture 28 - Estimation of adhesion hysteresis using rolling contact mechanics

Lecture 29 - Estimation of adhesion hysteresis using rolling contact mechanics (Continued...)

Lecture 30 - Adhesion of a rigid punch with convex head on an elastic half-space

Lecture 31 - Adhesion of a rigid punch with convex head on an elastic half-space (Continued...)

Lecture 32 - Indentation of an elastic half space using a concave indenter

Lecture 33 - Indentation of an elastic half space using a concave indenter: Comparison with a flat plate indenter

Lecture 34 - Numerical Problems on Indentation of an elastic half space using a concave indenter

Lecture 35 - Indentation of an elastic half space using a concave indenter having general ellipsoidal shape: Contact area splitting and multiple indenters

Lecture 36 - Multiplicity of indenters / Contact Area splitting: Adhesion between two rigid spheres and Effect of roughness

Lecture 37 - JKR vs. DMT model

Lecture 38 - Numerical Problems on JKR vs. DMT model

Lecture 39 - Thin, elastic film sandwiched between two rigid parallel plates

Lecture 40 - Thin, elastic film sandwiched between two rigid parallel plates (Continued...)

Lecture 41 - Thin, elastic film sandwiched between two rigid parallel plates (Continued...)

Lecture 42 - Estimation of load required to pull a rigid plate from a thin, elastic adhesive bonded system

Lecture 43 - Estimation of load required to pull a rigit plate from a thin, elastic adhesive bonded system (Continued...)

Lecture 44 - A thin elastic adhesive sandwiched between two parallel plates (perfect slippage at interface between adhesive and top surface)

Lecture 45 - A thin elastic adhesive sandwiched between two parallel disks (perfect slippage at interface between adhesive and top surface)

Lecture 46 - Adhesive layer sandwiched between two parallel disks

Lecture 47 - Peel experiment

Lecture 48 - Peel experiment (Continued...)

Lecture 49 - Bending of thin plate

Lecture 50 - Bending of thin plate (Continued...)

Lecture 51 - Lift-off experiment for measuring adhesion strength

Lecture 52 - Lift-off experiment for measuring adhesion strength (Continued...)

Lecture 53 - Lift-off experiment for measuring adhesion strength (Continued...)

Lecture 54 - Physical Mechanisms of Enhancing Adhesion without using Viscoelastic Effect

Lecture 55 - Physical Mechanisms of Enhancing Adhesion without using Viscoelastic Effect (Continued...)

Lecture 56 - Adhesive Layer with Spatially varying Thickness and Modulus

Lecture 57 - Adhesion of Viscoelastic Spheres

Lecture 58 - Adhesion of Vistoelastic Spheres (Continued...)

Lecture 59 - Adhesion on Rough Surface

Lecture 60 - Adhesion on a Randomly Rough Surface and Summary of the Course content covered

NPTEL : Biochemical Engineering (Chemical Engineering)

Co-ordinators : Dr. Saikat Chakraborty, Dr. Rintu Banerjee

Lecture 1 - Fundamentals of Biology & Biotechnology

Lecture 2 - Glimpses of Microbial World - Bacteria

Lecture 3 - Virus and Cell Organelles

Lecture 4 - Carbohydrate

Lecture 5 - Nucleic Acid

Lecture 6 - Lipids

Lecture 7 - Proteins

Lecture 8 - Biochemistry & Thermodynamics of Enzymes

Lecture 9 - Enzyme Kinetics : Michealis-Menten Kinetics

Lecture 10 - Regulation of Enzyme Activity : Inhibition

Lecture 11 - Regulation of Enzyme Activity : Inhibition (Continued...)

Lecture 12 - Effects of Substrate and Inhibition, pH and Temperature on Enzyme Activity

Lecture 13 - Immobilized Enzymes

Lecture 14 - Immobilized Enzymes (Continued...)

Lecture 15 - Interphase Mass Transfer and Reaction in Immobilized Enzymes

Lecture 16 - Interphase Mass Transfer and Reaction in Immobilized Enzymes (Continued...)

Lecture 17 - Effectiveness Factor in Immobilized Enzymes

Lecture 18 - Bioenergetics and Glycolysis

Lecture 19 - TCA Cycle

Lecture 20 - Electron Transport Chain & Oxidative Phosphorylation

Lecture 21 - Pentose Phosphate Pathways Glycogenesis & Glycogenolysis

Lecture 22 - Urea Cycle, Gluconeogenesis and Glyoxalate Cycle

Lecture 23 - Microbial Growth : Phases and Models

Lecture 24 - Effect of Mass Transfer on Microbial & Fungal Growth

Lecture 25 - Effect of Multiple Substrates and Inhibition on Microbial Growth

Lecture 26 - Design of Bioreactors

Lecture 27 - Design of Chemostats

Lecture 28 - Stability of Bioreactors

Lecture 29 - Stability of Bioreactors (Continued...)

Lecture 30 - Introduction to Receptor - Ligand Binding

Lecture 31 - Effects of Ligand Depletion and Multiple Receptors on Binding Kinetics

Lecture 32 - Effects of Ligand Depletion and Multiple Receptors on Binding Kinetics (Continued...)

Lecture 33 - Receptors-Mediated Endocytosis

Lecture 34 - Kinetics of Receptor-Mediated Endocytosis

Lecture 35 - General Model for Receptor-Mediated Endocytosis

Lecture 36 - Multiple Interacting Microbial Population: Prey-Predator Models

Lecture 37 - Manufacture of Biochemicals

Lecture 38 - Manufacture of Biochemicals (Continued...) & Strategies for Biomolecules Separation

Lecture 39 - Strategies for Biomolecules Separation (Continued...)

Lecture 40 - Strategies for Biomolecules Separation (Continued...)

NPTEL : Microscale Transport Processes (Chemical Engineering)

Co-ordinators : Dr. Somnath Ganguly, Prof. S. Dasgupta

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Lab on Chip

Lecture 4 - Lab on Chip (Continued...)

Lecture 5 - Microscale manufacturing practices

Lecture 6 - Photolithography

Lecture 7 - Photolithography (Continued...)

Lecture 8 - Deposition

Lecture 9 - Plastic microfluidic devices

Lecture 10 - Mixing

Lecture 11 - Micro Heat Pipes

Lecture 12 - Mixing (Continued...)

Lecture 13 - Mixing (Continued...)

Lecture 14 - Micro Heat Pipes (Continued...)

Lecture 15 - Mixing (Continued...)

Lecture 16 - Dispersion

Lecture 17 - Dispersion (Continued...)

Lecture 18 - Dispersion (Continued...)

Lecture 19 - Electrowetting

Lecture 20 - Electro osmosis

Lecture 21 - Electrowetting (Continued...)

Lecture 22 - Electro osmosis (Continued...)

Lecture 23 - Dielectrophoresis

Lecture 24 - Dielectrophoresis (Continued...)

Lecture 25 - Dielectrophoresis (Continued...)

Lecture 26 - Scaling dimension and issues

Lecture 27 - Slip flow

Lecture 28 - Microstructured reactor

Lecture 29 - Immiscible flow in microchannel

Lecture 30 - Immiscible flow in microchannel (Continued...)

Lecture 31 - Immiscible flow in microchannel (Continued...)

Lecture 32 - Scaling dimension and issues (Continued...)

Lecture 33 - Immiscible flow in microchannel (Continued...)

Lecture 34 - Plastic device making

Lecture 35 - Transport processes and their descriptions

Lecture 36 - Convective fluid dynamics in microchannels

Lecture 37 - Microfluidic networks

Lecture 38 - Electrohydrodynamic atomization

Lecture 39 - Electrohydrodynamic atomization (Continued...)

Lecture 40 - Interfacial phenomena in thin liquid films

NPTEL : Multiphase Flow (Chemical Engineering)

Co-ordinators : Prof. P.K. Das, Prof. Gargi Das

Lecture 1 - Introduction

Lecture 2 - Estimation of Flow Patterns

Lecture 3 - Estimation of Flow Patterns (Continued...)

Lecture 4 - Flow Pattern Maps Fascinating Taylor Bubbles

Lecture 5 - Definitions and Common Terminologies

Lecture 6 - Definitions and Common Terminologies (Continued...)

Lecture 7 - Simple Analytical Models

Lecture 8 - The Homogeneous Flow Theory

Lecture 9 - The Homogeneous Flow Theory (Continued...)

Lecture 10 - Compressible Flow A Recapitulation

Lecture 11 - Compressible Flow A Recapitulation (Continued...)

Lecture 12 - Choked Flow Condition for Homogeneous Flow

Lecture 13 - Drift Flux Model

Lecture 14 - Drift Flux Model (Continued...)

Lecture 15 - Drift Flux Model (Continued...)

Lecture 16 - Drift Flux Model (Continued...)

Lecture 17 - Separated Flow Model

Lecture 18 - Separated Flow Model (Continued...)

Lecture 19 - Separated Flow Model (Continued...)

Lecture 20 - Separated Flow Model - Condition of Choking

Lecture 21 - Separated Flow Model - Condition of Choking (Continued...)

Lecture 22 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction

Lecture 23 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction (Continued...)

Lecture 24 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction (Continued...)

Lecture 25 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction (Continued...)

Lecture 26 - Analysis of Specific Flow Regimes

Lecture 27 - Analysis of Specific Flow Regimes (Continued...)

Lecture 28 - Analysis of Specific Flow Regimes - Slug Flow (Continued...)

Lecture 29 - Two Phase Flow with Phase Change - An Introduction to Boiling Heat Transfer

Lecture 30 - Bubble Growth

Lecture 31 - Different Types of Nucleation

Lecture 32 - Ibullition from Hot Surfaces

Lecture 33 - Cycle of Bubble Growth and Departure

Lecture 34 - Heat Transfer in Different Regimes of Boiling

Lecture 35 - Heat Transfer in Different Regimes of Boiling (Continued...)

Lecture 36 - Critical Heat Flux, Film Boiling

Lecture 37 - Measurement Techniques for Two Phase flow Parameters

Lecture 38 - Measurement Techniques for Two Phase flow Parameters - Void Fraction Measurement

Lecture 39 - Measurement Techniques for Two Phase flow Parameters - Void Fraction Measurement (Continued...)

Lecture 40 - Measurement Techniques for Two Phase flow Parameters - Estimation of Flow Patterns

NPTEL : Novel Separation Processes (Chemical Engineering)

Co-ordinators : Prof. S. De

Lecture 1 - Fundamentals of Separation Processes

Lecture 2 - Identification of Novel Separation Processes

Lecture 3 - Membrane Separation Processes

Lecture 4 - Membrane Separation Processes (Continued...1)

Lecture 5 - Membrane Separation Processes (Continued...2)

Lecture 6 - Membrane Separation Processes (Continued...3)

Lecture 7 - Membrane Separation Processes (Continued...4)

Lecture 8 - Membrane Separation Processes (Continued...5)

Lecture 9 - Membrane Separation Processes (Continued...6)

Lecture 10 - Membrane Separation Processes (Continued...7)

Lecture 11 - Membrane Separation Processes (Continued...8)

Lecture 12 - Membrane Separation Processes (Continued...9)

Lecture 13 - Membrane Separation Processes (Continued...10)

Lecture 14 - Membrane Separation Processes (Continued...11)

Lecture 15 - Membrane Separation Processes (Continued...12)

Lecture 16 - Membrane Separation Processes (Continued...13)

Lecture 17 - Membrane Separation Processes (Continued...14)

Lecture 18 - Membrane Separation Processes (Continued...15)

Lecture 19 - Membrane Separation Processes (Continued...16)

Lecture 20 - Membrane Separation Processes (Continued...17)

Lecture 21 - Membrane Separation Processes (Continued...18)

Lecture 22 - External Field Induced Membrane Separation Processes

Lecture 23 - External Field Induced Membrane Separation Processes (Continued...1)

Lecture 24 - External Field Induced Membrane Separation Processes (Continued...2)

Lecture 25 - External Field Induced Membrane Separation Processes (Continued...3)

Lecture 26 - External Field Induced Membrane Separation Processes (Continued...4)

Lecture 27 - Gas Separation

Lecture 28 - Gas Separation (Continued...)

Lecture 29 - Surfactant Based Separation Processes

Lecture 30 - Surfactant Based Separation Processes (Continued...)

Lecture 31 - Micellar Enhanced Ultrafiltration

Lecture 32 - Micellar Enhanced Ultrafiltration (Continued...)

Lecture 33 - Liquid Membranes

Lecture 34 - Liquid Membranes (Continued...)

Lecture 35 - Centrifugal Separation Processes

Lecture 36 - Chromatographic Separation Processes

Lecture 37 - Chromatographic Separation Processes (Continued...)

Lecture 38 - Ion Exchange Processes

Lecture 39 - Electrophoretic Separation Methods

Lecture 40 - Electrophoretic Separation Methods (Continued...)

Lecture 41 - Supercritical Fluid Extraction

NPTEL : Process Control and Instrumentation (Chemical Engineering)

Co-ordinators : Dr. D. Sarkar, Dr. A.K. Jana

Lecture 1 - Introduction to Process Control

Lecture 2 - Introduction to Process Control (Continued...)

Lecture 3 - Mathematical Modeling (Continued...1)

Lecture 4 - Mathematical Modeling (Continued...2)

Lecture 5 - Mathematical Modeling (Continued...3)

Lecture 6 - Dynamic Behavior of Chemical Processes

Lecture 7 - Dynamic Behavior of Chemical Processes (Continued...1)

Lecture 8 - Dynamic Behavior of Chemical Processes (Continued...2)

Lecture 9 - Dynamic Behavior of Chemical Processes (Continued...3)

Lecture 10 - Dynamic Behavior of Chemical Processes (Continued...4)

Lecture 11 - Dynamic Behavior of Chemical Processes (Continued...5)

Lecture 12 - Dynamic Behavior of Chemical Processes (Continued...6)

Lecture 13 - Dynamic Behavior of Chemical Processes (Continued...7)

Lecture 14 - Dynamic Behavior of Chemical Processes (Continued...8)

Lecture 15 - Feedback Control Schemes

Lecture 16 - Feedback Control Schemes (Continued...1)

Lecture 17 - Feedback Control Schemes (Continued...2)

Lecture 18 - Feedback Control Schemes (Continued...3)

Lecture 19 - Feedback Control Schemes (Continued...4)

Lecture 20 - Feedback Control Schemes (Continued...5)

Lecture 21 - Feedback Control Schemes (Continued...6)

Lecture 22 - Feedback Control Schemes (Continued...7)

Lecture 23 - Feedback Control Schemes (Continued...8)

Lecture 24 - Feedback Control Schemes (Continued...9)

Lecture 25 - Feedback Control Schemes (Continued...10)

Lecture 26 - Feedback Control Schemes (Continued...11)

Lecture 27 - Feedback Control Schemes (Continued...12)

Lecture 28 - Feedback Control Schemes (Continued...13)

Lecture 29 - Feedback Control Schemes (Continued...14)

Lecture 30 - Advanced Control Schemes

Lecture 31 - Advanced Control Schemes (Continued...1)

Lecture 32 - Advanced Control Schemes (Continued...2)

Lecture 33 - Advanced Control Schemes (Continued...3)

Lecture 34 - Advanced Control Schemes (Continued...4)

Lecture 35 - Instrumentation: General Principles of Measurement Systems

Lecture 36 - Instrumentation: General Principles of Measurement Systems (Continued...1)

Lecture 37 - Instrumentation: General Principles of Measurement Systems (Continued...2)

Lecture 38 - Instrumentation: General Principles of Measurement Systems (Continued...3)

Lecture 39 - Instrumentation: General Principles of Measurement Systems (Continued...4)

Lecture 40 - Instrumentation: General Principles of Measurement Systems (Continued...5)

Lecture 41 - Transducer Elements

Lecture 42 - Pressure Measurement

Lecture 43 - Pressure Measurement (Continued...1)

Lecture 44 - Pressure Measurement (Continued...2)

NPTEL : Instability and Patterning of Thin Polymer Films (Chemical Engineering)

Co-ordinators : Dr. R. Mukherjee

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Some Fundamental Surface Related Concepts - I

Lecture 4 - Surface Tension (in terms of molecular interactions)

Lecture 5 - Effect Surface Tension : Laplace Pressure

Lecture 6 - Young Laplace Equation

Lecture 7 - Rayleish Instability

Lecture 8 - Meso Scale Fabrication Approaches

Lecture 9 - Photo Lithography - I

Lecture 10 - Photo Lithography - II

Lecture 11 - Photo Lithography - III

Lecture 12 - Photo Lithography - IV

Lecture 13 - Photo Lithography - V

Lecture 14 - Nano Imprint Lithography

Lecture 15 - Nano Imprint Lithography (Continued...)

Lecture 16 - Soft Lithography - I

Lecture 17 - Soft Lithography - II

Lecture 18 - Soft Lithography - III

Lecture 19 - Soft Lithography - IV

Lecture 20 - Soft Lithography - V

Lecture 21 - Soft Lithography - VI

Lecture 22 - Atomic Force Microscope - I

Lecture 23 - Atomic Force Microscope - II

Lecture 24 - Atomic Force Microscope - III

Lecture 25 - Atomic Force Microscope - IV

Lecture 26 - Atomic Force Microscope - V

Lecture 27 - Intermolecular Forces between Particles and Surfaces - I

Lecture 28 - Intermolecular Forces between Particles and Surfaces - II

Lecture 29 - Intermolecular Forces between Particles and Surfaces - III

Lecture 30 - Intermolecular Forces between Particles and Surfaces - IV

Lecture 31 - Spontaneous instability and dwetting of thin polymer film - I

Lecture 32 - Spontaneous instability and dwetting of thin polymer film - II

Lecture 33 - Spontaneous instability and dwetting of thin polymer film - III

Lecture 34 - Spontaneous instability and dwetting of thin polymer film - IV

Lecture 35 - Spontaneous instability and dwetting of thin polymer film - V

Lecture 36 - Spontaneous instability and dwetting of thin polymer film - VI

Lecture 37 - Spontaneous instability and dwetting of thin polymer film - VII

Lecture 38 - Template Guided Dewetting

Lecture 39 - Elastic Contact Instability and Lithography

Lecture 40 - Gradient Surfaces

NPTEL : Advanced Mathematical Techniques in Chemical Engineering (Chemical Engineering)

Co-ordinators : Prof. S. De

Lecture 1 - Introduction to vector space

Lecture 2 - Introduction to vector space (Continued...)

Lecture 3 - Onto, into, one to one function

Lecture 4 - Vectors

Lecture 5 - Vectors (Continued...)

Lecture 6 - Contraction Mapping

Lecture 7 - Contraction Mapping (Continued...)

Lecture 8 - Matrix, Determinant

Lecture 9 - Eigenvalue Problem in Discrete Domain

Lecture 10 - Eigenvalue Problem in Discrete Domain (Continued...)

Lecture 11 - Eigenvalue Problem in Discrete Domain (Continued...)

Lecture 12 - Eigenvalue Problem in Discrete Domain (Continued...)

Lecture 13 - Stability Analysis

Lecture 14 - Stability Analysis (Continued...)

Lecture 15 - Stability Analysis (Continued...)

Lecture 16 - More Examples

Lecture 17 - Partial Differential Equations

Lecture 18 - Partial Differential Equations (Continued...)

Lecture 19 - Eigenvalue Problem in Continuous Domain

Lecture 20 - Special ODEs

Lecture 21 - Adjoint Operator

Lecture 22 - Theorems of Eigenvalues and Eigenfunction

Lecture 23 - Solution PDE : Separation of Variables Method

Lecture 24 - Solution of Parabolic PDE : Separation of variables method

Lecture 25 - Solution of Parabolic PDE : Separation of Variables Method (Continued...)

Lecture 26 - Solution of Higher Dimensional PDEs

Lecture 27 - Solution of Higher Dimensional PDEs (Continued...)

Lecture 28 - Four Dimensional Parabolic PDE

Lecture 29 - Solution of Elliptic and Hyperbolic PDE

Lecture 30 - Solution of Elliptic and Hyperbolic PDE (Continued...)

Lecture 31 - PDE in Cylindrical and Spherical Coordinate

Lecture 32 - Solution of non-homogeneous PDE

Lecture 33 - Solution of non-homogeneous PDE (Continued...)

Lecture 34 - Solution of non-homogeneous Parabolic PDE

Lecture 35 - Solution of non-homogeneous Elliptic PDE

Lecture 36 - Solution of non-homogeneous Elliptic PDE (Continued...)

Lecture 37 - Similarity Solution

Lecture 38 - Similarity Solution (Continued...)

Lecture 39 - Integral Method

Lecture 40 - Laplace Transform

Lecture 41 - Fourier Transform

NPTEL : NOC:Introduction to Process Modeling in Membrane Separation Process (Chemical Engineering)

Co-ordinators : Prof. S. De

Lecture 1 - Fundamentals of Separation Processes and Introduction of Membrane System

Lecture 2 - Fundamentals of Separation Processes and Introduction of Membrane System (Continued...)

Lecture 3 - Fundamentals of Separation Processes and Introduction of Membrane System (Continued...)

Lecture 4 - Fundamentals of Separation Processes and Introduction of Membrane System (Continued...)

Lecture 5 - Modeling of Reverse Osmosis

Lecture 6 - Concentration Polarization

Lecture 7 - Osmotic Pressure Controlling Filtration

Lecture 8 - Osmotic Pressure Controlling Filtration (Continued...)

Lecture 9 - Osmotic Pressure Controlling Filtration (Continued...)

Lecture 10 - Osmotic Pressure Controlling Filtration (Continued...)

Lecture 11 - Osmotic Pressure Controlling Filtration (Continued...)

Lecture 12 - Osmotic Pressure Controlling Filtration (Continued...)

Lecture 13 - Modeling of Gel Layer Controlling Filtration

Lecture 14 - Modeling of Gel Layer Controlling Filtration (Continued...)

Lecture 15 - Modeling of Gel Layer Controlling Filtration (Continued...) and Resistance in Series Models

Lecture 16 - Design of Membrane Module

Lecture 17 - Design of Membrane Module (Continued...)

Lecture 18 - Design of Membrane Module (Continued...)

Lecture 19 - Modeling of Dialysis

Lecture 20 - Modeling of Dialysis (Continued...)

NPTEL : NOC:Soft Nano Technology (Chemical Engineering)

Co-ordinators : Dr. R. Mukherjee

Lecture 1 - Introduction - 1

Lecture 2 - Introduction - 2

Lecture 3 - Introduction - 3

Lecture 4 - Fundamental Concepts Related to Surface Tension - 1

Lecture 5 - Fundamental Concepts Related to Surface Tension - 2

Lecture 6 - Fundamental Concepts Related to Surface Tension - 3

Lecture 7 - Fundamental Concepts Related to Surface Tension - 4

Lecture 8 - Components of Surface Tension - 1

Lecture 9 - Components of Surface Tension - 2

Lecture 10 - Sell Assembly of Surfactant Molecules

Lecture 11 - Laplace Pressure

Lecture 12 - Photo Lithography - 1

Lecture 13 - Photo Lithography - 2

Lecture 14 - Photo Lithography - 3

Lecture 15 - Photo Lithography - 4

Lecture 16 - Photo Lithography - 5

Lecture 17 - Photo Lithography - 6

Lecture 18 - Soft Lithography - I

Lecture 19 - Soft Lithography - 2

Lecture 20 - Soft Lithography - 3

Lecture 21 - Soft Lithography - 4

Lecture 22 - Soft Lithography - 5

Lecture 23 - Soft Lithography - 6

Lecture 24 - Atomic Force Microscope - 1

Lecture 25 - Atomic Force Microscope - 2

Lecture 26 - Atomic Force Microscope - 3

Lecture 27 - Atomic Force Microscope - 4

Lecture 28 - Atomic Force Microscope - 5

Lecture 29 - Atomic Force Microscope - 6

Lecture 30 - Dewetting - 1

Lecture 31 - Dewetting - 2

Lecture 32 - VdW Interaction Between Two Surfaces

Lecture 33 - Interaction Between Two Surfaces - 2

Lecture 34 - Interaction Between Two Surfaces - 3

Lecture 35 - Dewetting - 3

Lecture 36 - Pattern Directed Dewetting - I

Lecture 37 - Pattern Directed Dewetting - II

Lecture 38 - Spin Dewetting

Lecture 39 - Elastic Contact Instability - I

Lecture 40 - Elastic Contact Instability - II

NPTEL : NOC:Adiabatic Two-Phase Flow & Flow Boiling in Microchannel (Chemical Engineering)

Co-ordinators : Prof. Gargi Das

Lecture 1 - Brief Introduction to Multiphase Flow

Lecture 2 - Brief Introduction to Multiphase Flow (Continued...)

Lecture 3 - Two Phase Flow through Micro Channels

Lecture 4 - Two Phase Flow through Micro Channels (Continued...)

Lecture 5 - Criteria for Confinement for in Case of Two Phase Flow

Lecture 6 - Pertinent Dimensionless Numbers in Two Phase

Lecture 7 - Flow Pattern Maps for Milli and Micro Systems

Lecture 8 - Pattern Transition from Energy Minimisation Principle

Lecture 9 - Experimental Identification of Flow Regimes

Lecture 10 - Experimental Identification of Flow Regimes (Continued...)

Lecture 11 - Flow Regimes and Void Fraction Estimation

Lecture 12 - Influence of Operating Parameter on Flow Patterns

Lecture 13 - Influence of Operating Parameter on Flow Patterns (Continued...)

Lecture 14 - Influence of Operating Parameter on Flow Patterns (Continued...)

Lecture 15 - Influence of Operating Parameter on Flow Patterns (Continued...)

Lecture 16 - Void Fraction Characteristic Mini and Micro Channel

Lecture 17 - Void Fraction and Pressure Drop in Reduced Dimensions - Experimental results

Lecture 18 - Void Fraction and Pressure Drop in Reduced Dimensions - Experimental results (Continued...)

Lecture 19 - Theoretical Analysis of Two Phase Flow in Reduced Dimensions

Lecture 20 - Theoretical Analysis of Two Phase Flow in Reduced Dimensions (Continued...)

Lecture 21 - Flow Pattern based Analysis in Micro Systems - Drift Flux Model

Lecture 22 - Flow Pattern based Modelling - Slug Flow Model

Lecture 23 - Flow Boiling in Microchannels

Lecture 24 - Tutorial - I

Lecture 25 - Tutorial - II

NPTEL : NOC:Phase Equilibrium Thermodynamics (Chemical Engineering)

Co-ordinators : Prof. Gargi Das

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - First Law of Thermodynamics

Lecture 4 - Second Law of Thermodynamics

Lecture 5 - Second Law of Thermodynamics (Continued...)

Lecture 6 - Entropy Change during Spontaneous Processes

Lecture 7 - Criteria of Spontaneity

Lecture 8 - Criteria of Spontaneity (Continued...)

Lecture 9 - Thermodynamic Network

Lecture 10 - Thermodynamic Network (Continued...)

Lecture 11 - Tutorial 1

Lecture 12 - Gibbs free energy as a function of temperature and pressure

Lecture 13 - P-v-T behaviour of gases

Lecture 14 - P-v-T behaviour (Continued...)

Lecture 15 - P-v-T behaviour (Continued...)

Lecture 16 - P-v-T behaviour (Continued...)

Lecture 17 - Tutorial 2

Lecture 18 - Property estimation from P-v-T behaviour

Lecture 19 - Property estimation (Continued...)

Lecture 20 - Concept of chemical potential

Lecture 21 - Chemical potential (Continued...)

Lecture 22 - Homogeneous open systems

Lecture 23 - Homogeneous open systems (Continued...)

Lecture 24 - Heterogeneous Closed Systems

Lecture 25 - Tutorial 3

Lecture 26 - Concept of fugacity

Lecture 27 - Fugacity (Continued...)

Lecture 28 - Estimation of fugacity coefficients

Lecture 29 - Fugacity of condensed phase

Lecture 30 - Mixtures

Lecture 31 - Mixtures (Continued...)

Lecture 32 - Tutorial 4

Lecture 33 - Partial molar properties

Lecture 34 - Partial molar properties (Continued...)

Lecture 35 - Partial molar fugacity

Lecture 36 - Ideal solutions

Lecture 37 - Ideal solutions (Continued...)

Lecture 38 - Ideal solutions (Continued...)

Lecture 39 - Ideal solutions (Continued...)

Lecture 40 - Non-ideal solutions

Lecture 41 - Non-ideal solutions (Continued...)

Lecture 42 - Non-ideal solutions (Continued...)

Lecture 43 - Non-ideal solutions (Continued...)

Lecture 44 - Non-ideal solutions (Continued...)

Lecture 45 - Deviations from ideal dilute solutions

Lecture 46 - Tutorial 5

Lecture 47 - Tutorial 6

Lecture 48 - Thermodynamics Consistency Test of VLE Data

Lecture 49 - Retrograde Condensation

Lecture 50 - Partial and Complete Immiscibility of Liquid Mixtures

Lecture 51 - Partial and Complete Immiscibility of Liquid Mixtures (Continued...)

Lecture 52 - Phase Equilibrium for Mass Transfer Processes

Lecture 53 - Control Mass Analysis of Transient process

Lecture 54 - Control Volume Analysis

Lecture 55 - Throttling and problem

Lecture 56 - Tutorial 7

Lecture 57 - First Law for reacting systems

Lecture 58 - Estimation of standard heat of reaction

Lecture 59 - Effect of operating variables on heat of reaction

Lecture 60 - Chemical Reaction Equilibrium

Lecture 61 - Equilibrium constant and its estimation

Lecture 62 - Relation of Equilibrium constant to composition

Lecture 63 - Effect of operating conditions on equilibrium conversion

Lecture 64 - Relation of Equilibrium constant to composition (Continued...)

Lecture 65 - Miscellaneous concepts on Reaction Equilibrium

NPTEL : NOC:Transport Phenomena (Chemical Engineering)

Co-ordinators : Prof. Sunando Dasgupta

Lecture 1 - Introduction : Newton's Law of Viscosity

Lecture 2 - Fourier and Fick's Laws

Lecture 3 - Shell Momentum Balance

Lecture 4 - Example of Shell Momentum Balance

Lecture 5 - Example of Shell Momentum Balance (Continued...)

Lecture 6 - Example of Shell Momentum Balance (Continued...)

Lecture 7 - Example of Shell Momentum Balance (Continued...)

Lecture 8 - Example of Shell Momentum Balance (Continued...)

Lecture 9 - Equations of Change for Isothermal Systems

Lecture 10 - Equations of Change for Isothermal Systems (Continued...)

Lecture 11 - Equations of Change for Isothermal Systems (Continued...)

Lecture 12 - Equations of Change for Isothermal Systems (Continued...)

Lecture 13 - Equations of Change for Isothermal Systems (Continued...)

Lecture 14 - Equations of Change for Isothermal Systems (Continued...)

Lecture 15 - Unsteady Flow

Lecture 16 - Boundary Layers

Lecture 17 - Boundary Layers (Continued...)

Lecture 18 - Boundary Layers (Continued...)

Lecture 19 - Boundary Layers (Continued...)

Lecture 20 - Boundary Layers (Continued...)

Lecture 21 - Boundary Layers (Continued...)

Lecture 22 - Boundary Layers (Continued...)

Lecture 23 - Boundary Layers (Continued...)

Lecture 24 - Boundary Layers (Continued...)

Lecture 25 - Turbulent Boundary Layers

Lecture 26 - Turbulent Boundary Layers (Continued...)

Lecture 27 - Turbulent Boundary Layers (Continued...)

Lecture 28 - Drag

Lecture 29 - Drag (Continued...)

Lecture 30 - Heat Transfer Basics

Lecture 31 - Heat Transfer Basics (Continued...)

Lecture 32 - 1-D Heat Conduction - Temperature Distributions

Lecture 33 - 1-D Heat Conduction - Shell Heat Balance

Lecture 34 - Shell Heat Balance

Lecture 35 - Viscous Dissipation

Lecture 36 - Transient Conduction

Lecture 37 - Transient Conduction (Continued...)

Lecture 38 - Forced Convection

Lecture 39 - Energy Equation

Lecture 40 - Energy Equation (Continued...)

Lecture 41 - Free Convection

Lecture 42 - Thermal Boundary Layer

Lecture 43 - Mass Transfer

Lecture 44 - Mass Transfer (Continued...)

Lecture 45 - Mass Transfer (Continued...)

Lecture 46 - Mass Transfer (Continued...)

Lecture 47 - Mass Transfer (Continued...)

Lecture 48 - Mass Transfer (Continued...)

Lecture 49 - Mass Transfer (Continued...)

Lecture 50 - Mass Transfer (Continued...)

Lecture 51 - Convection Transfer Equations

Lecture 52 - Boundary Layer Similarity

Lecture 53 - Boundary Layer - Analogy

Lecture 54 - Analogy - Tutorial I

Lecture 55 - Analogy - Tutorial II

Lecture 56 - Analogy - Tutorial III

Lecture 57 - Analogy - Tutorial IV and V

Lecture 58 - Tutorial on Displacement Thickness

Lecture 59 - Tutorial on Momentum Integral Equation

Lecture 60 - Summary of the Course

NPTEL : NOC:Chemical Process Instrumentation (Chemical Engineering)

Co-ordinators : Prof. Debasis Sarkar

Lecture 1 - General Principles and Representation of Instruments

Lecture 2 - General Principles and Representation of Instruments (Continued...)

Lecture 3 - General Principles and Representation of Instruments (Continued...)

Lecture 4 - General Principles and Representation of Instruments (Continued...)

Lecture 5 - General Principles and Representation of Instruments (Continued...)

Lecture 6 - Performance Characteristics of Instruments and Data Analysis - I

Lecture 7 - Performance Characteristics of Instruments and Data Analysis - I (Continued...)

Lecture 8 - Performance Characteristics of Instruments and Data Analysis - I (Continued...)

Lecture 9 - Performance Characteristics of Instruments and Data Analysis - I (Continued...)

Lecture 10 - Performance Characteristics of Instruments and Data Analysis - I (Continued...)

Lecture 11 - Performance Characteristics of Instruments and Data Analysis - II

Lecture 12 - Performance Characteristics of Instruments and Data Analysis - II (Continued...)

Lecture 13 - Performance Characteristics of Instruments and Data Analysis - II (Continued...)

Lecture 14 - Performance Characteristics of Instruments and Data Analysis - II (Continued...)

Lecture 15 - Performance Characteristics of Instruments and Data Analysis - II (Continued...)

Lecture 16 - Transducer Elements

Lecture 17 - Transducer Elements (Continued...)

Lecture 18 - Transducer Elements (Continued...)

Lecture 19 - Transducer Elements (Continued...)

Lecture 20 - Transducer Elements (Continued...)

Lecture 21 - Pressure Measurement: Moderate and High Pressure Measuring Instruments

Lecture 22 - Pressure Measurement: Moderate and High Pressure Measuring Instruments (Continued...)

Lecture 23 - Pressure Measurement: Moderate and High Pressure Measuring Instruments (Continued...)

Lecture 24 - Pressure Measurement: Moderate and High Pressure Measuring Instruments (Continued...)

Lecture 25 - Pressure Measurement: Moderate and High Pressure Measuring Instruments (Continued...)

Lecture 26 - High Vacuum Measurement

Lecture 27 - High Vacuum Measurement (Continued...)

Lecture 28 - High Vacuum Measurement (Continued...)

Lecture 29 - High Vacuum Measurement (Continued...)

Lecture 30 - Pressure Measurement

Lecture 31 - Temperature Measurement

Lecture 32 - Temperature Measurement (Continued...)

Lecture 33 - Temperature Measurement (Continued...)

Lecture 34 - Temperature Measurement (Continued...)

Lecture 35 - Temperature Measurement (Continued...)

Lecture 36 - Temperature Measurement (Continued...)

Lecture 37 - Temperature Measurement (Continued...)

Lecture 38 - Temperature Measurement (Continued...)

Lecture 39 - Temperature Measurement (Continued...)

Lecture 40 - Temperature Measurement (Continued...)

Lecture 41 - Flow Measurement

Lecture 42 - Flow Measurement (Continued...)

Lecture 43 - Flow Measurement (Continued...)

Lecture 44 - Flow Measurement (Continued...)

Lecture 45 - Flow Measurement (Continued...)

Lecture 46 - Level Measurement

Lecture 47 - Level Measurement (Continued...)

Lecture 48 - Level Measurement (Continued...)

Lecture 49 - Level Measurement (Continued...)

Lecture 50 - Level Measurement (Continued...)

Lecture 51 - Miscellaneous Measurements : Composition

Lecture 52 - Miscellaneous Measurements : Composition (Continued...)

Lecture 53 - Miscellaneous Measurements : Composition (Continued...)

Lecture 54 - Miscellaneous Measurements : Composition (Continued...)

Lecture 55 - Miscellaneous Measurements : Composition (Continued...)

Lecture 56 - Pneumatic Control Valve

Lecture 57 - Pneumatic Control Valve (Continued...)

Lecture 58 - Pneumatic Control Valve (Continued...) and P&ID

Lecture 59 - GATE Questions

Lecture 60 - GATE Questions (Continued...)

NPTEL : NOC:Optimization in Chemical Engineering (Chemical Engineering)

Co-ordinators : Prof. Debasis Sarkar

Lecture 1 - Introduction to Optimization

Lecture 2 - Introduction to Optimization (Continued...)

Lecture 3 - Introduction to Optimization (Continued...)

Lecture 4 - Introduction of Optimization (Continued...)

Lecture 5 - Introduction of Optimization (Continued...)

Lecture 6 - Optimization Problem Formulation

Lecture 7 - Optimization Problem Formulation (Continued...)

Lecture 8 - Optimization Problem Formulation (Continued...)

Lecture 9 - Optimization Problem Formulation (Continued...)

Lecture 10 - Optimization Problem Formulation (Continued...)

Lecture 11 - Basic Concepts of Optimization - I

Lecture 12 - Basic Concepts of Optimization - I (Continued...)

Lecture 13 - Basic Concepts of Optimization - I (Continued...)

Lecture 14 - Basic Concepts of Optimization - I (Continued...)

Lecture 15 - Basic Concepts of Optimization - I (Continued...)

Lecture 16 - Basic Concepts of Optimization - II

Lecture 17 - Basic Concepts of Optimization - II (Continued...)

Lecture 18 - Basic Concepts of Optimization - II (Continued...)

Lecture 19 - Basic Concepts of Optimization - II (Continued...)

Lecture 20 - Basic Concepts of Optimization - II (Continued...)

Lecture 21 - Unconstrained Single Variable Optimization: Methods and Applications (Continued...)

Lecture 22 - Unconstrained Single Variable Optimization: Methods and Applications (Continued...)

Lecture 23 - Unconstrained Single Variable Optimization: Methods and Applications (Continued...)

Lecture 24 - Unconstrained Single Variable Optimization: Methods and Applications (Continued...)

Lecture 25 - Unconstrained Single Variable Optimization: Methods and Applications (Continued...)

Lecture 26 - Unconstrained Multivariable Optimization: Direct Search Methods

Lecture 27 - Unconstrained Multivariable Optimization: Direct Search Methods (Continued...)

Lecture 28 - Unconstrained Multivariable Optimization: Direct Search Methods (Continued...)

Lecture 29 - Unconstrained Multivariable Optimization: Direct Search Methods (Continued...)

Lecture 30 - Unconstrained Multivariable Optimization: Direct Search Methods (Continued...)

Lecture 31 - Unconstrained Multivariable Optimization: Gradient Based Methods

Lecture 32 - Unconstrained Multivariable Optimization: Gradient Based Methods (Continued...)

Lecture 33 - Unconstrained Multivariable Optimization: Gradient Based Methods (Continued...)

Lecture 34 - Unconstrained Multivariable Optimization: Gradient Based Methods (Continued...)

Lecture 35 - Unconstrained Multivariable Optimization: Gradient Based Methods (Continued...)

Lecture 36 - Introduction to Linear Programming

Lecture 37 - Introduction to Linear Programming (Continued...)

Lecture 38 - Introduction to Linear Programming (Continued...)

Lecture 39 - Introduction to Linear Programming (Continued...)

Lecture 40 - Introduction to Linear Programming (Continued...)

Lecture 41 - Linear Programming - The Simplex Method

Lecture 42 - Linear Programming - The Simplex Method (Continued...)

Lecture 43 - Linear Programming - The Simplex Method (Continued...)

Lecture 44 - Linear Programming - The Simplex Method (Continued...)

Lecture 45 - Linear Programming - The Simplex Method (Continued...)

Lecture 46 - Constrained Nonlinear Programming

Lecture 47 - Constrained Nonlinear Programming (Continued...)

Lecture 48 - Constrained Nonlinear Programming (Continued...)

Lecture 49 - Constrained Nonlinear Programming (Continued...)

Lecture 50 - Constrained Nonlinear Programming (Continued...)

Lecture 51 - Applications of Optimization

Lecture 52 - Applications of Optimization (Continued...)

Lecture 53 - Applications of Optimization (Continued...)

Lecture 54 - Applications of Optimization (Continued...)

Lecture 55 - Applications of Optimization (Continued...)

Lecture 56 - Software Tools for Optimization

Lecture 57 - Software Tools for Optimization (Continued...)

Lecture 58 - Software Tools for Optimization (Continued...)

Lecture 59 - Software Tools for Optimization (Continued...)

Lecture 60 - Software Tools for Optimization (Continued...)

NPTEL : NOC:Heat Transfer (2018) (Chemical Engineering)

Co-ordinators : Prof. Sunando Dasgupta

Lecture 1 - Introduction to Heat Transfer

Lecture 2 - Introduction to Heat Transfer

Lecture 3 - Heat Diffusion Equation

Lecture 4 - Relevant Boundary Conditions in Conduction

Lecture 5 - One Dimensional Steady State Conduction

Lecture 6 - Temperature Distribution in Radial Systems

Lecture 7 - Tutorial Problem on Critical Insulation Thickness

Lecture 8 - Heat Source Systems

Lecture 9 - Tutorial Problems of Heat Generating Systems

Lecture 10 - Transient Conduction

Lecture 11 - Lumped Capacitance (Continued...) and Tutorial Problem

Lecture 12 - Transient heat Conduction

Lecture 13 - Transient Conduction - Heisler Chart

Lecture 14 - Heat Transfer from Extended Surface

Lecture 15 - Fins and General Conduction Analysis

Lecture 16 - Fundamentals of Convection

Lecture 17 - Equations of Change for Non-isothermal Systems

Lecture 18 - Equations of Change for Non-isothermal Systems (Continued...)

Lecture 19 - Tutorial on the Application of Energy Equation

Lecture 20 - Nusselt Number of a heated sphere in Stagnant Air

Lecture 21 - Momentum and Thermal Boundary Layers

Lecture 22 - The Flat Plate in Parallel Flow - Hydrodynamics and Momentum Transfer

Lecture 23 - The Flat Plate in Parallel Flow - Heat Transfer

Lecture 24 - The Effects of Turbulence

Lecture 25 - Turbulent External Flow

Lecture 26 - Heat and Momentum Transfer Analogy

Lecture 27 - Mixed Boundary Layers

Lecture 28 - Tutorial Problem on External Flow and Behavior of Heat Transfer Coefficient

Lecture 29 - Tutorial Problem in External Flow and Convection

Lecture 30 - Tutorial Problem in External Flow and Convection

Lecture 31 - Tutorial Problem in External Flow and Convection

Lecture 32 - Internal Flow Heat Transfer

Lecture 33 - Internal Flow Heat Transfer (Continued...)

Lecture 34 - Internal Flow Heat Transfer (Continued...)

Lecture 35 - Internal Flow and Heat Transfer (Continued...)

Lecture 36 - Internal Flow and Heat Transfer (Tutorial)

Lecture 37 - Free Convection

Lecture 38 - Heat Exchangers

Lecture 39 - Heat Exchangers

Lecture 40 - Heat Exchangers

Lecture 41 - Tutorial Problems on Heat Exchanger Calculations

Lecture 42 - Tutorial Problem on LMTD and Dirt Factor

Lecture 43 - Epsilon-NTU Method - 1

Lecture 44 - Epsilon-NTU Method - 1 (Continued...)

Lecture 45 - Tutorial Problems on Epsilon - NTU Methods

Lecture 46 - Tutorial Problems on Epsilon - NTU Methods

Lecture 47 - Boiling, Evaporation and Evaporators

Lecture 48 - Radiation - Fundamental Concepts

Lecture 49 - Spectral Blackbody Radiation Intesity and Emissive Power

Lecture 50 - Wein's Law, Stephen Boltzmann Law, Blackbody Radiation Function, Tutorial Problem

Lecture 51 - Kirchhoff's Law

Lecture 52 - Tutorial on Emissivity, Absroptivity and Blackbody Radiation Functions

Lecture 53 - Solar Radiation and the Concept of View Factors

Lecture 54 - Determination of View Factors

Lecture 55 - Radiosity Blackbody Radiation Exchanges, Relevant Problem

Lecture 56 - Network Method for Radiation Exchange in an Enclosure

Lecture 57 - Network Method - Two and Three Zone Enclosures

Lecture 58 - Tutorial Problem on Radiation Exhange using the Network Method

Lecture 59 - Radiation Shields

Lecture 60 - Gaseous Radiation (Participating Medium)

NPTEL : NOC:Flow through Porous Media (Chemical Engineering)

Co-ordinators : Dr. Somnath Ganguly

Lecture 1 - Introduction (Definition Of Porous Media)

Lecture 2 - Introduction (Conceptual Flow Models)

Lecture 3 - Introduction (Applications)

Lecture 4 - Mass Continuity (Introduction)

Lecture 5 - Mass Continuity (Cartesian Coordinates)

Lecture 6 - Mass Continuity (Cylindrical Coordinates)

Lecture 7 - Mass Continuity (Radial Flow)

Lecture 8 - Mass Continuity (Non-Uniform Permeability)

Lecture 9 - Mass Continuity (Continued...)

Lecture 10 - Mass Continuity (Streamlines And Potential Lines)

Lecture 11 - Mass Continuity (Elementary Flow)

Lecture 12 - Mass Continuity (Source/Sink)

Lecture 13 - Mass Continuity (Superposition Of Elementary Flow)

Lecture 14 - Mass Continuity (Superposition Of Elementary Flow) (Continued...)

Lecture 15 - Transport Mechanisms (Introduction)

Lecture 16 - Transport Mechanisms (Combined Mode)

Lecture 17 - Transport Mechanisms (Adsorption/Pore Condensation)

Lecture 18 - Transport Mechanisms (Continued...)

Lecture 19 - Flow Equation (Introduction)

Lecture 20 - Flow Equations (Continued...)

Lecture 21 - Flow Equations (Viscous Flow in Capillary)

Lecture 22 - Flow Equations (Packed Bed)

Lecture 23 - Flow Equations (Fluidized Bed)

Lecture 24 - Miscible Displacement (Uniform Velocity Over Capillary Cross-Section)

Lecture 25 - Miscible Displacement (Laminar Flow in Capillary)

Lecture 26 - Miscible Displacement (Movement of Concentration Pulse)

Lecture 27 - Miscible Displacement (Step Change in Concentration)

Lecture 28 - Miscible Displacement (Continued...)

Lecture 29 - Miscible Displacement (Continued...)

Lecture 30 - Miscible Displacement (Continued...)

Lecture 31 - Miscible Displacement (Continued...)

Lecture 32 - Miscible Displacement (Fractured Porous Media)

Lecture 33 - Miscible Displacement (Viscous Front)

Lecture 34 - Immiscible Flow

Lecture 35 - Immiscible Flow (Continued...)

Lecture 36 - Immiscible Flow (Continued...)

Lecture 37 - Immiscible Flow (Continued...)

Lecture 38 - Immiscible Flow (Continued...)

Lecture 39 - Immiscible Flow (Continued...)

Lecture 40 - Immiscible Flow (Continued...)

Lecture 41 - IMMISCIBLE FLOW (Continued...)

Lecture 42 - Immiscible Flow (Continued...)

Lecture 43 - Immiscible Flow (Continued...)

Lecture 44 - Immiscible Flow (Continued...)

Lecture 45 - Immiscible Flow (Continued...)

Lecture 46 - Immiscible Flow (Continued...)

Lecture 47 - Interception Of Suspended Solids

Lecture 48 - Interception Of Suspended Solids (Continued...)

Lecture 49 - Interception Of Suspended Solids (Continued...)

Lecture 50 - Interception Of Suspended Solids (Continued...)

Lecture 51 - Interception Of Suspended Solids (Continued...)

Lecture 52 - Interception Of Suspended Solids (Continued...)

Lecture 53 - Deformable Porous Media

Lecture 54 - Deformable Porous Media (Continued...)

Lecture 55 - Deformable Porous Media (Continued...)

Lecture 56 - Heat Transfer With Fluid Flow

Lecture 57 - Heat Transfer With Fluid Flow (Continued...)

Lecture 58 - Heat Transfer With Fluid Flow (Continued...)

Lecture 59 - Characterization

Lecture 60 - Characterization (Continued...)

NPTEL : NOC:Fundamentals of Particle and Fluid Solid Processing (Chemical Engineering)

Co-ordinators : Prof. Arnab Atta

Lecture 1 - Solid particle characterization

Lecture 2 - Solid particle characterization (Continued...)

Lecture 3 - Particle size distribution

Lecture 4 - Particle size distribution (Continued...)

Lecture 5 - Particle size distribution (Continued...)

Lecture 6 - Fluid - particle mechanics

Lecture 7 - Fluid - particle mechanics (Continued...)

Lecture 8 - Fluid - particle mechanics (Continued...)

Lecture 9 - Fluid - particle mechanics (Continued...)

Lecture 10 - Fluid - particle mechanics (Continued...)

Lecture 11 - Fluid - particle mechanics (Continued...)

Lecture 12 - Fluid - particle mechanics (Continued...)

Lecture 13 - Fluid - particle mechanics (Continued...)

Lecture 14 - Fluid - particle mechanics (Continued...)

Lecture 15 - Fluid - particle mechanics (Continued...)

Lecture 16 - Flow through packed beds

Lecture 17 - Flow through packed beds (Continued...)

Lecture 18 - Flow through packed beds (Continued...)

Lecture 19 - Flow through packed beds (Continued...)

Lecture 20 - Flow through packed beds (Continued...)

Lecture 21 - Fluidization

Lecture 22 - Fluidization (Continued...)

Lecture 23 - Fluidization (Continued...)

Lecture 24 - Fluidization (Continued...)

Lecture 25 - Fluidization (Continued...)

Lecture 26 - Sedimentation

Lecture 27 - Sedimentation (Continued...)

Lecture 28 - Sedimentation (Continued...)

Lecture 29 - Sedimentation (Continued...)

Lecture 30 - Sedimentation (Continued...)

Lecture 31 - Filtration

Lecture 32 - Filtration (Continued...)

Lecture 33 - Filtration (Continued...)

Lecture 34 - Filtration (Continued...)

Lecture 35 - Filtration (Continued...)

Lecture 36 - Centrifugal Separation

Lecture 37 - Centrifugal Separation (Continued...)

Lecture 38 - Centrifugal Separation (Continued...)

Lecture 39 - Centrifugal Separation (Continued...)

Lecture 40 - Centrifugal Separation (Continued...)

Lecture 41 - Particle size reduction

Lecture 42 - Particle size reduction (Continued...)

Lecture 43 - Particle size reduction (Continued...)

Lecture 44 - Particle size reduction (Continued...)

Lecture 45 - Particle size reduction (Continued...)

Lecture 46 - Particle size reduction (Continued...)

Lecture 47 - Particle size enlargement

Lecture 48 - Particle size enlargement (Continued...)

Lecture 49 - Particle size enlargement (Continued...)

Lecture 50 - Particle size enlargement (Continued...)

Lecture 51 - Fluid - solid transport

Lecture 52 - Fluid - solid transport (Continued...)

Lecture 53 - Fluid - solid transport (Continued...)

Lecture 54 - Fluid - solid transport (Continued...)

Lecture 55 - Fluid - solid transport (Continued...)

Lecture 56 - Colloids and nanoparticles

Lecture 57 - Colloids and nanoparticles (Continued...)

Lecture 58 - Colloids and nanoparticles (Continued...)

Lecture 59 - Colloids and nanoparticles (Continued...)

Lecture 60 - Colloids and nanoparticles (Continued...)

NPTEL : NOC:Plant Design and Economics (Chemical Engineering)

Co-ordinators : Prof. Debasis Sarkar

Lecture 1 - Introduction

Lecture 2 - Typical Design Steps

Lecture 3 - Flow Diagram

Lecture 4 - Flow Diagram - Mass and Energy Balance

Lecture 5 - Piping and Instrumentation Diagram

Lecture 6 - Selection of Process Equipment

Lecture 7 - Process Utilities

Lecture 8 - Plant Location

Lecture 9 - Site and Plant Layout

Lecture 10 - Heuristics in Process Synthesis and Design

Lecture 11 - Capital Investment

Lecture 12 - Capital Cost Estimates

Lecture 13 - Cost Components in Capital Investments

Lecture 14 - Methods of Capital Cost Estimates

Lecture 15 - Estimation of Total Product Cost

Lecture 16 - Different Types of Interest

Lecture 17 - Continuous Interest, Cash Flow Diagram, Time Value of Money

Lecture 18 - Uniform Cash Flows and Continuous Flows

Lecture 19 - Income Tax and Depreciation

Lecture 20 - Depreciation

Lecture 21 - Cumulative Cash Flow and Profitability Standards

Lecture 22 - Profitability Analysis

Lecture 23 - Profitability Analysis (Continued...)

Lecture 24 - Profitability Analysis (Continued...)

Lecture 25 - Alternative Investment, Replacement and Sensitivity Analysis

Lecture 26 - Introduction to Process Synthesis

Lecture 27 - Hierarchical Approach to Process Synthesis - I

Lecture 28 - Hierarchical Approach to Process Synthesis - II

Lecture 29 - Hierarchical Approach to Process Synthesis - III

Lecture 30 - Hierarchical Approach to Process Synthesis - IV

Lecture 31 - Basic Reactor Principles

Lecture 32 - Reactor Synthesis for Complex Reactions by Attainable Region: Fundamentals

Lecture 33 - Reactor Synthesis for Complex Reactions by Attainable Region: Example-1

Lecture 34 - Reactor Synthesis for Complex Reactions by Attainable Region: Example-2

Lecture 35 - General Procedure for Reactor Design and Cost Estimation

Lecture 36 - Introduction to Separation Systems

Lecture 37 - Selection Criteria for Separation Processes

Lecture 38 - Design of Multi-component Distillation Column: Short Cut Method

Lecture 39 - Design of Multi-component Distillation Column: Short Cut Method - Example

Lecture 40 - Introduction to Sequencing of Ordinary Distillation Columns

Lecture 41 - Sequences for Simple Nonintegrated Distillation Columns

Lecture 42 - Distillation Sequencing using Columns with Sidestreams

Lecture 43 - Distillation Sequencing using Thermal Coupling

Lecture 44 - Azeotropic Distillation: Residue Curve Maps

Lecture 45 - Azeotropic Distillation Methods and Cost Estimation

Lecture 46 - Introduction to Pinch Technology

Lecture 47 - Composite Curves

Lecture 48 - The Problem Table Method

Lecture 49 - The Heat Recovery Pinch and The Grand Composite Curve

Lecture 50 - Heat Exchanger Network Design

Lecture 51 - Introduction

Lecture 52 - Fires and Explosions: Flammability Characteristics

Lecture 53 - Fires and Explosions: Prevention

Lecture 54 - Toxic Release, Hazard Identification and MSDS

Lecture 55 - Inherently Safer Design

Lecture 56 - Optimality Criteria for Unconstrained Functions

Lecture 57 - Examples

Lecture 58 - Equality Constrained Problems: Langrange Multipliers

Lecture 59 - Linear Programming Problems

Lecture 60 - Batch Process Scheduling

NPTEL : NOC:Material and Energy Balance Computations (Chemical Engineering)

Co-ordinators : Prof. Arnab Atta

Lecture 1 - Introduction to Engineering Calculations

Lecture 2 - Introduction to Engineering Calculations (Continued...)

Lecture 3 - Introduction to Engineering Calculations (Continued...)

Lecture 4 - Introduction to Processes and Process Variables

Lecture 5 - Introduction to Processes and Process Variables (Continued...)

Lecture 6 - Fundamentals of Material Balance

Lecture 7 - Fundamentals of Material Balance (Continued...)

Lecture 8 - Fundamentals of Material Balance (Continued...)

Lecture 9 - Fundamentals of Material Balance (Continued...)

Lecture 10 - Material Balance of Single-unit

Lecture 11 - Material Balance of Multiple Units

Lecture 12 - Material Balance of Multiple Units (Continued...)

Lecture 13 - Material Balance of Multiple Units (Continued...)

Lecture 14 - Material Balance of Multiple Units (Continued...)

Lecture 15 - Material Balance of Multiple Units - Recycle

Lecture 16 - Material Balance of Recycle and Bypass Units

Lecture 17 - Material Balance of Recycle and Bypass Units (Continued...)

Lecture 18 - Introduction

Lecture 19 - Introduction (Continued...)

Lecture 20 - Introduction (Continued...)

Lecture 21 - Multiple reactions and reactive process balance

Lecture 22 - Reactive process balance

Lecture 23 - Multiple reactions and reactive process balance

Lecture 24 - Reactive process balance (Continued...)

Lecture 25 - Reactive process balance (Continued...)

Lecture 26 - Combustion reactions balance

Lecture 27 - Combustion reactions balance (Continued...)

Lecture 28 - Single-phase systems

Lecture 29 - Single phase systems (Continued...)

Lecture 30 - Single-phase problems and concept of multi-phase system

Lecture 31 - Introduction to Energy Balance - I

Lecture 32 - Introduction to Energy Balance - II

Lecture 33 - Introduction to Energy Balance - III

Lecture 34 - Introduction to Energy Balance - IV

Lecture 35 - Introduction to Energy Balance - V

Lecture 36 - Introduction to Energy Balance - VI

Lecture 37 - Introduction to Energy Balance - VII

Lecture 38 - Introduction to Energy Balance - VIII

Lecture 39 - Introduction to Energy Balance - IX

Lecture 40 - Introduction to Energy Balance - X

Lecture 41 - Introduction to Energy Balance - XI

Lecture 42 - Estimation of Physical Properties - I

Lecture 43 - Estimation of Physical Properties - II

Lecture 44 - Estimation of Physical Properties - III

Lecture 45 - Tutorial - I

Lecture 46 - Tutorial - II

Lecture 47 - Tutorial - III

Lecture 48 - Tutorial - IV

Lecture 49 - Estimation of Physical Parameters - IV

Lecture 50 - Estimation of Physical Parameters - V

Lecture 51 - Energy Balance with Chemical Reactions - I

Lecture 52 - Energy Balance with Chemical Reactions - II

Lecture 53 - Energy Balance with Chemical Reactions - III

Lecture 54 - Energy Balance with Chemical Reactions - IV

Lecture 55 - Energy Balance with Chemical Reactions - V

Lecture 56 - Energy Balance with Chemical Reactions - VI

Lecture 57 - Humidity and Psychrometric Chart - I

Lecture 58 - Humidity and Psychrometric Chart - II

Lecture 59 - Humidity and Psychrometric Chart - III

Lecture 60 - Humidity and Psychrometric Chart - IV

NPTEL : NOC:Principles and Practices of Process Equipment and Plant Design (Chemical Engineering)

Co-ordinators : Prof. Gargi Das

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Optimum design and design documentation

Lecture 4 - Introduction to Mass Transfer Processes

Lecture 5 - Phase Equillibrium

Lecture 6 - Phase Equillibrium (Continued...)

Lecture 7 - Phase Equillibrium (Continued...)

Lecture 8 - Distillation

Lecture 9 - Flash Distillation and Design problem

Lecture 10 - Fractionation

Lecture 11 - Fractionation (Continued...)

Lecture 12 - McCabe-Thiele construction for number of ideal stages

Lecture 13 - Optimum Design

Lecture 14 - Multi-component fractionation design

Lecture 15 - Batch Distillation

Lecture 16 - Practical issues in desigining distillation processes

Lecture 17 - Design of absorbers

Lecture 18 - Design of absorbers (Continued...)

Lecture 19 - Design of absorbers (Continued...)

Lecture 20 - Tower and Tower internals

Lecture 21 - Tower and Tower internals (Continued...)

Lecture 22 - Tower and Tower internals (Continued...)

Lecture 23 - Sieve Tray Design

Lecture 24 - Sieve Tray Design (Continued...)

Lecture 25 - Sieve Tray Design (Continued...)

Lecture 26 - Bubble Cap Tray Design

Lecture 27 - Bubble Cap Tray Design (Continued...)

Lecture 28 - Bubble Cap Tray Design (Continued...)

Lecture 29 - Tower and Tower internals (Packed Tower Design)

Lecture 30 - Tower and Tower internals (Packed Tower Design) (Continued...)

Lecture 31 - Adsorption

Lecture 32 - Packed bed adsorption

Lecture 33 - Packed bed adsorber design

Lecture 34 - Packed bed adsorber design (Continued...)

Lecture 35 - Liquid-liquid extraction (LLE)

Lecture 36 - Liquid-liquid extraction (L2)

Lecture 37 - Liquid-liquid extraction (L3)

Lecture 38 - Liquid-liquid extraction (L4)

Lecture 39 - Liquid-liquid extraction (L5)

Lecture 40 - Design of Mass Transfer Processes (Review)

Lecture 41 - Design of Heat Transfer Processes - Introduction

Lecture 42 - Double Pipe Heat exchanger

Lecture 43 - Double Pipe Heat exchanger (Continued...)

Lecture 44 - Double Pipe Heat exchanger (Continued...)

Lecture 45 - Design of Shell and Tube Heat Exchangers - a general overview

Lecture 46 - Design of Shell and Tube Heat Exchangers - a general overview (Continued...)

Lecture 47 - Shell and Tube Heat Exchanger - Design

Lecture 48 - Shell and Tube Heat Exchanger - Design

Lecture 49 - Heat exchanger Network Analysis

Lecture 50 - Heat exchanger Network Analysis (Continued...)

Lecture 51 - Heat exchanger Network Analysis (Continued...)

Lecture 52 - Heat exchanger Network Analysis (Continued...)

Lecture 53 - Heat exchanger Network Analysis (Continued...)

Lecture 54 - Plant Hydraulics

Lecture 55 - Plant Hydraulics (Continued...)

Lecture 56 - Plant Hydraulics (Continued...)

Lecture 57 - Plant Hydraulics (End)

Lecture 58 - Process Vessels

Lecture 59 - Process Instrumentation and Control

Lecture 60 - Engineered Safety

Lecture 61 - Process Utilities

Lecture 62 - Process Design using Simulators

Lecture 63 - Process Packages

Lecture 64 - Design of a 10 TPD Mono-nitrotoluene plant

NPTEL : NOC:Mathematical Modelling and Simulation of Chemical Engineering Process (Chemical Engineering)

Co-ordinators : Prof. Sourav Mondal

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Constitutive relations

Lecture 4 - Constitutive relations - Mass transfer and thermodynamics

Lecture 5 - Process diagrams

Lecture 6 - Special functions

Lecture 7 - Partial differential equations

Lecture 8 - Partial differential equations - Separation of variables

Lecture 9 - PDE - Separation of variables (Continued...)

Lecture 10 - PDE - Integral transforms

Lecture 11 - Numerical techniques of solving PDE - Discretization

Lecture 12 - Stability of finite difference schemes

Lecture 13 - Numerical solution of PDE - Method of lines

Lecture 14 - Numerical solution of implicit formulation - Tridiagonal matrix

Lecture 15 - Numerical solution of PDE - Finite volume method

Lecture 16 - Perturbation methods

Lecture 17 - Asymptotics

Lecture 18 - Matched Asymptotics

Lecture 19 - Stability of dynamical systems

Lecture 20 - Stability of dynamical systems (Continued...)

Lecture 21 - Modelling transport phenomena problems - Part 1

Lecture 22 - Modelling transport phenomena problems - Part 2

Lecture 23 - Modelling transport phenomena problems - Part 3

Lecture 24 - Modelling transport phenomena problems - Part 4

Lecture 25 - Modelling transport phenomena problems - Part 5

Lecture 26 - Modelling reaction systems - Packed bed catalytic reactor

Lecture 27 - Modelling intraparticle transport and catalysis

Lecture 28 - Modelling pore diffusion and reaction

Lecture 29 - Modelling enzymatic reactions

Lecture 30 - Demonstration of COMSOL Multiphysics

Lecture 31 - Modelling of multistage distillation process

Lecture 32 - FUG method of stage calculations

Lecture 33 - MESH equations and DOF analysis

Lecture 34 - Tearing method

Lecture 35 - Bubble point method stage calculations

Lecture 36 - Simultaneous correction method

Lecture 37 - Block tridiagonal matrix

Lecture 38 - Simple binary batch distillation

Lecture 39 - Multistage batch distillation

Lecture 40 - Heat exchanger network design pinch analysis

Lecture 41 - Pinch point temperature

Lecture 42 - Heat exchanger network synthesis

Lecture 43 - Solving a distillation column using Aspen plus

Lecture 44 - Solving two unit operations using Aspen Plus

Lecture 45 - Solving multiple units using Aspen Plus

Lecture 46 - Dispersed phase modelling - Introduction

Lecture 47 - Population balance equation

Lecture 48 - Dispersed phase modelling - Breakage process

Lecture 49 - Drop size distribution in lean mixtures

Lecture 50 - Mass transfer in lean liquid-liquid dispersion

Lecture 51 - Dispersed phase modelling - Aggregation

Lecture 52 - Dispersed phase modelling - Aerosol dynamics

Lecture 53 - Dispersed phase modelling - Aerosol dynamics (Continued...)

Lecture 54 - Solution of the population balance equation

Lecture 55 - Numerical solution of the population balance equation

Lecture 56 - Kinetic monte carlo simulation

Lecture 57 - Response surface methodology

Lecture 58 - Design of experiments

Lecture 59 - Artificial neural network

Lecture 60 - Supervised training

NPTEL : NOC:Advanced Process Dynamics (Chemical Engineering)

Co-ordinators : Prof. Parag A. Deshpande

Lecture 1 - Introduction and motivation

Lecture 2 - Dynamics of linear first order autonomous systems

Lecture 3 - Dynamics of linear first order autonomous systems (Continued...)

Lecture 4 - Lumped parameter analysis of cooling of a body

Lecture 5 - Lumped parameter analysis of cooling of a body (Continued...)

Lecture 6 - Introduction to higher order systems

Lecture 7 - Phase plane analysis of linear autonomous second order systems

Lecture 8 - Phase plane analysis of linear autonomous second order systems (Continued...)

Lecture 9 - Analysis of a free spring-mass system

Lecture 10 - Analysis of a free spring-mass system (Continued...)

Lecture 11 - Dynamics of non-autonomous systems

Lecture 12 - Similarity solution for non-autonomous higher order dynamics

Lecture 13 - Similarity solution for non-autonomous higher order dynamics (Continued...)

Lecture 14 - Analysis of a forced spring-mass system

Lecture 15 - Analysis of a forced spring-mass system (Continued...)

Lecture 16 - Phase portraits of linear autonomous systems of order three and higher

Lecture 17 - Phase portraits of linear autonomous systems of order three and higher (Continued...)

Lecture 18 - Analysis of complex reaction systems

Lecture 19 - Analysis of complex reaction systems (Continued...)

Lecture 20 - Analysis of complex reaction systems (Continued...)

Lecture 21 - Introduction to non-linear systems

Lecture 22 - Logistic population growth model

Lecture 23 - Logistic population growth model (Continued...)

Lecture 24 - Logistic population growth with harvesting

Lecture 25 - Logistic population growth with harvesting (Continued...)

Lecture 26 - Logistic population growth with threshold population

Lecture 27 - Logistic population growth with threshold population (Continued...)

Lecture 28 - Analysis of population dynamics in discrete domain

Lecture 29 - Analysis of fixed points and bifurcation in discrete domain

Lecture 30 - Analysis of fixed points and bifurcation in discrete domain (Continued...)

Lecture 31 - More on bifurcations in non-linear systems

Lecture 32 - Non-linear systems in higher dimensions

Lecture 33 - Reactor stability analysis

Lecture 34 - Reactor stability analysis (Continued...)

Lecture 35 - Reactor stability analysis (Continued...)

Lecture 36 - Analysis of infectious disease dynamics

Lecture 37 - Analysis of infectious disease dynamics (Continued...)

Lecture 38 - Analysis of infectious disease dynamics (Continued...)

Lecture 39 - Analysis of atmosphere dynamics using Lorenz equations

Lecture 40 - Analysis of atmosphere dynamics using Lorenz equations (Continued...)

Lecture 41 - Analysis of system dynamics in transform domain

Lecture 42 - Analysis of first order system subjected to ideal forcing functions

Lecture 43 - Analysis of first order system subjected to ideal forcing functions (Continued...)

Lecture 44 - Analysis of response of second order systems

Lecture 45 - Analysis of response of second order systems (Continued...)

Lecture 46 - Analysis of (p,q) order systems

Lecture 47 - Analysis of (p,q) order systems (Continued...)

Lecture 48 - Analysis of multiple input - multiple output systems

Lecture 49 - Block diagrams and inter-conversion of state-space and transform domain models

Lecture 50 - Analysis of inverse response systems

Lecture 51 - Analysis of dynamics of discrete-time systems

Lecture 52 - Sampling and reconstruction of continuous signals

Lecture 53 - Conversion of continuous models to discrete-time models

Lecture 54 - Introduction to z-transforms

Lecture 55 - z-transforms Continued

Lecture 56 - Response of discrete-time systems

Lecture 57 - Response of discrete-time systems (Continued...)

Lecture 58 - Response of discrete-time systems (Continued...)

Lecture 59 - Stability analysis in transform domain

Lecture 60 - Review of the course

NPTEL : NOC:Metallocene and Metal-Carbene based Organometallic Compounds as Industrially Important Advanced Polyolefin Catalysts (Chemical Engineering)

Co-ordinators : Prof. Sanjib K. Patra

Lecture 1 - A Brief Introduction to Polymers

Lecture 2 - A Brief Introduction to Polymers (Continued...)

Lecture 3 - Polyethylene and Polypropylene: Chemical structure and properties

Lecture 4 - Polyethylene and Polypropylene: Chemical structure and properties (Continued...)

Lecture 5 - Common polymerization protocol and mechanism

Lecture 6 - Common polymerization protocol and mechanism (Continued...)

Lecture 7 - Common polymerization protocol and mechanism: Controlled Polymerization

Lecture 8 - Anionic living polymerization and Coordination polymerization

Lecture 9 - Transition metal/Organometallic complexes: Unique reactions

Lecture 10 - Metallocene compounds: Structure and Bonding

Lecture 11 - Metallocene compounds: Structure and Bonding (Continued...)

Lecture 12 - Bonding in Metallocene, MOT and Electronic nature

Lecture 13 - Bonding and Electronic nature in Bent Metallocene

Lecture 14 - Bonding and Electronic nature in Bent Metallocene (Continued...)

Lecture 15 - General Synthetic Strategies for Metallocenes (Parallel and Bent)

Lecture 16 - Properties and Unique Reactivities of parallel and bent Metallocenes

Lecture 17 - Unique Reactivities of bent Metallocenes

Lecture 18 - Unique Reactivities of bent Metallocenes (Continued...)

Lecture 19 - Coordination polymerization of olefin and stereoregularity

Lecture 20 - Olefin polymerization by Zeigler Natta Catalyst: Important features

Lecture 21 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts

Lecture 22 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts (Continued...)

Lecture 23 - Symmetry of metallocene and Stereoregularity in polyolefin

Lecture 24 - Symmetry of metallocene and Stereoregularity in polyolefin (Continued...)

Lecture 25 - Metallocene to Post-metallocene catalysts for olefin polymerization

Lecture 26 - Metallocene to Post-metallocene catalysts for olefin polymerization (Continued...)

Lecture 27 - Polymerization strategy for industrial preparation of LLDPE

Lecture 28 - Polymerization strategy for industrial preparation of LLDPE (Continued...)

Lecture 29 - Metallocene and Post-metallocene Catalysts: Homogeneous to Heterogeneous and Lab to Industry

Lecture 30 - Metallocene and Post-metallocene Catalysts: Homogeneous to Heterogeneous and Lab to Industry (Continued...)

Lecture 31 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts

Lecture 32 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts

Lecture 33 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction

Lecture 34 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction (Continued...)

Lecture 35 - Bonding and Electronic properties in Metal-carbene complexes

Lecture 36 - General synthetic protocol of Metal-carbene complexes

Lecture 37 - N-Heterocyclic carbene (NHC) complex: Bonding and General synthetic protocol

Lecture 38 - Alkene metathesis by metal-carbene catalysts and its mechanism

Lecture 39 - Utility of metal-carbene catalysts in alkene polymerization

Lecture 40 - Industrially important polymers by ROMP: Recent development and scope; Overall summary of this course

NPTEL : NOC:Chemical Engineering Fluid Dynamics and Heat Transfer (Chemical Engineering)

Co-ordinators : Prof. Rabibrata Mukherjee, Prof. Arnab Atta

Lecture 1 - Introduction Basic Concepts and Kinematics - 1

Lecture 2 - Kinematics - 2

Lecture 3 - Kinematics - 3

Lecture 4 - Kinematics - 4

Lecture 5 - Kinematics - 5 - Shear Stress

Lecture 6 - Kinematics - 6 and Conservation Equation - 1

Lecture 7 - Conservation Equation - 2

Lecture 8 - Conservation Equation - 3 - Conservation of Momentum

Lecture 9 - Conservation Equation - 4 - Conservation of Momentum - 2

Lecture 10 - Conservation Equation - 5 - Conservation of Momentum - 3

Lecture 11 - Exact Solution - 1

Lecture 12 - Exact Solution - 2

Lecture 13 - Exact Solution - 3

Lecture 14 - Exact Solution - 4

Lecture 15 - Boundary Layer Analysis - 1

Lecture 16 - Boundary Layer Analysis - 2

Lecture 17 - Boundary Layer Analysis - 3

Lecture 18 - Boundary Layer Analysis - 4: Blasius Solution - 1

Lecture 19 - Boundary Layer Analysis - 4: Blasius Solution - 2

Lecture 20 - Boundary Layer Analysis - 5: Momentum Integral Method - 1

Lecture 21 - Boundary Layer Analysis - 6: Momentum Integral Method - 2

Lecture 22 - Boundary Layer Analysis - 6: Momentum Integral Method - 3

Lecture 23 - Turbulence - 1

Lecture 24 - Turbulence - 2

Lecture 25 - Turbulence - 3

Lecture 26 - Turbulence - 4

Lecture 27 - Turbulence - 5

Lecture 28 - Turbulence - 6

Lecture 29 - Turbulence - 7

Lecture 30 - Turbulence - 8 and Final Wrap-up

Lecture 31 - Fundamentals and Mechanism of Heat Transfer

Lecture 32 - Fundamentals and Mechanism of Heat Transfer (Continued...)

Lecture 33 - Fundamentals and Mechanism of Heat Transfer (Continued...)

Lecture 34 - Fundamentals and Mechanism of Heat Transfer (Continued...)

Lecture 35 - Fundamentals and Mechanism of Heat Transfer (Continued...)

Lecture 36 - One-dimensional Heat Conduction

Lecture 37 - One-dimensional Heat Conduction (Continued...)

Lecture 38 - One-dimensional Heat Conduction (Continued...)

Lecture 39 - One-dimensional Heat Conduction (Continued...)

Lecture 40 - One-dimensional Heat Conduction (Continued...)

Lecture 41 - One-dimensional Heat Conduction (Continued...)

Lecture 42 - One-dimensional Heat Conduction (Continued...)

Lecture 43 - Transient Heat Conduction

Lecture 44 - Transient Heat Conduction (Continued...)

Lecture 45 - Transient Heat Conduction (Continued...)

Lecture 46 - Forced Convection

Lecture 47 - Forced Convection (Continued...)

Lecture 48 - Forced Convection (Continued...)

Lecture 49 - Forced Convection (Continued...)

Lecture 50 - Forced Convection (Continued...)

Lecture 51 - Internal Forced Convection

Lecture 52 - Internal Forced Convection (Continued...)

Lecture 53 - Internal Forced Convection (Continued...)

Lecture 54 - Internal Forced Convection (Continued...)

Lecture 55 - Internal Forced Convection (Continued...)

Lecture 56 - Natural Convection

Lecture 57 - Natural Convection (Continued...)

Lecture 58 - Boiling and Condensation

Lecture 59 - Radiation

Lecture 60 - Radiation (Continued...)

NPTEL : NOC:Characterization of Polymers, Elastomers and Composites (Chemical Engineering)

Co-ordinators : Prof. Santanu Chattopadhyay

Lecture 1 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

Lecture 2 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

Lecture 3 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

Lecture 4 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

Lecture 5 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

Lecture 6 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 2

Lecture 7 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 2

Lecture 8 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 2

Lecture 9 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 2

Lecture 10 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 2

Lecture 11 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration

Lecture 12 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

Lecture 13 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

Lecture 14 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

Lecture 15 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

Lecture 16 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites

Lecture 17 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 18 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 19 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 20 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 21 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 22 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 23 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 24 - Practical demonstration on UV-Visible spectroscopy

Lecture 25 - Practical demonstration on FTIR spectroscopy and Sulphur analyzer

Lecture 26 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy

Lecture 27 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 28 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 29 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 30 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 31 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites

Lecture 32 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 33 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 34 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 35 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

Lecture 36 - Thermal analysis techniques and application in polymer, elastomer and composites

Lecture 37 - Thermal analysis techniques and application in polymer, elastomer and composites (Continued...)

Lecture 38 - Thermal analysis techniques and application in polymer, elastomer and composites (Continued...)

Lecture 39 - Practical demostration on TGA, DSC and DMA

Lecture 40 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites

Lecture 41 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 42 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 43 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 44 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 45 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM)

Lecture 46 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 47 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 48 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 49 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 50 - Applications of microscopy in polymers, elastomers and composites

Lecture 51 - Applications of microscopy in polymers, elastomers and composites (Continued...)

Lecture 52 - Practical demonstration on optical microscopy

Lecture 53 - Practical demonstration on atomic force microscopy (AFM)

Lecture 54 - Practical demonstration on image processing using standard software (Image)

Lecture 55 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances

Lecture 56 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

Lecture 57 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

Lecture 58 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

Lecture 59 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

Lecture 60 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

NPTEL : NOC:Matlab-Based Programming Lab in Chemical Engineering (Chemical Engineering)

Co-ordinators : Prof. Parag A. Deshpande

Lecture 1 - Motivation for the Lab Course

Lecture 2 - Analysis of the Need of Computers in Process Industries

Lecture 3 - Analysis of the Need of Computers in Process Industries (Continued...)

Lecture 4 - Discussion on Computational Tools available to Chemical Engineers

Lecture 5 - Analysis and Comparison of different Programming Languages

Lecture 6 - MATLAB Primer - Basic Features

Lecture 7 - MALTAB Primer - Writing Codes

Lecture 8 - MATLAB Primer - Coding (Continued...)

Lecture 9 - MATLAB Primer - Coding (Continued...)

Lecture 10 - MATLAB Primer - Plotting and Presentation of Results

Lecture 11 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Problem Definition and Analysis

Lecture 12 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Theory and Solution Strategy

Lecture 13 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Solution of the Problem under ...

Lecture 14 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Solution of the Problem under ...

Lecture 15 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Presentation and Interpretation ...

Lecture 16 - LAB 2 - Steady-state Operation of a Diabatic CSTR Problem Definition and Analysis

Lecture 17 - LAB 2 - Steady-state Operation of a Diabatic CSTR Theory and Solution Strategy

Lecture 18 - LAB 2 - Steady-state Operation of a Diabatic CSTR Solution of the Problem under ...

Lecture 19 - LAB 2 - Steady-state Operation of a Diabatic CSTR Solution of the Problem under ...

Lecture 20 - LAB 2 - Steady-state Operation of a Diabatic CSTR Analysis and Presentation ...

Lecture 21 - LAB 3 - Analysis of multicomponent distillation Problem definition and analysis

Lecture 22 - LAB 3 - Analysis of Multicomponent Distillation Theory and Solution Strategy

Lecture 23 - LAB 3 - Analysis of Multicomponent Distillation Solution of the Problem under Various ...

Lecture 24 - LAB 3 - Analysis of Multicomponent Distillation Solution of the Problem under Various ...

Lecture 25 - LAB 3 - Analysis of Multicomponent Distillation Presentation and Analysis of Results

Lecture 26 - LAB 4 - Analysis of Cooling of a Solid Body in a Reservoir Problem Definition ...

Lecture 27 - LAB 4 - Analysis of Cooling of a Solid Body in a Reservoir Theory and Solution ...

Lecture 28 - LAB 4 - Analysis of Cooling of a Solid Body in a Reservoir Solution of the Problem ...

Lecture 29 - LAB 4 - Analysis of Cooling of a Solid Body in a Reservoir Solution of the Problem ...

Lecture 30 - LAB 4 - Analysis of cooling of a solid body in a reservoir Presentation ...

Lecture 31 - LAB 5 - Analysis of unsteady-state operation of cascade CSTR's Problem Definition ...

Lecture 32 - LAB 5 - Analysis of unsteady-state operation of cascade CSTR's Theory and Solution ...

Lecture 33 - LAB 5 - Analysis of unsteady-state operation of cascade CSTR's Solution of the Problem

Lecture 34 - LAB 5 - Analysis of unsteady-state operation of cascade CSTR's Solution of the problem

Lecture 35 - LAB 5 - Analysis of unsteady-state operation of cascade CSTR's Presentation ...

Lecture 36 - LAB 6 - Analysis of Steady-state Heat Conduction in a 1-D rod

Lecture 37 - LAB 6 - Analysis of Steady-state Heat Conduction in a 1-D rod

Lecture 38 - LAB 6 - Analysis of steady-state Heat Conduction in a 1-D rod

Lecture 39 - LAB 6 - Analysis of steady-state Heat Conduction in a 1-D rod

Lecture 40 - LAB 6 - Analysis of steady-state Heat Conduction in a 1-D rod

Lecture 41 - LAB 7 - Reaction-diffusion in a spherical catalyst pallet Problem definition and ...

Lecture 42 - LAB 7 - Reaction-diffusion in a spherical catalyst pallet Theory and solution strategy

Lecture 43 - LAB 7 - Reaction-diffusion in a spherical catalyst pallet Solution of the problem ...

Lecture 44 - LAB 7 - Reaction-diffusion in a spherical catalyst pallet Solution of the problem ...

Lecture 45 - LAB 7 - Reaction-diffusion in a spherical catalyst pallet Analysis and interpretation ...

Lecture 46 - LAB 8 - Heat conduction in higher dimensions Problem definition and analysis

Lecture 47 - LAB 8 - Heat conduction in higher dimensions Background theory and solution strategy

Lecture 48 - LAB 8 - Heat conduction in higher dimensions Problem solution

Lecture 49 - LAB 8 - Heat conduction in higher dimensions Problem solution (Continued...)

Lecture 50 - LAB 8 - Heat conduction in higher dimensions Problem solution and analysis

Lecture 51 - LAB 9 - Process economics and optimisation Problem definition and analysis

Lecture 52 - LAB 9 - Process economics and optimisation Theory and solution strategy

Lecture 53 - LAB 9 - Process economics and optimisation Solution of the problem

Lecture 54 - LAB 9 - Process economics and optimisation Solution of the problem (Continued...)

Lecture 55 - LAB 9 - Process economics and optimisation Solution of the problem and analysis of ...

Lecture 56 - LAB 10 - Regression and curve - fitting of data Problem definition and analysis

Lecture 57 - LAB 10 - Regression and curve - fitting of data Background theory and solution strategy

Lecture 58 - LAB 10 - Regression and curve - fitting of data Problem solution

Lecture 59 - LAB 10 - Regression and curve - fitting of data Problem solution (Continued...)

Lecture 60 - Review of the course

NPTEL : NOC:Petroleum Technology (Chemical Engineering)

Co-ordinators : Dr. Sonali Sengupta

Lecture 1 - What is Petroleum How it is stored under the earth Exploration of petroleum underground

Lecture 2 - Concept of Seismic Reflection, Introduction to Drilling

Lecture 3 - Drilling Mud and Mechanisms of Recovery of Petroleum

Lecture 4 - Composition of Crude Petroleum and Evaluation of Oil Stocks

Lecture 5 - Evaluation of Oil Stocks: Vaporization Characteristics

Lecture 6 - Primary Processing of Crude Oil: Desalting

Lecture 7 - Primary Processing of Crude Oil: Atmospheric Distillation Unit (ADU)

Lecture 8 - Primary Processing of Crude Oil: Reflux Systems, Vacuum Distillation Unit (VDU)

Lecture 9 - Products and Process Utilities in Primary Processing, Pipe Still Heater

Lecture 10 - Refinery Units

Lecture 11 - Secondary Processing: Decomposition of Residues: Thermal Cracking

Lecture 12 - Coking, Gasification and Steam Cracking

Lecture 13 - Secondary Processing: Decomposition of Residues: Hydrocracking

Lecture 14 - Secondary Processing: Decomposition of Residues: Catalytic Cracking

Lecture 15 - Secondary Processing: Decomposition of Residues: Process description of FCC

Lecture 16 - Properties and Testing of Petroleum Products

Lecture 17 - Properties and Testing of Petroleum Products (Continued...)

Lecture 18 - Properties and Testing of Petroleum Products (Continued...)

Lecture 19 - Properties and Testing of Petroleum Products (Continued...)

Lecture 20 - Properties and Testing of Petroleum Products (Continued...)

Lecture 21 - Petroleum fractions from distillation units

Lecture 22 - Petroleum fractions from distillation units (Continued...)

Lecture 23 - Petroleum fractions from distillation units (Continued...)

Lecture 24 - Petroleum fractions from distillation units (Continued...)

Lecture 25 - Petroleum fractions from distillation units (Continued...)

Lecture 26 - Upgradation of straight run cuts from atmospheric distillation unit

Lecture 27 - Upgradation of straight run cuts from atmospheric distillation unit (Continued...)

Lecture 28 - Upgradation of straight run cuts from atmospheric distillation unit (Continued...)

Lecture 29 - Upgradation of straight run cuts from atmospheric distillation unit (Continued...)

Lecture 30 - Upgradation of straight run cuts from distillation unit

Lecture 31 - Purification processes

Lecture 32 - Purification processes (Continued...)

Lecture 33 - Bitumen preparation processes

Lecture 34 - Grease: preparation, description and application

Lecture 35 - Emission control and effluent treatment in refinery

Lecture 36 - Fundamentals of thermochemistry: Combustion

Lecture 37 - Fundamentals of thermochemistry: Flame

Lecture 38 - Fundamentals of thermochemistry: Adiabatic flame temperature

Lecture 39 - Fundamentals of thermochemistry: Burner

Lecture 40 - Fundamentals of thermochemistry: Internal Combustion engine

NPTEL : NOC:Rheology and Processing of Paints, Plastic and Elastomer Based Composites (Chemical Engineering)

Co-ordinators : Prof. Santanu Chattopadhyay

Lecture 1 - Basic Introduction to Polymer

Lecture 2 - Structure Process Correlation

Lecture 3 - Basic Rheology

Lecture 4 - Classification of Fluids

Lecture 5 - Flow of Liquids Through Various Channels - 1

Lecture 6 - Flow of Liquids Through Various Channels - 2

Lecture 7 - Flow of Liquids Through Various Channels - 3

Lecture 8 - Introduction to Viscometers and Rheometers

Lecture 9 - Ostwald Viscometer, Brookfield Viscometer, Falling Piston Viscometers

Lecture 10 - ODR, MDR, RPA, PPR

Lecture 11 - DMA -In-Light of rheology

Lecture 12 - Master Curve and its Implications

Lecture 13 - Capillary Rheometer

Lecture 14 - Introduction to Paints and importance of rheology in paints

Lecture 15 - Rheology of paints - 1

Lecture 16 - Rheology of paints - 2

Lecture 17 - Rheology of Adhesives and Sealants

Lecture 18 - Rheology of Fiber and Plastics

Lecture 19 - Practical demonstration on Brookfield viscometer and Oswald viscometer

Lecture 20 - Practical demonstration on Mooney viscometer, ODR and MDR

Lecture 21 - Practical demonstration on RPA

Lecture 22 - Practical demonstration on PPR and DMA

Lecture 23 - Practical demonstration on Capillary Rheometer

Lecture 24 - Numeriacal Problems related to basic rhelogy

Lecture 25 - Importance of compounding and introduction to various compounding ingredients

Lecture 26 - Properties and role of various compounding ingredients

Lecture 27 - Surface treatment of reinforcing elements

Lecture 28 - Rhelogy of Elastomers

Lecture 29 - Importance of die swell (correlating with normal force differences)

Lecture 30 - Melt Fracture and other ectrudate instabilities

Lecture 31 - Introduction to plastic and rubber mixing and blending

Lecture 32 - Various mixing equipment and their importance

Lecture 33 - Introduction to Two-Roll Mill and Mixing on Two - Roll Mill 1

Lecture 34 - Introduction to Two-Roll Mill and Mixing on Two - Roll Mill 2

Lecture 35 - Introduction to Internel mixture Kneaders and Mixing using Internel mixture and Kneaders

Lecture 36 - Practical demonstration of Rubber mixing on a two roll and using an internal mixer

Lecture 37 - Molding Techniques

Lecture 38 - Calendering

Lecture 39 - Extrusion

Lecture 40 - Rheology of Injection moulding process

Lecture 41 - Plastic and fiber-related processing

Lecture 42 - Numerical problems related to various processing techniques

Lecture 43 - Wire coating, Garvey die, Profile Extrusion

Lecture 44 - Introduction to FEA based computationalfluid mechanics on extrusion - 1

Lecture 45 - Introduction to FEA based computationalfluid mechanics on extrusion - 2

Lecture 46 - Introduction to FEA based computationalfluid mechanics on extrusion - 3

Lecture 47 - Practical demonstartion on FEA

Lecture 48 - Concluding remarks and commentson applied rheology for advanced learners

NPTEL : NOC:Petroleum Formation Evaluation (Chemical Engineering)

Co-ordinators : Dr. Neetish Kumar Maurya, Dr. Sayantan Ghosh

Lecture 1 - Petroleum Formation Evaluation

Lecture 2 - Mud Logging

Lecture 3 - Mud Logging (Continued...)

Lecture 4 - Coring Operations

Lecture 5 - Coring Operations (Continued...)

Lecture 6 - Wireline Logging

Lecture 7 - Resistivity Log

Lecture 8 - Resistivity Log (Continued...)

Lecture 9 - Resistivity Log (Continued...)

Lecture 10 - Resistivity Log (Continued...)

Lecture 11 - Resistivity Log (Continued...)

Lecture 12 - Resistivity Log (Continued...)

Lecture 13 - Resistivity Log (Continued...)

Lecture 14 - Resistivity Log (Continued...)

Lecture 15 - Resistivity Log (Continued...)

Lecture 16 - Spontaneous Potential Log

Lecture 17 - Spontaneous Potential Log (Continued...)

Lecture 18 - Petrophysical Model

Lecture 19 - Petrophysical Model (Continued...)

Lecture 20 - Gamma Ray Log

Lecture 21 - Gamma Ray Log (Continued...)

Lecture 22 - Gamma Ray Log (Continued...)

Lecture 23 - Caliper Log

Lecture 24 - Porosity Logs

Lecture 25 - Density Porosity Log

Lecture 26 - Density Porosity Log (Continued...)

Lecture 27 - Density Porosity Log (Continued...)

Lecture 28 - Density Porosity Log (Continued...)

Lecture 29 - Density Porosity Log (Continued...)

Lecture 30 - Neutron Porosity Log

Lecture 31 - Neutron Porosity Log (Continued...)

Lecture 32 - Neutron Porosity Log (Continued...)

Lecture 33 - Neutron Porosity Log (Continued...)

Lecture 34 - Neutron Porosity Log (Continued...)

Lecture 35 - Sonic (Acoustic) Porosity Log

Lecture 36 - Sonic Porosity Log (Continued...)

Lecture 37 - Sonic Porosity Log (Continued...)

Lecture 38 - Sonic Porosity Log (Continued...)

Lecture 39 - Sonic Porosity Log (Continued...)

Lecture 40 - NMR Log

Lecture 41 - NMR Log (Continued...)

Lecture 42 - Well Log interpretation

Lecture 43 - Well Log interpretation (Continued...)

Lecture 44 - Well Log interpretation (Continued...)

Lecture 45 - Well Log interpretation (Continued...)

Lecture 46 - Well Log Interpretation (Continued...)

Lecture 47 - Well Log Interpretation (Continued...)

Lecture 48 - Well Log Interpretation (Continued...)

Lecture 49 - Well Log Interpretation (Continued...)

Lecture 50 - Well Log Interpretation (Continued...)

Lecture 51 - Formation Evalution (well log analysis) Practical

Lecture 52 - Formation tops and Core Data

Lecture 53 - Formation Temperature and Shaliness

Lecture 54 - Formation porosity and Water Saturation

Lecture 55 - Permeability and Effective Porosity

Lecture 56 - Determination of Archie Equation Parameters

Lecture 57 - Lithology Determination

Lecture 58 - Net Pay and Well Diagram

Lecture 59 - Rock Typing

Lecture 60 - Miscellaneous Topics

NPTEL : NOC:Momentum Transfer in Fluids (Chemical Engineering)

Co-ordinators : Prof. Somenath Ganguly, Prof. Sunando DasGupta

Lecture 1 - Introduction and Basic Concepts

Lecture 2 - Elementary Framework

Lecture 3 - Elementary Framework (Continued...)

Lecture 4 - Elementary Framework (Continued...)

Lecture 5 - Elementary Framework (Continued...)

Lecture 6 - Shell Momentum Balance - 1

Lecture 7 - Shell Momentum Balance - 2

Lecture 8 - Shell Momentum Balance - 3

Lecture 9 - Shell Momentum Balance - 4

Lecture 10 - Limitations and General Approach - Continuity Equation

Lecture 11 - Elements of Inviscid Flow

Lecture 12 - Elements of Inviscid Flow (Continued...)

Lecture 13 - Elements of Inviscid Flow (Continued...)

Lecture 14 - Elements of Inviscid Flow (Continued...)

Lecture 15 - Elements of Inviscid Flow (Continued...)

Lecture 16 - Equations of Motion - Conceptual Derivation of NS Equations

Lecture 17 - Use of NS Equation for Solving Previous Problems

Lecture 18 - Equations of Motion and Applications - 1

Lecture 19 - Equations of Motion and Applications - 2

Lecture 20 - Equations of Motion and Applications - 3

Lecture 21 - Motion of fluid particles

Lecture 22 - Motion of fluid particles (Continued...)

Lecture 23 - Motion of fluid particles (Continued...)

Lecture 24 - Stream Function and Potential Function

Lecture 25 - Stream Function and Potential Function (Continued...)

Lecture 26 - Equations of Motion and Applications - 4

Lecture 27 - Equations of Motion and Applications - 5

Lecture 28 - Basic Equations in Integral Form - 1

Lecture 29 - Basic Equations in Integral Form - 2

Lecture 30 - Basic Equations in Integral Form - 3

Lecture 31 - Complex Potential

Lecture 32 - Complex Potential (Continued...)

Lecture 33 - Complex Potential (Continued...)

Lecture 34 - Complex Potential (Continued...)

Lecture 35 - Complex Potential (Continued...)

Lecture 36 - Basic Equations in Integral Form - 4

Lecture 37 - Basic Equations in Integral Form - 5

Lecture 38 - Basic Equations in Integral Form - 6

Lecture 39 - Bernoulli's Equation Fundamentals - 1

Lecture 40 - Bernoulli's Equation Fundamentals - 2

Lecture 41 - Elements of Fluid Statics and Associated Problems

Lecture 42 - Elements of Fluid Statics and Associated Problems (Continued...)

Lecture 43 - Elements of Fluid Statics and Associated Problems (Continued...)

Lecture 44 - Dimensional Analysis and Similitude

Lecture 45 - Dimensional Analysis and Similitude (Continued...)

Lecture 46 - Bernoulli's Equation Application - 1

Lecture 47 - Bernoulli's Equation Application - 2

Lecture 48 - Bernoulli's Equation Application - 3

Lecture 49 - Bernoulli's Equation Application - 4

Lecture 50 - Bernoulli's Equation Application - 5

Lecture 51 - Bernoulli's Equation Application - 6

Lecture 52 - Flow meters

Lecture 53 - Pumps

Lecture 54 - Recap of Fluid Dynamics

Lecture 55 - Cavitation and Net Positive Suction Head

Lecture 56 - Flow Metaring and Associated Problems

Lecture 57 - Flow Metaring and Associated Problems (Continued...)

Lecture 58 - Flow Metaring and Associated Problems (Continued...)

Lecture 59 - Turbulence

Lecture 60 - Flow Through Porous Media

NPTEL : NOC:Enhanced Oil Recovery Techniques (Chemical Engineering)

Co-ordinators : Prof. Ajay Mandal

Lecture 1 - Principles of Enhanced Oil Recovery (EOR); Difference of Tertiary recovery

Lecture 2 - Pressure maintenance and Well Patterns

Lecture 3 - Need for EOR and Screening Methods

Lecture 4 - Sweep and Displacement Efficiencies

Lecture 5 - Fundamental of immiscible fluid displacement processes

Lecture 6 - Buckley Leverette Theorem for one dimensional immiscible displacement

Lecture 7 - Welge Method for Oil Recovery Calculation

Lecture 8 - Effects of verious parameters on recovery by water flood

Lecture 9 - Chemical Enhanced Oil Recovery Methods

Lecture 10 - Enhanced Oil Recovery by Polymer Flooding - I

Lecture 11 - Enhanced Oil Recovery by Polymer Flooding - II

Lecture 12 - Enhanced Oil Recovery by Polymer Flooding - III

Lecture 13 - Oil Recovery by Polymer Flooding: Lab Study and Recovery Calculations

Lecture 14 - Surfactant Flooding: Properties of Surfactants

Lecture 15 - Surfactant Flooding for Enhanced Oil recovery - I

Lecture 16 - Surfactant Flooding for Enhanced Oil recovery - II

Lecture 17 - Phase Behaviour of Surfactant Stabilized Microemulsions

Lecture 18 - Surfactant Flooding and Screening Criteria

Lecture 19 - Micellar - Polymer Flooding

Lecture 20 - Microemulsion Flooding

Lecture 21 - Nanoemulsion and Pickering Emulsion for EOR

Lecture 22 - Alkali Flooding for EOR and Monitoring of Chemical Flooding

Lecture 23 - Foam Flooding for EOR

Lecture 24 - Introduction to Miscible Flooding, Thermodynamics of miscibility

Lecture 25 - Thermodynamics of miscibility and Mechanisms of Miscible Displacement

Lecture 26 - Minimum Miscibility Pressure (MMP)

Lecture 27 - Mechanisms of Miscible flooding

Lecture 28 - Enriched Gas Injection/Condensing Gas Drive

Lecture 29 - CO_2 Sequestration, utilisation and storage

Lecture 30 - Mechanisms of CO_2 Miscible flooding

Lecture 31 - Immiscible flooding Mechanisms of CO_2

Lecture 32 - Thermal Oil Recovery Methods

Lecture 33 - Mechanisms of Thermal Oil Recovery

Lecture 34 - Thermal Oil Recovery: Hot Water and Steam flooding

Lecture 35 - Steam Flooding for EOR

Lecture 36 - Steam Assisted Gravity Drainage and Hybrid Steam Injection

Lecture 37 - Thermal Oil Recovery-In-Situ Combustion

Lecture 38 - Air Requirement in In-situ Combustion

Lecture 39 - Electromagnetic heating and Ultrasonication for Enhanced Oil Recovery

Lecture 40 - Low salinity water flooding

Lecture 41 - Low salinity water flooding (Continued...)

Lecture 42 - Low salinity water flooding (Continued...)

Lecture 43 - Low salinity water flooding (Continued...)

Lecture 44 - Low salinity water flooding in Carbonate Reservoir - Smart Water Flooding

Lecture 45 - Nanotechnology based EOR

Lecture 46 - Nanotechnology based EOR (Continued...)

Lecture 47 - Microbial Enhanced Oil Recovery

Lecture 48 - Carbonated water injection (CWI) for EOR

Lecture 49 - Plasma pulse technology and Exothermic Chemical Treatment (ECT) in EOR

Lecture 50 - Enhanced Gas Recoveries

Lecture 51 - Water Shutoff and Profile Modification

Lecture 52 - Reservoir Simulation Studies for Enhanced Oil Recovery

Lecture 53 - Introduction to Artificial Intelligence and Machine Learning in EOR

Lecture 54 - Techno-economic feasibility analysis

Lecture 55 - Review of Classes

Lecture 56 - Review of Classes (Continued...)

Lecture 57 - Review of Classes (Continued...)

Lecture 58 - Case Studies of EOR Methods

Lecture 59 - Case Studies of EOR Methods (Continued...)

Lecture 60 - Role of Petroleum Engineering for design and operation of EOR Methods

NPTEL : NOC:Adsorption Science and Technology: Fundamentals and Applications (Chemical Engineering)

Co-ordinators : Prof. Sourav Mondal

Lecture 1 - Background of Adsorption

Lecture 2 - Adsorbents

Lecture 3 - Key Features of Adsorption, Thermodynamic Background

Lecture 4 - Adsorption Isotherm

Lecture 5 - Langmuir Isotherm

Lecture 6 - Multicomponent Langmuir and Other Isotherms

Lecture 7 - Other Important Isotherms (Continued...)

Lecture 8 - Equilibrium Modelling - I

Lecture 9 - Equilibrium Modelling - II

Lecture 10 - Adsorption Kinetics

Lecture 11 - BET Analysis

Lecture 12 - Gas Sorption

Lecture 13 - Surface Area Calculations

Lecture 14 - Pore Size Analysis

Lecture 15 - Limitations of BET Analysis

Lecture 16 - Adsorption and Diffusion Models

Lecture 17 - Film Diffusion

Lecture 18 - Linear Driving Force Model

Lecture 19 - Intraparticle Adsorption Diffusion Model

Lecture 20 - Slurry Adsorption

Lecture 21 - Fixed Bed Adsorption

Lecture 22 - Mass Transfer Zone Modelling

Lecture 23 - Fixed Bed Design: Thomas Model

Lecture 24 - Fixed Bed Design: Adams-Bohart and Other Models

Lecture 25 - Fixed Bed Design: Constant Pattern Behaviour

Lecture 26 - Fixed Bed Design: Multi-Scale Model

Lecture 27 - Fixed Bed Adsorption: Illustrative Problems

Lecture 28 - Introduction to Pressure Swing Adsorption (PSA)

Lecture 29 - Modelling PSA Systems

Lecture 30 - Design of Medical Grade Oxygen Concentrator

Lecture 31 - Introduction to Chromatography

Lecture 32 - Chromatography: Principles

Lecture 33 - Column Chromatography

Lecture 34 - Chromatography: Illustrative Problems 1

Lecture 35 - Chromatography: Illustrative Problems 2

Lecture 36 - Ion Exchange: Principles

Lecture 37 - Ion Exchange Adsorbents

Lecture 38 - Ion Exchange: Illustrative Problem

Lecture 39 - Ion Exchange Cycle

Lecture 40 - Ion Exchange Cycle: Illustrative Problem

NPTEL : Chemical Engineering Thermodynamics (Chemical Engineering)

Co-ordinators : Prof. M.S. Ananth

Lecture 1 - Thermodynamics and the Chemical Industry

Lecture 2 - James Prescot Joule and the first law

Lecture 3 - Sadi Carnot and the second law

Lecture 4 - Equilibrium and Extrema in work

Lecture 5 - Illustrative Calculations - I

Lecture 6 - Properties of pure substances

Lecture 7 - The p-h chart

Lecture 8 - Work calculation

Lecture 9 - Illustrative Calculations - II

Lecture 10 - Heat-Work Interconversion Devices

Lecture 11 - Refrigeration / Thermodynamics of mixtures

Lecture 12 - The Gibbs Duhem equation

Lecture 13 - Models for Excess Gibbs Free Energy

Lecture 14 - Van Laar model

Lecture 15 - Gaseous and liquid mixtures

Lecture 16 - Separation Work / Equations of state

Lecture 17 - Chemical potentials in gas and condensed phases

Lecture 18 - Vapour Liquid Equilibria - I

Lecture 19 - Vapour Liquid Equilibria - II

Lecture 20 - Solvent-Solvent mixtures

Lecture 21 - Solvent-Solute mixtures

Lecture 22 - Liquid-liquid equilibria

Lecture 23 - An industrial example

Lecture 24 - Liquid-liquid equilibria / Reaction Equilibria

Lecture 25 - Reaction Equilibria

Lecture 26 - Illustrative Examples - I

Lecture 27 - Illustrative Examples - II

Lecture 28 - Illustrative Examples - III

Lecture 29 - Simultaneous Relations

Lecture 30 - Thermodynamic Consistency / Reverse Osmosis

Lecture 31 - Miscellaneous topics in phase equilibria

Lecture 32 - Absorption Refrigeration

Lecture 33 - Summary of Classical Thermodynamics

Lecture 34 - Molecular basis of Thermodynamics - I

Lecture 35 - Molecular basis of Thermodynamics - II

NPTEL : Computational Fluid Dynamics (Chemical Engineering)

Co-ordinators : Prof. Sreenivas Jayanti

Lecture 1 - Motivation for CFD and Introduction to the CFD approach

Lecture 2 - Illustration of the CFD approach through a worked out example

Lecture 3 - Eulerian approach, Conservation Equation, Derivation of Mass Conservation Equation and Statement of the momentum conservation equation

Lecture 4 - Forces acting on a control volume; Stress tensor; Derivation of the momentum conservation equation ; Closure problem; Deformation of a fluid element in fluid flow

Lecture 5 - Kinematics of deformation in fluid flow; Stress vs strain rate relation; Derivation of the Navier-Stokes equations

Lecture 6 - Equations governing flow of incompressible flow; Initial and boundary conditions; Wellposedness of a fluid flow problem

Lecture 7 - Equations for some simple cases; Generic scalar transport equation form of the governing equations; Outline of the approach to the solution of the N-S equations.

Lecture 8 - cut out the first 30s; Spatial discretization of a simple flow domain; Taylorâ€™s series expansion and the basis of finite difference approximation of a derivative; Central and one-sided difference approximations; Order of accuracy of finite difference ap

Lecture 9 - Finite difference approximation of pth order of accuracy for qth order derivative; cross -derivatives; Examples of high order accurate formulae for several derivatives

Lecture 10 - One -sided high order accurate approximations; Explicit and implicit formulations for the time derivatives

Lecture 11 - Numerical solution of the unsteady advection equation using different finite difference approximations

Lecture 12 - Need for analysis of a discretization scheme; Concepts of consistency, stability and convergence and the equivalence theorem of Lax ; Analysis for consistency

Lecture 13 - Statement of the stability problem; von Neumann stability analysis of the first order wave equation

Lecture 14 - Consistency and stability analysis of the unsteady diffusion equation; Analysis for two- and three -dimensional cases; Stability of implicit schemes

Lecture 15 - Interpretation of the stability condition; Stability analysis of the generic scalar equation and the concept of upwinding ; Diffusive and dissipative errors in numerical solution; Introduction to the concept of TVD schemes

Lecture 16 - Template for the generic scalar transport equation and its extension to the solution of Navier-Stokes equa tions for a compressible flow.

Lecture 17 - Illustration of application of the template using the MacCormack scheme for a three-dimensional compressible flow

Lecture 18 - Stability limits of MacCormack scheme; Limitations in extending compressible flow schemes to incompre ssible flows ; Difficulty of evaluation of pressure in incompressible flows and listing of various approaches

Lecture 19 - Artificial compressibility method and the streamfunction-vorticity method for the solution of NS equations and their limitations

Lecture 20 - Pressur e equation method for the solution of NS equations

Lecture 21 - Pressure-correction approach to the solution of NS equations on a staggered grid; SIMPLE and its family of methods

Lecture 22 - Need for effici ent solution of linear algebraic equations; Classification of approaches for the solution of linear algebraic equations.

Lecture 23 - Direct methods for linear algebraic equations; Gaussian elimination method

Lecture 24 - Gauss-Jordan method; LU decomposition method; TDMA and Thomas algorithm

Lecture 25 - Basic iterative methods for linear algebraic equations: Description of point -Jacobi, Gauss-Seidel and SOR methods

Lecture 26 - Convergence analysis of basic iterative schemes; Diagonal dominance condition for convergence; Influence of source terms on the diagonal dominance condition; Rate of convergence

Lecture 27 - Application to the Laplace equation

Lecture 28 - Advanced iterative methods: Alternating Direction Implicit Method; Operator splitting

Lecture 29 - Advanced iterative methods; Strongly Implicit Proc edure; Conjugate gradient method; Multigrid method

Lecture 30 - Illustration of the Multigrid method for the Laplace equation

Lecture 31 - Overview of the approach of numerical solution of NS equations for simple domains; Introduction to complexity arising from physics and geometry

Lecture 32 - Derivation of the energy conservation equation

Lecture 33 - Derivation of the species conservation equation; dealing with chemical reactions

Lecture 34 - Turbulence; Characteri stics of turbulent flow; Dealing with fluctuations and the concept of time-averaging

Lecture 35 - Derivation of the Reynolds -averaged Navier -Stokes equations; identification of the closure problem of turbulence; Boussinesq hypothesis and eddy viscosity

Lecture 36 - Reynol ds stresses in turbulent flow; Time and length scales of turbulence; Energy cascade; Mixing length model for eddy viscosity

Lecture 37 - One-equation model for turbulent flow

Lecture 38 - Two -equation model for turbulent flow; Numerical calculation of turbulent reacting flows

Lecture 39 - Calculation of near-wall region in turbulent flow; wall function approach; near-wall turbulence models

Lecture 40 - Need for special methods for dealing with irregular flow geometry; Outline of the Body-fitted grid approach ; Coordinate transformation to a general, 3-D curvilinear system

Lecture 41 - Transformation of the governing equations; Illustration for the Laplace equation; Appearance and significance of cross - derivative terms; Concepts of structured and unstructured grids.

Lecture 42 - Finite vol ume method for complicated flow domain; Illustration for the case of flow through a duct of triangular cross - section.

Lecture 43 - Finite volume method for the general case

Lecture 44 - Generation of a structured grid for irregular flow domain; Algebraic methods; Elliptic grid generation method

Lecture 45 - Unstructured grid generation; Domain nodalization; Advancing front method for triangulation

Lecture 46 - Delaunay triangulation method for unstructured grid generation

Lecture 47 - Co -located grid approach for irregular geometries; Pressure correction equation for a co -located structured grid; Pressure correction equation for a co-located unstructured grid.

NPTEL : Computational Techniques (Chemical Engineering)

Co-ordinators : Dr. Niket S. Kaisare

Lecture 1 - Introduction

Lecture 2 - Computational and Error Analysis

Lecture 3 - Linear Equations - Part 1

Lecture 4 - Linear Equations - Part 2

Lecture 5 - Linear Equations - Part 3

Lecture 6 - Linear Equations - Part 4

Lecture 7 - Linear Equations - Part 5

Lecture 8 - Linear Equations - Part 6

Lecture 9 - Non Linear Algebraic Equations - Part 1

Lecture 10 - Non Linear Algebraic Equations - Part 2

Lecture 11 - Non Linear Algebraic Equations - Part 3

Lecture 12 - Non Linear Algebraic Equations - Part 4

Lecture 13 - Non Linear Algebraic Equations - Part 5

Lecture 14 - Non Linear Algebraic Equations - Part 6

Lecture 15 - Regression and Interpolation - Part 1

Lecture 16 - Regression and Interpolation - Part 2

Lecture 17 - Regression and Interpolation - Part 3

Lecture 18 - Regression and Interpolation - Part 4

Lecture 19 - Regression and Interpolation - Part 5

Lecture 20 - Differentiation and Integration - Part 1

Lecture 21 - Differentiation and Integration - Part 2

Lecture 22 - Differentiation and Integration - Part 3

Lecture 23 - Differentiation and Integration - Part 4

Lecture 24 - Differentiation and Integration - Part 5

Lecture 25 - Ordinary Differential Equations (initial value problems) - Part 1

Lecture 26 - Ordinary Differential Equations (initial value problems) - Part 2

Lecture 27 - Ordinary Differential Equations (initial value problems) - Part 3

Lecture 28 - Ordinary Differential Equations (initial value problems) - Part 4

Lecture 29 - Ordinary Differential Equations (initial value problems) - Part 5

Lecture 30 - Ordinary Differential Equations (initial value problems) - Part 6

Lecture 31 - Ordinary Differential Equations (initial value problems) - Part 7

Lecture 32 - Ordinary Differential Equations (initial value problems) - Part 8

Lecture 33 - Ordinary Differential Equations (initial value problems) - Part 9

Lecture 34 - Ordinary Differential Equations (boundary value problems) - Part 1

Lecture 35 - Ordinary Differential Equations (boundary value problems) - Part 2

Lecture 36 - Ordinary Differential Equations (boundary value problems) - Part 3

Lecture 37 - Partial Differential Equations - Part 1

Lecture 38 - Partial Differential Equations - Part 2

Lecture 39 - Partial Differential Equations - Part 3

Lecture 40 - Partial Differential Equations - Part 4

NPTEL : Particle Characterization (PG) (Chemical Engineering)

Co-ordinators : Dr. R. Nagarajan

Lecture 1 - Introduction: Why study particle characterization?

Lecture 2 - Introduction: Classification of particle characteristics

Lecture 3 - Morphological Characterization: Shape analysis methods

Lecture 4 - Morphological Characterization: Techniques of shape assessment

Lecture 5 - Morphological Characterization: Decision rules

Lecture 6 - Morphological Characterization: Static vs dynamic methods of size analysis

Lecture 7 - Morphological Characterization: Static methods of size analysis

Lecture 8 - Morphological Characterization: Light scattering from spherical particles

Lecture 9 - Morphological Characterization: Particle counters

Lecture 10 - Morphological Characterization: Particle size distributions

Lecture 11 - Morphological Characterization: Acoustic Attenuation Spectroscopy

Lecture 12 - Morphological Characterization: Nano-particle size analysis

Lecture 13 - Structural Characterization

Lecture 14 - Interfacial Characterization

Lecture 15 - Surface Adhesion: Forces

Lecture 16 - Surface Adhesion: Electrostatic & Surface-Tension Forces

Lecture 17 - Surface Adhesion: Adhesion Force Measurement

Lecture 18 - Particle Removal: Methods

Lecture 19 - Particle Removal: Wet Cleaning

Lecture 20 - Particle Cohesion: Forces

Lecture 21 - Particle Cohesion: Flowability Implications

Lecture 22 - Transport Properties: Diffusion & Electrostatic Field Effects

Lecture 23 - Transport Properties: Drag & Inertia

Lecture 24 - Transport Properties: Deposition Fluxes & Rates

Lecture 25 - Transport Properties: Illustrative Application

Lecture 26 - Chemical & Compositional Characterization: Reactivity

Lecture 27 - Chemical & Compositional Characterization: Analytical Methods

Lecture 28 - Chemical & Compositional Characterization: XRD & AFM

Lecture 29 - Nano-particle Characterization: Bottom-Up Synthesis Methods

Lecture 30 - Nano-particle Characterization: Top-Down Synthesis Methods

Lecture 31 - Nano-particle Characterization: Dispersion

Lecture 32 - Nano-particle Characterization: Properties & Techniques

Lecture 33 - Practical Relevance of Particle Characterization: Nano-Fluids

Lecture 34 - Practical Relevance of Particle Characterization: Filtration

Lecture 35 - Practical Relevance of Particle Characterization: Cleanrooms

Lecture 36 - Practical Relevance of Particle Characterization: High-Technology Manufacturing

Lecture 37 - Practical Relevance of Particle Characterization: Explosivity

Lecture 38 - Practical Relevance of Particle Characterization: Environment & Human Health

Lecture 39 - Practical Relevance of Particle Characterization: Other Applications

Lecture 40 - Summary

NPTEL : Statistics for Experimentalists (Chemical Engineering)

Co-ordinators : Dr. A. Kannan

Lecture 1 - Introduction

Lecture 2 - Random Variables

Lecture 3 - Discrete Probability Distributions

Lecture 4 - Example Set - I

Lecture 5 - Continuous probability distributions

Lecture 6 - Normal probability distribution

Lecture 7 - Exploratory Data Analysis - Part A

Lecture 8 - Exploratory Data Analysis - Part B

Lecture 9 - Example Set - II

Lecture 10 - Example Set - III

Lecture 11 - Random samples: Sampling distribution of the mean (Part A)

Lecture 12 - Random samples: Sampling distribution of the mean (Part B)

Lecture 13 - Point Estimation

Lecture 14 - Sampling distributions and the Central Limit Theorem

Lecture 15 - Example Set - IV Part A

Lecture 16 - Estimation of Population Parameters Using Moments

Lecture 17 - Confidence Intervals (Part A)

Lecture 18 - Confidence Intervals (Part B)

Lecture 19 - The T-distribution

Lecture 20 - Chi-square distribution

Lecture 21 - F-Distribution

Lecture 22 - Example Set - V

Lecture 23 - Hypothesis Testing - Part A

Lecture 24 - Hypothesis Testing - Part B

Lecture 25 - Hypothesis Testing - Part C

Lecture 26 - Analysis of Experiments involving Single Factor - Part A

Lecture 27 - Analysis of Experiments involving Single Factor - Part B

Lecture 28 - Blocking and Randomization

Lecture 29 - Example Set - VI - Part A

Lecture 30 - Example Set - VI - Part B

Lecture 31 - Factorial Design of Experiments - Part A

Lecture 32 - Factorial Design of Experiments - Part B: 22 Factorial Design

Lecture 33 - Fractional Factorial Design - Part A

Lecture 34 - Fractional Factorial Design - Part B

Lecture 35 - Factorial Design of Experiments: Example Set (Part A)

Lecture 36 - Factorial Design of Experiments: Example Set (Part B)

Lecture 37 - Factorial Design of Experiments: Example Set (Part C)

Lecture 38 - Regression Analysis: Part A

Lecture 39 - Regression Analysis: Part B

Lecture 40 - Hypothesis Testing in Linear Regression

Lecture 41 - Discussion on Regression Output

Lecture 42 - Regression Analysis: Example Set 8

Lecture 43 - Regression Analysis: Example Set 8 (Continued...)

Lecture 44 - Regression Analysis: Example Set 8 (Continued...)

Lecture 45 - Orthogonal Model Fitting Concepts - Part A

Lecture 46 - Orthogonal Model Fitting Concepts - Part B

Lecture 47 - Experimental Design Strategies - A

Lecture 48 - Experimental Design Strategies - B

Lecture 49 - Experimental Design Strategies - C

Lecture 50 - Response Surface Methodology - A

Lecture 51 - Response Surface Methodology - B

Lecture 52 - Optimal Designs - Part A

Lecture 53 - Optimal Designs - Part B

Lecture 54 - Statistics for Experimentalists - Summary Part A

Lecture 55 - Statistics for Experimentalists - Summary Part B

NPTEL : Multiphase flows:Analytical solutions and Stability Analysis (Chemical Engineering)

Co-ordinators : Prof. S. Pushpavanam

Lecture 1 - Introduction and overview of the course: Multiphase flows

Lecture 2 - Stratified flow in a micro channel: Velocity profiles

Lecture 3 - Stratified flow in a micro channel: Effects of physical parameters

Lecture 4 - Flow regimes in microchannels: Modeling and Experiments

Lecture 5 - Scaling Analysis: Introduction

Lecture 6 - Scaling Analysis: Worked Examples

Lecture 7 - Interfacial tension and its role in Multiphase flows

Lecture 8 - Eulerian and Lagrangian approaches

Lecture 9 - Reynolds Transport Theorem and the Equation of Continuity

Lecture 10 - Derivation of Navier-Stokes equation

Lecture 11 - Vector operations in general orthogonal coordinates: Grad., Div., Lapacian

Lecture 12 - Normal and shear stresses on arbitrary surfaces: Force balance

Lecture 13 - Normal and shear stresses on arbitrary surfaces: Stress Tensor formulation

Lecture 14 - Stresses on deforming surfaces: Introduction to Perturbation Theory

Lecture 15 - Pulsatile flow: Analytical solution

Lecture 16 - Pulsatile flow: Analytical solution and perturbation solution for Rw 1

Lecture 17 - Pulsatile flow: Perturbation solution for Rw 1

Lecture 18 - Viscous heating: Apparent viscosity in a viscometer

Lecture 19 - Domain perturbation methods: Flow between wavy walls

Lecture 20 - Flow between wavy walls: Velocity profile

Lecture 21 - Introduction to stability of dynamical systems: ODEs

Lecture 22 - Stability of distributed systems (PDEs): reaction diffusion example

Lecture 23 - Stability of a reaction-diffusion system (Continued...)

Lecture 24 - Rayleigh-Benard convection: Physics and governing equations

Lecture 25 - Rayleigh-Benard convection: Linear stability analysis - Part 1

Lecture 26 - Rayleigh-Benard convection: Linear stability analysis - Part 2

Lecture 27 - Rayleigh-Benard convection: Linear stability analysis - Part 3

Lecture 28 - Rayleigh Benard convection: Discussion of results

Lecture 29 - Rayleigh-Taylor â€˜heavy over lightâ€™ instability

Lecture 30 - Rayleigh-Taylor instability (Continued...)

Lecture 31 - Capillary jet instability: Problem formulation

Lecture 32 - Capillary jet instability: Linear stability analysis

Lecture 33 - Capillary jet instability: Rayleighâ€™s Work Principle

Lecture 34 - Tutorial Session: Solution of Assignment 4 on linear stability

Lecture 35 - Turing patterns: Instability in reaction-diffusion systems

Lecture 36 - Turing patterns: Results

Lecture 37 - Marangoni convection: Generalised tangential and normal stress boundary conditions

Lecture 38 - Marangoni convection: Stability analysis

Lecture 39 - Flow in a circular curved channel: Governing equations and scaling

Lecture 40 - Flow in a circular curved channel: Solution by regular perturbation

Lecture 41 - Stability of flow through curved channels: Problem formulation

Lecture 42 - Stability of flow through curved channels: Numerical calculation

Lecture 43 - Viscous Fingering: Darcyâ€™s law

Lecture 44 - Viscous Fingering: Stability analysis

Lecture 45 - Shallow Cavity flows

NPTEL : NOC:Introduction to Time-Frequency Analysis and Wavelet Transforms (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

Lecture 1 - Introduction - Lecture 1.1 A

Lecture 2 - Introduction - Lecture 1.1 B

Lecture 3 - Introduction - Lecture 1.2 A

Lecture 4 - Introduction - Lecture 1.2 B

Lecture 5 - Basic Definitions and concepts - Lecture 2.1 (Basic Definitions and concepts - Part I)

Lecture 6 - Basic Definitions and concepts - Lecture 2.2 (Basic Definitions and concepts - Part II)

Lecture 7 - Basic Definitions and concepts - Lecture 2.3 (Basic Definitions and concepts - Part III)

Lecture 8 - A review of Fourier transforms - Lecture 3.1 (Continuous time Fourier series)

Lecture 9 - A review of Fourier transforms - Lecture 3.2 (Continuous time Fourier transform)

Lecture 10 - A review of Fourier transforms - Lecture 3.3 (Discrete time Fourier series)

Lecture 11 - A review of Fourier transforms - Lecture 3.4 (Discrete time Fourier transform)

Lecture 12 - A review of Fourier transforms - Lecture 3.5 (Properties of Fourier transforms)

Lecture 13 - A review of Fourier transforms - Lecture 3.6 (Discrete Fourier transform)

Lecture 14 - A review of Fourier transforms - MATLAB demo of Fourier transform and periodogram

Lecture 15 - Duration and Bandwidth - Duration and Bandwidth

Lecture 16 - Duration and Bandwidth - Bandwidth equation and Instantaneous frequency

Lecture 17 - Duration and Bandwidth - Instantaneous frequency and analytic signals

Lecture 18 - Duration and Bandwidth - Duration-Bandwidth principle

Lecture 19 - Duration and Bandwidth - Requirements of time-frequency anlysis techniques

Lecture 20 - Duration and Bandwidth - Requirements of time-frequency analysis and techniques

Lecture 21 - Short-time Fourier transform - Short-time Fourier transform

Lecture 22 - Short-time Fourier transform - Auxillary (MATLAB demonstration)

Lecture 23 - Short-time Fourier transform - Properties of STFT

Lecture 24 - Practical aspects of STFT

Lecture 25 - Closing Remarks

Lecture 26 - Wigner-Ville Distributions

Lecture 27 - Properties of WVD

Lecture 28 - Properties of WVD 2

Lecture 29 - Discrete WVD

Lecture 30 - Pseudo and Smoothed WVD

Lecture 31 - Cohens class and smoothed WVD

Lecture 32 - Cohens class and smoothed WVD

Lecture 33 - Cohens class and Ambiguity functions

Lecture 34 - Affine class and closing remarks

Lecture 35 - Continuous Wavelet Transform

Lecture 36 - Continuous Wavelet Transforms

Lecture 37 - Scale to Frequency

Lecture 38 - Computational aspects of CWT

Lecture 39 - Scalogram and MATLAB demonstration

Lecture 40 - Scalogram and MATLAB demonstration

Lecture 41 - Scaling function

Lecture 42 - Scaling Function

Lecture 43 - Wavelets

Lecture 44 - Wavelets

Lecture 45 - Applications of CWT

Lecture 46 - Applications of CWT

Lecture 47 - Discrete Wavelet Transform

Lecture 48 - Discrete Wavelet Transform.

Lecture 49 - Orthogonal scaling function bases and MRA

Lecture 50 - Orthogonal scaling function bases and MRA.

Lecture 51 - Wavelet Filters and Fast DWT Algorithm

Lecture 52 - Wavelet Filters and Fast DWT Algorithm (Continued...)

Lecture 53 - Wavelet Filters and Fast DWT Algorithm (Continued...)

Lecture 54 - Wavelets for DWT

Lecture 55 - Wavelets for DWT (Continued...)

Lecture 56 - Wavelets for DWT (Continued...)

Lecture 57 - DWT computation

Lecture 58 - DWT computation (Continued...)

Lecture 59 - DWT computation (Continued...)

NPTEL : Chemical Engineering Principles of CVD Processes (Chemical Engineering)

Co-ordinators : Dr. R. Nagarajan

Lecture 1 - Introduction

Lecture 2 - CVD Reactor and Process Design Fundamentals

Lecture 3 - Overview of CVD Process Fundamentals

Lecture 4 - Basics of Chemical Equilibrium Calculations and Flow Dynamics

Lecture 5 - Introduction to CVD Films

Lecture 6 - Film Structure and Properties

Lecture 7 - Pressure Effects on CVD Processes

Lecture 8 - CVD of Metals

Lecture 9 - CVD of Coatings

Lecture 10 - CVD Film Property Measurements

Lecture 11 - CVD Film Property Measurements: Qualitative and Quantitative

Lecture 12 - CVD in Tungsten Filament Lamps

Lecture 13 - CVD in Tungsten Filament Lamps: Design Aspects

Lecture 14 - CVD in Hot Corrosion

Lecture 15 - CVD Transport Phenomena: Conservation Equations

Lecture 16 - CVD Transport Phenomena: Constitutive Laws

Lecture 17 - CVD Transport Phenomena: Mass Transfer Mechanisms

Lecture 18 - CVD Transport Phenomena: Mass Transfer Analogy Condition (MTAC)

Lecture 19 - CVD Transport Phenomena: Effect of Homogeneous Reactions on MTAC

Lecture 20 - CVD Applications: Hot Filament CVD (HFCVD)

Lecture 21 - CVD Applications: Aerosol CVD (ACVD)

Lecture 22 - CVD Applications: CVD of Silicon

Lecture 23 - CVD Applications: CVD in Free-Molecular Flow Regime (FMFR)

Lecture 24 - CVD Applications: CVD of nano-Structured Films

Lecture 25 - CVD Overview

Lecture 26 - Review of CVD Basics: Part-I (PDF Lecture)

Lecture 27 - Review of CVD Basics: Part-II (PDF Lecture)

Lecture 28 - CVD Question Bank (PDF Lecture)

Lecture 29 - Basics of Nano-Structured Material Synthesis: Part-I

Lecture 30 - Basics of Nano-Structured Material Synthesis: Part-II

Lecture 31 - Undesirable CVD: Bulb-Blackening (Adobe Presenter)

Lecture 32 - Undesirable CVD: Moolten Salt Deposition in Combustion Systems (Adobe Presenter)

Lecture 33 - Undesirable CVD: Hot Corrosion (Adobe Presenter)

Lecture 34 - Multi-component Transport Fundamentals: Assumptions and Control Volumes (Adobe Presenter)

Lecture 35 - Multi-component Transport Fundamentals: Mass Conservation Equations (Adobe Presenter)

Lecture 36 - Multi-component Transport Fundamentals: Momentum and Energy Conservation (Adobe Presenter)

Lecture 37 - Multi-component Transport Fundamentals: Entropy conservation (Adobe Presenter)

Lecture 38 - Multi-component Transport Fundamentals: Constitutive Laws for Mass and Momentum (Adobe Presenter)

Lecture 39 - Multi-component Transport Fundamentals: Constitutive Laws for Energy and Entropy (Adobe Presenter)

NPTEL : Chemical Reaction Engineering 1 (Homogeneous Reactors) (Chemical Engineering)

Co-ordinators : Prof K. Krishnaiah

Lecture 1 - Motivation and Introduction - Part I

Lecture 2 - Motivation and Introduction - Part II

Lecture 3 - What is Chemical Engineering - Part I

Lecture 4 - What is Chemical Engineering - Part II

Lecture 5 - What is Chemical Reaction Engineering - Part I

Lecture 6 - What is Chemical Reaction Engineering - Part II

Lecture 7 - Homogeneous and Heterogeneous Reactions - Part I

Lecture 8 - Homogeneous and Heterogeneous Reactions - Part II

Lecture 9 - Basics of Kinetics and Contacting

Lecture 10 - Design of Batch reactors - Part I

Lecture 11 - Design of Batch reactors - Part II

Lecture 12 - Basics of Plug Flow Reactor - Part I

Lecture 13 - Basics of Plug Flow Reactor - Part II

Lecture 14 - Design of Plug Flow Reactors - Part I

Lecture 15 - Design of Plug Flow Reactors - Part II

Lecture 16 - Basics of Mixed Flow Reactors

Lecture 17 - Design of Mixed Flow Reactors

Lecture 18 - Basics of Kinetics

Lecture 19 - Kinetics of Heterogeneous reactions - Part I

Lecture 20 - Kinetics of Heterogeneous reactions - Part II

Lecture 21 - Kinetics of Heterogeneous reactions - Part III

Lecture 22 - Kinetics of Homogeneous reactions

Lecture 23 - Reaction rate for Homogeneous reactions

Lecture 24 - Gas Phase Homogeneous reactions

Lecture 25 - (Continued...) And later Reactor Design of PFR

Lecture 26 - Reactor Design for MFR and Combination of reactors

Lecture 27 - PFR and MFR in series.

Lecture 28 - Unsteady state MFR and PFR

Lecture 29 - Recycle Reactors

Lecture 30 - Recycle Reactors (Autocatalytic reactions) - Part I

Lecture 31 - Recycle Reactors (Autocatalytic reactions) - Part II

Lecture 32 - Multiple Reactions - Part I

Lecture 33 - Multiple Reactions - Part II

Lecture 34 - Multiple Reactions - Part III

Lecture 35 - Multiple Reactions - Part IV

Lecture 36 - Multiple Reactions - Part V

Lecture 37 - Multiple Reactions - Part VI

Lecture 38 - Non-Isothermal Reactors - Part I

Lecture 39 - Non-Isothermal Reactors - Part II

Lecture 40 - Non-Isothermal Reactors (Graphical Design)

Lecture 41 - Non-Isothermal Reactors contd. & Adiabatic Reactors

Lecture 42 - Non-Isothermal Reactors (Graphical Design) (Continued...)

Lecture 43 - Non-Isothermal Batch Reactors

Lecture 44 - Non-isothermal Plug Flow Reactors - Part I

Lecture 45 - Non-isothermal Plug Flow Reactors - Part II

Lecture 46 - Adiabatic Plug Flow Reactors

Lecture 47 - Non-isothermal Mixed Flow Reactors

Lecture 48 - Non-isothermal Mixed Flow Reactors (Continued...) (Multiple steady states) - Part I

Lecture 49 - Non-isothermal Mixed Flow Reactors (Continued...) (Multiple steady states) - Part II

Lecture 50 - Non-Ideal Flow and Residence Time Distributions (RTD) basics - Part I

Lecture 51 - Non-Ideal Flow and Residence Time Distributions (RTD) basics - Part II

Lecture 52 - RTD for various reactors (Continued...) Part I

Lecture 53 - RTD for various reactors (Continued...) Part II

Lecture 54 - Diagnosing the ills of equipments and Various RTD Models

Lecture 55 - Dispersion Model

Lecture 56 - Dispersion with reaction Model and Tanks in Series Model

Lecture 57 - Multi-parameter model (MFR with dead space and bypass)

Lecture 58 - Direct use of RTD to predict conversion (Macro and Micro-fluid as well as Macro & Micro-mixing Concept) Part I

Lecture 59 - Direct use of RTD to predict conversion (Macro and Micro-fluid as well as Macro & Micro-mixing Concept) Part II

Lecture 60 - Direct use of RTD to predict conversion (Macro and Micro-fluid as well as Macro & Micro-mixing Concept) Part III

NPTEL : Chemical Reaction Engineering 2 (Heterogeneous Reactors) (Chemical Engineering)

Co-ordinators : Prof K. Krishnaiah

Lecture 1 - Introduction to Kinetics (Gas solid non-catalytic reaction)

Lecture 2 - Intro to Kinetics (Continued...) for catalytic reactions in different reactors

Lecture 3 - Heterogeneous rate of reactions and different types of kinetic models for non-catalytic reactions

Lecture 4 - Basics of Kinetics of type A & B reactions (Shrinking core model & Porous particle homogeneous model)

Lecture 5 - Shrinking Core Model (Continued...)

Lecture 6 - Shrinking Core Model (Continued...)

Lecture 7 - (Continued...) & Proof of Pseudo steady state assumption

Lecture 8 - Shrinking core model (Continued...) for type D reactions

Lecture 9 - Shrinking core model (Continued...) for type D reactions (Continued...)

Lecture 10 - Reactors, Homogeneous reaction model, Design of non-catalytic gas solid reactors

Lecture 11 - Design of non-catalytic gas solid reactors (Continued...)

Lecture 12 - Design of non-catalytic gas solid reactors (Continued...)

Lecture 13 - Design equation for MF of solids, uniform gas composition, const. single particle size, Shrinking core model.

Lecture 14 - Design equation for MF of solids, mixture of particles for different sizes but unchanging size, uniform gas composition, SCM

Lecture 15 - Design equation for MF of solids with elutriation, mixture of particles of different size, uniform gas composition, SCM

Lecture 16 - General Performance equation for non-catalytic gas solid reactions

Lecture 17 - Catalytic reactions (LHHW Kinetic model)

Lecture 18 - LHHW Kinetic model (Continued...) - Part I

Lecture 19 - LHHW Kinetic model (Continued...) - Part II

Lecture 20 - Industrially important catalytic reaction models

Lecture 21 - Inter and Intraphase effectiveness fator

Lecture 22 - Interface effectiveness factor & Generalized nonisothermal effectiveness factor for external mass transfer stepÂ…

Lecture 23 - Generalized nonisothermal effectiveness factor for external mass transfer step (Continued...)

Lecture 24 - Mass transfer correlations for various reactors

Lecture 25 - Isothermal intraphase effectiveness factor - Part I

Lecture 26 - Isothermal intraphase effectiveness factor - Part II

Lecture 27 - Non-isothermal intraphase effectiveness factor

Lecture 28 - Inter and Intraphase effectiveness factor (Continued...)

Lecture 29 - Inter and Intraphase Mass transfer

Lecture 30 - Packed (fixed) bed catalytic reactor design

Lecture 31 - Graphical design of Fixed bed reactors

Lecture 32 - Packed Bed Design (Continued...)

Lecture 33 - Design equations for Packed bed reactor design

Lecture 34 - Conservative Equations for Packed bed Reactor design

Lecture 35 - Problem solving session

Lecture 36 - Fluidized Bed Reactor Design - Part I

Lecture 37 - Fluidized Bed Reactor Design - Part II

Lecture 38 - Fluidized Bed Reactor Design - Part III

Lecture 39 - Fluidized Bed Reactor Design - Part IV

Lecture 40 - Continued... (Fluidized bed reactor Models)

Lecture 41 - Continued... (Davidson Harrison model and Kunii Levenspiel model)

Lecture 42 - Continued... (Kunii Levenspiel Model)

Lecture 43 - Slurry Reactor Design

NPTEL : NOC:MATLAB Programming for Numerical Computation (Chemical Engineering)

Co-ordinators : Dr. Niket S.Kaisare

Lecture 1 - Course Introduction

Lecture 2 - Basics of Programming using MATLAB

Lecture 3 - Array Operations in MATLAB

Lecture 4 - Loops and Execution Control

Lecture 5 - Tutorial: Using Arrays

Lecture 6 - MATLAB Files -- Scripts and Functions

Lecture 7 - Plotting and Output

Lecture 8 - How to submit MATLAB Assignment

Lecture 9 - Errors in Numerical Computation

Lecture 10 - Truncation Errors and Taylors Series

Lecture 11 - Round-Off Errors; and Iterative Methods

Lecture 12 - Step-wise Methods and Error Propagation

Lecture 13 - How to get MATLAB Online access (for all enrolled students of this course)

Lecture 14 - Differentiation in Single Variable

Lecture 15 - Higher Order Differentiation Formulae

Lecture 16 - Partial Differentials (Bonus)

Lecture 17 - Numerical Integration

Lecture 18 - Multiple Applications of Integration Formulae

Lecture 19 - In-Build MATLAB Integration Functions

Lecture 20 - Basics of Linear Algebra

Lecture 21 - Gauss Elimination and Back-Substitution

Lecture 22 - LU Decomposition and Partial Pivoting

Lecture 23 - Gauss Siedel Method

Lecture 24 - (Tutorial)

Lecture 25 - Tri-Diagonal Matrix Algorithm

Lecture 26 - Nonlinear Equations in Single Variable

Lecture 27 - Using MATLAB command fzero

Lecture 28 - Fixed Point Iteration in Single Variable

Lecture 29 - Newton-Raphson (single variable)

Lecture 30 - Using MATLAB command fsolve (multi-variable)

Lecture 31 - Newton-Raphson (multi Variable)

Lecture 32 - Introduction

Lecture 33 - Linear Least Squares Regression

Lecture 34 - Nonlinear and Functional Regression

Lecture 35 - Interpolation Functions in MATLAB

Lecture 36 - Introduction and Euler\'s Method

Lecture 37 - Runge-Kutta (RK-2) method

Lecture 38 - MATLAB ode45 algorithm

Lecture 39 - Higher order Runge-Kutta Methods

Lecture 40 - Error Analysis

Lecture 41 - Multi-Variable ODE

Lecture 42 - Stiff Systems & Solution using ode15s

Lecture 43 - Method of Lines for transient PDEs

Lecture 44 - A Final Example

Lecture 45 - Tutorial: How to do linear and nonlinear regression

NPTEL : NOC:Computational Fluid Dynamics (Chemical Engineering)

Co-ordinators : Prof. Sreenivas Jayanti

Lecture 1 - Motivation

Lecture 2 - Flow in a rectangular duct: Problem formulation

Lecture 3 - Flow in a rectangular duct: Discretiztion of flow domain

Lecture 4 - Tutorial 1: Converting PDE to algebraic equation using FD approximation

Lecture 5 - Tutorial 1 (Continued...) Solution for algebraic equations using Gauss- Seidel Method

Lecture 6 - Flow in a triangular duct: Problem formulation

Lecture 7 - Flow in a triangular duct: Discretiztion of flow domain

Lecture 8 - Tutorial 2: Converting PDE to algebraic equation using Finite Volume method

Lecture 9 - Tutorial 2 (Continued...) Description of FV method and solution using G-S Method

Lecture 10 - Effect of grid spacing & upcoming course outline

Lecture 11 - Mass conservation equations

Lecture 12 - Momentum conservation equations

Lecture 13 - Forces acting on control volume

Lecture 14 - Kinematics of deformation in fluid flow

Lecture 15 - Equations governing fluid flow in incompressible fluid

Lecture 16 - Navier-Stokes equation for simple cases of flow

Lecture 17 - Energy conservation equations

Lecture 18 - Practical cases of fluid flow with heat transfer in CFD point of view

Lecture 19 - Practical cases of fluid flow with mass transfer in CFD point of view

Lecture 20 - Equations governing fluid flow with chemical reactions

Lecture 21 - Concept of wellposedness of mathematical problems

Lecture 22 - Introduction to finite difference methods

Lecture 23 - Finite difference approximation on an uniform mesh

Lecture 24 - Higher order and mixed derivatives

Lecture 25 - Solution of Poisson equation in rectangular duct-Turorial

Lecture 26 - Discretization of time domain

Lecture 27 - FD approx. on a non-uniform mesh and need of analysis of obtained discretization

Lecture 28 - Need for the analysis of discretized equation

Lecture 29 - Properties of Numerical Schemes: Accuracy, Conservation property, Boundedness, Consistency, Stability and Convergence

Lecture 30 - Properties of Numerical Schemes: Stability analysis

Lecture 31 - Tutorial on Stability Analysis

Lecture 32 - Analysis of Generic 1-d scalar transport equation

Lecture 33 - Introduction to the solution of coupled N-S equations

Lecture 34 - N-S equation in compressible flow- Mac Cormack Scheme

Lecture 35 - Stability limits of Mac-Cormack Scheme and the intro to Beam-Warming Scheme

Lecture 36 - Implicit Beam-Warming Scheme

Lecture 37 - Compressible flow to Incompressible flow

Lecture 38 - Solution of coupled equations: Incompressible flow

Lecture 39 - Artificial compressiblity method, Stream function-vorticity method

Lecture 40 - Pressure equation method, Staggered grid system

Lecture 41 - Pressure Correction Method

Lecture 42 - Tutorial on Pressure Correction Method

Lecture 43 - Tutorial on Pressure Correction Method (Continued...)

Lecture 44 - Introduction to the basic numerical methods

Lecture 45 - Direct Methods: solution of the system of algebraic equations

Lecture 46 - Tri-diagonal Matrix Algorithm: Derivation

Lecture 47 - TDMA and other iterative methods

Lecture 48 - Recap of basic iterative methods.

Lecture 49 - Convergence analysis of basic iterative methods

Lecture 50 - Successive Over Relaxation (SOR) method

Lecture 51 - Alternating Direction Implicit (ADI) method

Lecture 52 - Strongly Implicit Procedure (ILU) method

Lecture 53 - Multigrid method

Lecture 54 - Body Fitted Grid Approach

Lecture 55 - Formulation Of Finite Volume Method

Lecture 56 - Methods For Unstructured Grid Generation

Lecture 57 - Triangulation: The Advancing Front Method

Lecture 58 - The Advancing Front Method continuation

Lecture 59 - Time and length scale of turbulance

Lecture 60 - The turbulent closure problem

Lecture 61 - The generic formulation for turbulence

Lecture 62 - More generic formulation and summary

NPTEL : NOC:Introduction to Statistical Hypothesis Testing (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

Lecture 1 - Motivation

Lecture 2 - Probability and statistics: Review - Part 1

Lecture 3 - Probability and Statistics: Review - Part 2

Lecture 4 - R Tutorial 1

Lecture 5 - Statistics for Hypothesis Testing - Part 1

Lecture 6 - Statistics for Hypothesis Testing - Part 2

Lecture 7 - Statistics for sample mean

Lecture 8 - Statistics for Variance and Proportion

Lecture 9 - Type I and Type II errors

Lecture 10 - p value

Lecture 11 - Hypothesis testing of means

Lecture 12 - Hypothesis testing of variance and proportions

Lecture 13 - Confidence interval construction

Lecture 14 - Hypothesis testing using confidence interval

Lecture 15 - Hypothesis testing of correlation

Lecture 16 - Statistic for linear regression

Lecture 17 - Hypothesis testing in linear regression

Lecture 18 - Power of hypothesis test

Lecture 19 - Factors affecting hypothesis test

NPTEL : NOC:Applied Time-Series Analysis (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

Lecture 1 - Lecture 1 - Part 1 - Motivation and Overview 1

Lecture 2 - Lecture 1 - Part 2 - Motivation and Overview 2

Lecture 3 - Lecture 2 - Part 1 - Motivation and Overview 3

Lecture 4 - Lecture 2 - Part 2 - Motivation and Overview 4

Lecture 5 - Lecture 3 - Part 1 - Motivation and Overview 5

Lecture 6 - Lecture 3 - Part 2 - Motivation and Overview 6

Lecture 7 - Lecture 4 - Part 1 - Probability and Statistics Review 1A

Lecture 8 - Lecture 4 - Part 2 - Probability and Statistics Review 1B

Lecture 9 - Lecture 5 - Part 1 - Probability and Statistics Review 1C

Lecture 10 - Lecture 5 - Part 2 - Probability and Statistics Review 1D

Lecture 11 - Lecture 6 - Part 1 - Probability and Statistics Review 2A

Lecture 12 - Lecture 6 - Part 2 - Probability and Statistics Review 2B

Lecture 13 - Lecture 6 - Part 3 - Probability and Statistics Review 2C

Lecture 14 - Lecture 7 - Part 1 - Probability and Statistics Review 2D

Lecture 15 - Lecture 7 - Part 2 - Probability and Statistics Review 2E

Lecture 16 - Lecture 7 - Part 3 - Probability and Statistics Review 2F

Lecture 17 - Lecture 8 - Part 1 - Probability and Statistics Review 2G (with R Demonstration)

Lecture 18 - Lecture 8 - Part 2 - Probability and Statistics Review 2H (with R Demonstration)

Lecture 19 - Lecture 9 - Part 1 - Probability and Statistics Review 2I

Lecture 20 - Lecture 9 - Part 2 - Probability and Statistics Review 2J

Lecture 21 - Lecture 9 - Part 3 - Introduction to Random Processes 1

Lecture 22 - Lecture 10 - Part 1 - Introduction to Random Processes 2

Lecture 23 - Lecture 10 - Part 2 - Introduction to Random Processes 3

Lecture 24 - Lecture 11 - Part 1 - Introduction to Random Processes 4

Lecture 25 - Lecture 11 - Part 2 - Introduction to Random Processes 5

Lecture 26 - Lecture 11 - Part 3 - Autocovariance & Autocorrelation Functions 1

Lecture 27 - Lecture 12 - Part 1 - Autocovariance & Autocorrelation Functions 2

Lecture 28 - Lecture 12 - Part 2 - Autocovariance & Autocorrelation Functions 3

Lecture 29 - Lecture 13 - Part 1 - Autocovariance & Autocorrelation Functions 4

Lecture 30 - Lecture 13 - Part 2 - Autocovariance & Autocorrelation Functions 5

Lecture 31 - Lecture 13 - Part 3 - Autocovariance & Autocorrelation Functions 6

Lecture 32 - Lecture 14 - Part 1 - Autocovariance & Autocorrelation Functions 7

Lecture 33 - Lecture 14 - Part 2 - Autocovariance & Autocorrelation Functions 8

Lecture 34 - Lecture 15 - Part 1 - Autocovariance & Autocorrelation Functions 9

Lecture 35 - Lecture 15 - Part 2 - Partial Autocorrelation Functions

Lecture 36 - Lecture 16 - Part 1 - Autocorrelation and Partial-autocorrelation Functions (with R Demonstration)

Lecture 37 - Lecture 16 - Part 2 - Models for Linear Stationary Processes 1

Lecture 38 - Lecture 17 - Part 1 - Models for Linear Stationary Processes 2

Lecture 39 - Lecture 17 - Part 2 - Models for Linear Stationary Processes 3

Lecture 40 - Lecture 18 - Part 1 - Models for Linear Stationary Processes 4

Lecture 41 - Lecture 18 - Part 2 - Models for Linear Stationary Processes 5

Lecture 42 - Lecture 18 - Part 3 - Models for Linear Stationary Processes 6

Lecture 43 - Lecture 19 - Part 1 - Models for Linear Stationary Processes 7

Lecture 44 - Lecture 19 - Part 2 - Models for Linear Stationary Processes 8

Lecture 45 - Lecture 19 - Part 3 - Models for Linear Stationary Processes 9

Lecture 46 - Lecture 20 - Part 1 - Models for Linear Stationary Processes 10

Lecture 47 - Lecture 20 - Part 2 - Models for Linear Stationary Processes 11

Lecture 48 - Lecture 21 - Part 1 - Models for Linear Stationary Processes 12

Lecture 49 - Lecture 21 - Part 2 - Models for Linear Stationary Processes 13

Lecture 50 - Lecture 22 - Part 1 - Models for Linear Stationary Processes 14 (with R Demonstrations)

Lecture 51 - Lecture 22 - Part 2 - Models for Linear Stationary Processes 15 (with R Demonstrations)

Lecture 52 - Lecture 22 - Part 3 - Models for Linear Stationary Processes 16 (with R Demonstrations)

Lecture 53 - Lecture 23 - Part 1 - Models for Linear Non-stationary Processes 1

Lecture 54 - Lecture 23 - Part 2 - Models for Linear Non-stationary Processes 2 (with R Demonstrations)

Lecture 55 - Lecture 24 - Part 1 - Models for Linear Non-stationary Processes 3 (with R Demonstrations)

Lecture 56 - Lecture 24 - Part 2 - Models for Linear Non-stationary Processes 4

Lecture 57 - Lecture 25 - Part 1 - Models for Linear Non-stationary Processes 5

Lecture 58 - Lecture 25 - Part 2 - Models for Linear Non-stationary Processes 6 (with R Demonstrations)

Lecture 59 - Lecture 26 - Part 1 - Fourier Transforms for Deterministic Signals 1

Lecture 60 - Lecture 26 - Part 2 - Fourier Transforms for Deterministic Signals 2

Lecture 61 - Lecture 27 - Part 1 - Fourier Transforms for Deterministic Signals 3

Lecture 62 - Lecture 27 - Part 2 - Fourier Transforms for Deterministic Signals 4

Lecture 63 - Lecture 28 - Part 1 - Fourier Transforms for Deterministic Signals 5

Lecture 64 - Lecture 28 - Part 2 - Fourier Transforms for Deterministic Signals 6

Lecture 65 - Lecture 29 - Part 1 - Fourier Transforms for Deterministic Signals 7

Lecture 66 - Lecture 29 - Part 2 - Fourier Transforms for Deterministic Signals 8

Lecture 67 - Lecture 30 - Part 1 - Fourier Transforms for Deterministic Signals 9

Lecture 68 - Lecture 30 - Part 2 - DFT and Periodogram 1

Lecture 69 - Lecture 31 - Part 1 - DFT and Periodogram 2

Lecture 70 - Lecture 31 - Part 2 - DFT and Periodogram 3 (with R Demonstrations)

Lecture 71 - Lecture 32 - Part 1 - Spectral Representations of Random Processes 1

Lecture 72 - Lecture 32 - Part 2 - Spectral Representations of Random Processes 2

Lecture 73 - Lecture 33 - Part 1 - Spectral Representations of Random Processes 3

Lecture 74 - Lecture 33 - Part 2 - Spectral Representations of Random Processes 4

Lecture 75 - Lecture 33 - Part 3 - Spectral Representations of Random Processes 5

Lecture 76 - Lecture 34 - Part 1 - Spectral Representations of Random Processes 6

Lecture 77 - Lecture 34 - Part 2 - Spectral Representations of Random Processes 7

Lecture 78 - Lecture 35 - Part 1 - Introduction to Estimation Theory 1

Lecture 79 - Lecture 35 - Part 2 - Introduction to Estimation Theory 2

Lecture 80 - Lecture 35 - Part 3 - Introduction to Estimation Theory 3

Lecture 81 - Lecture 36A - Introduction to Estimation Theory -4

Lecture 82 - Lecture 36B - Goodness of Estimators 1 - 1

Lecture 83 - Lecture 37A - Goodness of Estimators 1 - 2

Lecture 84 - Lecture 37B - Goodness of Estimators 1 - 3

Lecture 85 - Lecture 37C - Goodness of Estimators 1 - 4

Lecture 86 - Lecture 38A - Goodness of Estimators 2 - 1

Lecture 87 - Lecture 38B - Goodness of Estimators 2 - 2

Lecture 88 - Lecture 38C - Goodness of Estimators 2 - 3

Lecture 89 - Lecture 39A - Goodness of Estimators 2 - 4

Lecture 90 - Lecture 39B - Goodness of Estimators 2 - 5 (with R demonstrations)

Lecture 91 - Lecture 39C - Goodness of Estimators 2 - 6

Lecture 92 - Lecture 40A - Goodness of Estimators 2 - 7

Lecture 93 - Lecture 40B - Goodness of Estimators 2 - 8

Lecture 94 - Lecture 41A - Estimation Methods 1 - 1

Lecture 95 - Lecture 41B - Estimation Methods 1 - 2

Lecture 96 - Lecture 42A - Estimation Methods 1 - 3

Lecture 97 - Lecture 42B - Estimation Methods 1 - 4

Lecture 98 - Lecture 42C - Estimation Methods 1 - 5

Lecture 99 - Lecture 43A - Estimation Methods 1 - 6 (with R demonstrations)

Lecture 100 - Lecture 43B - Estimation Methods 1 - 7 (with R demonstrations)

Lecture 101 - Lecture 44A - Estimation Methods 1 - 8

Lecture 102 - Lecture 44B - Estimation Methods 1 - 9

Lecture 103 - Lecture 44C - Estimation Methods 2 - 1

Lecture 104 - Lecture 45A - Estimation Methods 2 - 2

Lecture 105 - Lecture 45B - Estimation Methods 2 - 3

Lecture 106 - Lecture 46A - MLE and Bayesian Estimation - 1

Lecture 107 - Lecture 46B - MLE and Bayesian Estimation - 2

Lecture 108 - Lecture 47A - MLE and Bayesian Estimation - 3

Lecture 109 - Lecture 47B - MLE and Bayesian Estimation - 4

Lecture 110 - Lecture 48A - Estimation of Time Domain Statistics - 1

Lecture 111 - Lecture 48B - Estimation of Time Domain Statistics - 2

Lecture 112 - Lecture 49 - Periodogram as PSD Estimator

NPTEL : NOC:Rheology of Complex Materials (Chemical Engineering)

Co-ordinators : Dr. Abhijit P. Deshpande

Lecture 1 - Flow phenomena in complex materials and Microstructure - 1

Lecture 2 - Flow phenomena in complex materials and Microstructure - 2

Lecture 3 - Applications of rheology : mechanisms at the molecular and microscopic scales - 1

Lecture 4 - Applications of rheology : mechanisms at the molecular and microscopic scales - 2

Lecture 5 - Applications of rheology : some example material systems - 1

Lecture 6 - Applications of rheology : some example material systems - 2

Lecture 7 - Stress and strain rate - 1

Lecture 8 - Stress and strain rate - 2

Lecture 9 - Velocity gradient and strain rate - 1

Lecture 10 - Velocity gradient and strain rate 1 Stress and strain rate - 3

Lecture 11 - Kinematics for simple flows - 1

Lecture 12 - Kinematics for simple flows - 2

Lecture 13 - Introduction to tensors

Lecture 14 - Rheometric flows

Lecture 15 - Viscous response - 1

Lecture 16 - Viscous response - 2

Lecture 17 - Viscoelasticity - Relaxation process

Lecture 18 - Viscoelasticity - Maxwell model

Lecture 19 - Linear viscoelasticity - oscillatory shear - 1

Lecture 20 - Linear viscoelasticity - oscillatory shear - 2

Lecture 21 - Introduction to tensors - 2

Lecture 22 - Introduction to tensors - 3

Lecture 23 - Rheometers - 1

Lecture 24 - Rheometers - 2

Lecture 25 - Rheometers - 3

Lecture 26 - Rheometers - 4

Lecture 27 - Rheometers - 5

Lecture 28 - Governing equations for rheology - 1

Lecture 29 - Governing equations for rheology - 2

Lecture 30 - Relaxation time spectrum - 1

Lecture 31 - Relaxation time spectrum - 2

Lecture 32 - Linear viscoelasticity: generalized Maxwell model

Lecture 33 - Time temperature superposition

Lecture 34 - Linear viscoelasticity: solidlike materials

Lecture 35 - General linear viscoelasticity

Lecture 36 - Rotational rheometry

Lecture 37 - Review of material functions - 1

Lecture 38 - Review of material functions - 2

Lecture 39 - Survey of material functions for polymers - 1

Lecture 40 - Survey of material functions for polymers - 2

Lecture 41 - Survey of material functions for polymers - 3

Lecture 42 - Survey of material functions for polymers - 4

Lecture 43 - Survey of material functions for multiphase systems - 1

Lecture 44 - Strain and convected rate - 1

Lecture 45 - Strain and convected rate - 2

Lecture 46 - Strain and convected rate - 3

Lecture 47 - Strain and convected rate - 4

Lecture 48 - Normal stresses - 1

Lecture 49 - Normal stresses - 2

Lecture 50 - Structured materials - yield stress

Lecture 51 - Yield stress and thixotropic materials

Lecture 52 - Normal stresses and stress growth

Lecture 53 - Rheometer demonstration

Lecture 54 - Review of material functions - 3

Lecture 55 - Survey of material functions for multiphase macromolecular systems

Lecture 56 - Problems during rheometry - example of cone and plate - 1

Lecture 57 - Problems during rheometry - example of cone and plate - 2

Lecture 58 - Strain, convected derivatives, non-linear models - 1

Lecture 59 - Strain, convected derivatives, non-linear models - 2

Lecture 60 - Rheometer demonstration

Lecture 61 - Microscopic modeling of rheology - 1

Lecture 62 - Microscopic modeling of rheology - 2

Lecture 63 - Live Session

NPTEL : NOC:Process Control - Design, Analysis and Assessment (Chemical Engineering)

Co-ordinators : Prof. Ragunathan Rengasamy

Lecture 1 - Introduction

Lecture 2 - Introductory Concepts

Lecture 3 - Introduction to Modeling

Lecture 4 - Introduction to Control Structures

Lecture 5 - Process Modelling

Lecture 6 - State Space Modeling

Lecture 7 - State Space Solution

Lecture 8 - Laplace Transforms - Part 1

Lecture 9 - Laplace Transforms - Part 2

Lecture 10 - Analysis of transfer function models - Part 1

Lecture 11 - Analysis of transfer function models - Part 2

Lecture 12 - Stability

Lecture 13 - MATLAB Tutorial 1: Process Modelling

Lecture 14 - MATLAB Tutorial 2: Time domain analysis of first order process

Lecture 15 - Controller Equations

Lecture 16 - Controllers and analysis of closed loop transfer functions

Lecture 17 - P, PI and PID Controllers

Lecture 18 - Stability analysis of closed loop systems

Lecture 19 - Controller design and tuning - Part 1

Lecture 20 - Controller design and tuning - Part 2

Lecture 21 - Traditional Advanced Control - Part 1

Lecture 22 - Traditional Advanced Control - Part 2

Lecture 23 - Frequency Response Analysis - Part 1

Lecture 24 - Frequency Response Analysis - Part 2

Lecture 25 - Traditional Advanced Control - Part 3

Lecture 26 - Traditional Advanced Control - Part 4

Lecture 27 - Traditional Advanced Control - Part 5

Lecture 28 - Understanding PID Gains

Lecture 29 - Nyquist Stability Criterion - Part 1

Lecture 30 - Nyquist Stability Criterion - Part 2

Lecture 31 - Nyquist Stability Criterion - Part 3

Lecture 32 - Controllers for Unstable Systems

Lecture 33 - Traditional Advanced Control - Part 6

Lecture 34 - Traditional Advanced Control - Part 7

Lecture 35 - Multivariable Control - Part 1

Lecture 36 - Multivariable Control - Part 2

Lecture 37 - Model Predictive Control - Part 1

Lecture 38 - Model Predictive Control - Part 2

Lecture 39 - Model Predictive Control-Mathematical Formulation - Part 1

Lecture 40 - Model Predictive Control-Mathematical Formulation - Part 2

Lecture 41 - Model Predictive Control - Discrete Model

Lecture 42 - Model Predictive Control - Putting all these together

Lecture 43 - Stability Analysis-Various methods - Part 1

Lecture 44 - Stability Analysis-Various methods - Part 2

Lecture 45 - Stability Analysis-Various methods - Part 3

Lecture 46 - PID Tuning

Lecture 47 - MATLAB Tutorial-Controller Tuning - Part 1

Lecture 48 - MATLAB Tutorial-Controller Tuning - Part 2

Lecture 49 - MATLAB Tutorial - Controller Design - Part 1

Lecture 50 - MATLAB Tutorial - Controller Design - Part 2

Lecture 51 - MATLAB Tutorial - Controller Design - Part 3

Lecture 52 - Conclusion Lecture

NPTEL : System Identification (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

Lecture 1 - Motivation and Overview 1

Lecture 2 - Motivation and Overview 2

Lecture 3 - Motivation and Overview 3

Lecture 4 - Motivation and Overview 4

Lecture 5 - Journey into Identification 1

Lecture 6 - Journey into Identification 2

Lecture 7 - Journey into Identification 3

Lecture 8 - Journey into Identification (Case Studies) 4

Lecture 9 - Journey into Identification (Case Studies) 5

Lecture 10 - Journey into Identification (Case Studies) 6

Lecture 11 - Journey into Identification (Case Studies) 7

Lecture 12 - Journey into Identification (Case Studies) 8

Lecture 13 - Journey into Identification (Case Studies) 9

Lecture 14 - Journey into Identification (Case Studies) 10

Lecture 15 - Journey into Identification (Case Studies) 11

Lecture 16 - Journey into Identification (Case Studies) 12

Lecture 17 - Journey into Identification (Case Studies) 13

Lecture 18 - Journey into Identification (Case Studies) 14

Lecture 19 - Journey into Identification (Case Studies) 15

Lecture 20 - Journey into Identification (Case Studies) 16

Lecture 21 - Journey into Identification 17

Lecture 22 - Journey into Identification 18

Lecture 23 - Response-based Description 1

Lecture 24 - Response-based Description 2

Lecture 25 - Response-based Description 3

Lecture 26 - Response-based Description 4

Lecture 27 - Response-based Description 5

Lecture 28 - Response-based Description 6

Lecture 29 - Response-based Description 7

Lecture 30 - Response-based Description 8

Lecture 31 - Response-based Description 9

Lecture 32 - Response-based Description 10

Lecture 33 - Response-based Description 11

Lecture 34 - Response-based Description 12

Lecture 35 - Response-based Description 13

Lecture 36 - Discrete time LTI system 1

Lecture 37 - Discrete time LTI system 2

Lecture 38 - z-Domain Descriptions 1

Lecture 39 - z-Domain Descriptions 2

Lecture 40 - z-Domain Descriptions 3

Lecture 41 - z-Domain Descriptions 4

Lecture 42 - z-Domain Descriptions 5

Lecture 43 - z-Domain Descriptions 6

Lecture 44 - State Space Representation 1

Lecture 45 - State Space Representation 2

Lecture 46 - State Space Representation 3

Lecture 47 - State Space Representation 4

Lecture 48 - Sampled - Data Systems 1

Lecture 49 - Sampled - Data Systems 2

Lecture 50 - Sampled - Data Systems 3

Lecture 51 - Sampled - Data Systems 4

Lecture 52 - Sampled - Data Systems 5

Lecture 53 - Sampled - Data Systems 6

Lecture 54 - Sampled - Data Systems 7

Lecture 55 - Sampled - Data Systems 8

Lecture 56 - Probability_Random variables and moments - Review 1

Lecture 57 - Probability_Random variables and moments - Review 2

Lecture 58 - Probability_Random variables and moments - Review 3

Lecture 59 - Probability_Random variables and moments - Review 4

Lecture 60 - Probability_Random variables and moments - Review 5

Lecture 61 - Probability_Random variables and moments - Review 6

Lecture 62 - Random Processes - Review 1

Lecture 63 - Random Processes - Review 2

Lecture 64 - Random Processes - Review 3

Lecture 65 - Random Processes - Review 4

Lecture 66 - Random Processes - Review 5

Lecture 67 - Random Processes - Review 6 (MATLAB)

Lecture 68 - Random Processes - Review 7

Lecture 69 - Random Processes - Review 8

Lecture 70 - Spectral Representation 1

Lecture 71 - Spectral Representation 2

Lecture 72 - Spectral Representation 3

Lecture 73 - Models for Identification 1

Lecture 74 - Models for Identification 2

Lecture 75 - Models for Identification 3

Lecture 76 - Models for Identification 4

Lecture 77 - One step and multi-step ahead prediction 1

Lecture 78 - One step and multi-step ahead prediction 2

Lecture 79 - One step and multi-step ahead prediction 3

Lecture 80 - One step and multi-step ahead prediction 4

Lecture 81 - One step and multi-step ahead prediction 5

Lecture 82 - Introduction to estimation theory 1

Lecture 83 - Introduction to estimation theory 2

Lecture 84 - Fisher's information and properties of estimators 1

Lecture 85 - Fisher's information and properties of estimators 2

Lecture 86 - Fisher's information and properties of estimators 3

Lecture 87 - Fisher's information and properties of estimators 4

Lecture 88 - Fisher's information and properties of estimators 5

Lecture 89 - Fisher's information and properties of estimators 6

Lecture 90 - Fisher's information and properties of estimators 7

Lecture 91 - Fisher's information and properties of estimators 8

Lecture 92 - Fisher's information and properties of estimators 9

Lecture 93 - Fisher's information and properties of estimators 10

Lecture 94 - Fisher's information and properties of estimators 11

Lecture 95 - Fisher's information and properties of estimators 12

Lecture 96 - Fisher's information and properties of estimators 13

Lecture 97 - Fisher's information and properties of estimators 14

Lecture 98 - Fisher's information and properties of estimators 15

Lecture 99 - Estimation of non-parametric model 1

Lecture 100 - Estimation of non-parametric model 2

Lecture 101 - Estimation of non-parametric model 3

Lecture 102 - Estimation of non-parametric model 4

Lecture 103 - Estimation of non-parametric model 5

Lecture 104 - Estimation of non-parametric model 3

Lecture 105 - Estimation of non-parametric model 4

Lecture 106 - Estimation of non-parametric model 5

Lecture 107 - Estimation of parametric model 1

Lecture 108 - Estimation of parametric model 2

Lecture 109 - Estimation of parametric model 3

Lecture 110 - Estimation of parametric model 4

Lecture 111 - State-Space/Subspace identification 1

Lecture 112 - State-Space/Subspace identification 2

Lecture 113 - State-Space/Subspace identification 3

Lecture 114 - State-Space/Subspace identification 4

Lecture 115 - State-Space/Subspace identification 5

Lecture 116 - State-Space/Subspace identification 6

Lecture 117 - State-Space/Subspace identification 7

Lecture 118 - State-Space/Subspace identification 8

Lecture 119 - Input for Identification

Lecture 120 - Input for Identification

Lecture 121 - Input for Identification

NPTEL : NOC:Fluid and Particle Mechanics (Chemical Engineering)

Co-ordinators : Prof. Basavaraju

Lecture 1 - Introduction

Lecture 2 - Fluid Stattics

Lecture 3 - Newton Law of Viscosity

Lecture 4 - Equation of Continuity Differential

Lecture 5 - Equation of Linear Momentum - 1

Lecture 6 - Equation of Linear Momentum - 2

Lecture 7 - Bernoulli's Equation

Lecture 8 - Solution of Navier Stokes - 1

Lecture 9 - Solution of Navier Stokes - 1

Lecture 10 - Introduction to cylindrical coordinate systems

Lecture 11 - Continuity equation in cylindrical coordinates

Lecture 12 - Solution of Navier Stokes in the Cylindrical co-ordinate system - 1

Lecture 13 - Solution of Navier Stokes in the Cylindrical co-ordinate system - 2

Lecture 14 - Circular poiseuille flow

Lecture 15 - Shear Stress Distribution

Lecture 16 - Flow between two concentric cylinder

Lecture 17 - Taylor couette flow

Lecture 18 - Viscosity and Momentum Transfer

Lecture 19 - Device For Measuring Fluid Viscosity

Lecture 20 - Fluid Properties And its Behaviour

Lecture 21 - Tutorial 4

Lecture 22 - Choice of Scaling Parameter

Lecture 23 - Non Dimensional analysis

Lecture 24 - Non-dimensional analysis - 2

Lecture 25 - Non-dimensional analysis - 3 (Buckingham Pi Theorem)

Lecture 26 - Non-dimensional analysis - 4 (Trinity test)

Lecture 27 - Non-dimensional analysis - 5 (Concept of similarity)

Lecture 28 - Characterization Of Particles - 1

Lecture 29 - Characterization Of Particles - 2

Lecture 30 - Motion of a Particle in a fluid

Lecture 31 - Brownian motion and electophoresis

Lecture 32 - Sedimentation and Seperation

Lecture 33 - Settling velocity - Stoke's regime and Newton's regime

Lecture 34 - Applications of settling - I

Lecture 35 - Applications of settling - II

Lecture 36 - Colloidal aggregates - Introduction

Lecture 37 - Settling of colloidal aggregates

Lecture 38 - Tutorial 5

Lecture 39 - Settling of colloidal aggregates - free settling

Lecture 40 - Settling in Multiple Particles System

Lecture 41 - Flow Through Packed Bed

Lecture 42 - Pressure Drop Through Packed Bed

Lecture 43 - Tutorial 6

Lecture 44 - Pressure Droped Through Packed bed Continue

Lecture 45 - Fluidized Bed - 1

Lecture 46 - Fluidized Bed - 2

Lecture 47 - Filtration - 1

Lecture 48 - Filtration - 2

Lecture 49 - Tutorial 7

Lecture 50 - Laminar and Turbulent Flows - 1

Lecture 51 - Laminar and Turbulent Flows - 2

Lecture 52 - Laminar and Turbulent Flows - 3

Lecture 53 - Turbulent Stress and Turbulent Shear Layer

Lecture 54 - Turbulent Flow near a wall and in a pipe

Lecture 55 - Effect of rough Walls

Lecture 56 - Roughness in Turbulent Pipe Flow

Lecture 57 - Pipes of non-circular cross section

Lecture 58 - Minnor Losses, Sudden Expansion and Contraction

Lecture 59 - Friction Losses in Sudden Expansion

Lecture 60 - Tutorial 8

Lecture 61 - Momentum and Kinetic Energy Correction Factor

Lecture 62 - pressure drop in pipes which connected in series

Lecture 63 - Pressure Drop in Pipes Which Connected in Parallel

Lecture 64 - Pressure Drop in Pipes Which Connected at Junction

Lecture 65 - Boundary Layer

Lecture 66 - Boundary Layer - Momentum Integral Analysis - 1

Lecture 67 - Boundary Layer - Momentum Integral Analysis - 2

Lecture 68 - Boundary Layer - Differential Approach

Lecture 69 - Laminar and Turbulent Boundary Layer

Lecture 70 - Tutorial 9

NPTEL : NOC:Continuum Mechanics and Transport Phenomena (Chemical Engineering)

Co-ordinators : Prof. T. Renganathan

Lecture 1 - Measurement and Prediction - Part 1

Lecture 2 - Measurement and Prediction - Part 2

Lecture 3 - Overview of Transport Phenomena

Lecture 4 - Scope of Course

Lecture 5 - Continuum Hypothesis

Lecture 6 - Lagrangian and Eulerian Descriptions - Part 1

Lecture 7 - Lagrangian and Eulerian Descriptions - Part 2

Lecture 8 - Substantial Derivative - Part 1

Lecture 9 - Substantial Derivative - Part 2

Lecture 10 - Substantial Derivative Example - 1

Lecture 11 - Substantial Derivative Example - 2

Lecture 12 - Visualization of Flow Patterns: Streamline, Pathline

Lecture 13 - Visualization of Flow Patterns: Streakline

Lecture 14 - Streamline, Pathline: Steady Flow Example

Lecture 15 - Streamline, Pathline, Streakline: Unsteady Flow Example

Lecture 16 - System and Control Volume

Lecture 17 - Reynolds transport theorem : Introduction

Lecture 18 - Reynolds transport theorem : Simplified form

Lecture 19 - Reynolds transport theorem : General form - Part 1

Lecture 20 - Reynolds transport theorem : General form - Part 2

Lecture 21 - Integral and differential balances

Lecture 22 - Integral total mass balance

Lecture 23 - Integral total mass balance : Simplification

Lecture 24 - Integral total mass balance : Examples

Lecture 25 - Differential total mass balance - Part 1

Lecture 26 - Differential total mass balance - Part 2

Lecture 27 - Differential total mass balance : Examples - Part 1

Lecture 28 - Differential total mass balance : Examples - Part 2

Lecture 29 - Integral linear momentum balance - Part 1

Lecture 30 - Integral linear momentum balance - Part 2

Lecture 31 - Integral linear momentum balance : Examples - Part 1

Lecture 32 - Integral linear momentum balance : Examples - Part 2

Lecture 33 - Integral linear momentum balance : Examples - Part 3

Lecture 34 - Differential linear momentum balance : Introduction

Lecture 35 - Differential linear momentum balance : Transient, convection and body force terms

Lecture 36 - Stress vector - Part 1

Lecture 37 - Stress vector - Part 2

Lecture 38 - Stress tensor - Part 1

Lecture 39 - Stress tensor - Part 2

Lecture 40 - Cauchy's formula

Lecture 41 - Components of Stress Vector : Example

Lecture 42 - Properties of stress tensor - Part 1

Lecture 43 - Properties of stress tensor - Part 2

Lecture 44 - Total stress tensor for fluids

Lecture 45 - Comparison of solids and fluids

Lecture 46 - Fluids at rest

Lecture 47 - Differential linear momentum balance : Surface force terms

Lecture 48 - Differential linear momentum balance : All terms

Lecture 49 - Convective momentum flux tensor

Lecture 50 - Differential linear momentum balance : Closure problem

Lecture 51 - Normal Strain and Shear Strain - Part 1

Lecture 52 - Normal Strain and Shear Strain - Part 2

Lecture 53 - Displacement Field and Displacement Gradient - Part 1

Lecture 54 - Displacement Field and Displacement Gradient - Part 2

Lecture 55 - Strain Displacement Gradient Relation : Example

Lecture 56 - Strain Displacement Gradient Relation : Normal and shear strain

Lecture 57 - Strain Displacement Gradient Relation : Rotation and volumetric strain

Lecture 58 - Strain Displacement Gradient Relation : Examples

Lecture 59 - Displacement Gradient Tensor

Lecture 60 - Components of Total Displacement - Part 1

Lecture 61 - Components of Total Displacement - Part 2

Lecture 62 - Strain Tensor and Rotation Tensor - Part 1

Lecture 63 - Components of Total Displacement : Example

Lecture 64 - Normal and Shear Strain Rate

Lecture 65 - Strain Rate Velocity Gradient Relation

Lecture 66 - Volumetric Strain Rate

Lecture 67 - Velocity Gradient Tenso

Lecture 68 - Strain Rate : Example 1

Lecture 69 - Strain Rate : Example 2

Lecture 70 - Stress Strain Relation : Introduction

Lecture 71 - Material Properties

Lecture 72 - Hookeâ€™s Law - Strain-stress Relation

Lecture 73 - Relation Between Material Properties

Lecture 74 - Hookeâ€™s Law - Stress-strain Relation

Lecture 75 - Hookeâ€™s Law : Examples

Lecture 76 - Stress Strain Rate Relation : Introduction

Lecture 77 - Newtonâ€™s Law of Viscosity : 1D Form

Lecture 78 - Newtonâ€™s Law of Viscosity : 3D Form

Lecture 79 - Navier Stokes Equation

Lecture 80 - Fluid at Rest : Pressure Distribution

Lecture 81 - Hydrostatic Pressure Distribution in Liquid

Lecture 82 - Hydrostatic Pressure Distribution in Gas

Lecture 83 - Fluid in Rigid Body Motion : Pressure Distribution

Lecture 84 - Flow Regimes : Laminar and Turbulent flow

Lecture 85 - Euler Equation

Lecture 86 - Bernoulli Equation : Inviscid Flow

Lecture 87 - Bernoulli Equation : Example 1

Lecture 88 - Bernoulli Equation : Irrotational Flow

Lecture 89 - Bernoulli Equation : Example 2

Lecture 90 - Planar Couette Flow - Governing Equations

Lecture 91 - Planar Couette Flow - Velocity and Pressure Distribution

Lecture 92 - Planar Couette Flow - Shear Force

Lecture 93 - Planar Poiseuille Flow : Governing Equations

Lecture 94 - Planar Poiseuille Flow : Velocity and Pressure Distribution

Lecture 95 - Planar Poiseuille Flow : Shear force

Lecture 96 - Planar Poiseuille Flow : Shear Stress Distribution

Lecture 97 - Viscous Stress vs. Molecular Momentum Flux - Part 1

Lecture 98 - Viscous Stress vs. Molecular Momentum Flux - Part 2

Lecture 99 - Linear Momentum Balance : Fluid Mechanics vs. Momentum Transport - Part 1

Lecture 100 - Linear Momentum Balance : Fluid Mechanics vs. Momentum Transport - Part 2

Lecture 101 - Viscous Stress vs. Molecular Momentum Flux - Part 3

Lecture 102 - Integral Energy Balance - Part 1

Lecture 103 - Integral Energy Balance - Part 2

Lecture 104 - Simplification of Integral Energy Balance

Lecture 105 - Integral Energy Balance : Examples

Lecture 106 - Differential Energy Balance : Introduction

Lecture 107 - Differential Total Energy Balance - Part 1

Lecture 108 - Differential Total Energy Balance - Part 2

Lecture 109 - Differential Energy Balance - Part 1

Lecture 110 - Differential Energy Balance - Part 2

Lecture 111 - Differential Energy Balance - Part 3

Lecture 112 - Fourierâ€™s Law of Heat Conduction

Lecture 113 - Simplifications of Differential Energy Balance

Lecture 114 - Heat Conduction in Slab

Lecture 115 - Heat Conduction in Furnace Wall

Lecture 116 - Non Isothermal Planar Couette Flow

NPTEL : NOC:Environmental Quality Monitoring and Analysis (Chemical Engineering)

Co-ordinators : Dr. R. Ravi Krishna

Lecture 1 - Introduction

Lecture 2 - Chemicals of Concern

Lecture 3 - Water Quality Screening Parameters

Lecture 4 - Water Quality Parameters

Lecture 5 - Air quality parameters; Sustainability

Lecture 6 - PM - Particulate Matter

Lecture 7 - Physical/Chemical properties of interest

Lecture 8 - Partition Constants

Lecture 9 - Soil-air partition constants

Lecture 10 - Application/Example of Equilibrium Partitioning

Lecture 11 - Introduction to Environmental Monitoring and Sampling

Lecture 12 - Environmental Sampling

Lecture 13 - Environmental Analysis: Quality Control - Part 1

Lecture 14 - Environmental Analysis: Quality Control - Part 2

Lecture 15 - Environmental Analysis of Organics in Water

Lecture 16 - Environmental Analysis: Quality Control - Part 3

Lecture 17 - Tutorial

Lecture 18 - Tutorial (Continued...)

Lecture 19 - Analysis Methods - Introduction and Water Quality Parameters

Lecture 20 - Analysis Methods - Water Quality Parameters

Lecture 21 - Analysis Methods - Review of Standard Methods

Lecture 22 - Analysis Methods - Organics in water

Lecture 23 - Analysis Methods - Overall Methodology for Organics

Lecture 24 - Analysis Methods - Chromatography Fundamentals

Lecture 25 - Analysis Methods - Gas Chromatography

Lecture 26 - Analysis Methods - Gas Chromatography (Mass Spectrometry)

Lecture 27 - Analysis Methods - Liquid Chromatography

Lecture 28 - Monitoring methods for Air - PM - Part 1

Lecture 29 - Monitoring methods for Air - PM - Part 2

Lecture 30 - Monitoring methods for Air - Vapor - Part 1

Lecture 31 - Monitoring methods for Air - Vapor - Part 2

Lecture 32 - Monitoring methods for Air - Vapor - Part 3

Lecture 33 - Monitoring and Measurement of Microorganisms

Lecture 34 - Transport of Pollutants - Introduction

Lecture 35 - Transport of Pollutants - Box Models in Water

Lecture 36 - Transport of Pollutants - Box Models in Air

Lecture 37 - Transport of Pollutants - Dispersion

Lecture 38 - Transport of Pollutants - Gaussian Dispersion Model

Lecture 39 - Dispersion Model - Parameters - Part 1

Lecture 40 - Dispersion Model - Parameters - Part 2

Lecture 41 - Gaussian Dispersion Model

Lecture 42 - Gaussian Dispersion Model - Example, Additional topics

Lecture 43 - Regulatory Models

Lecture 44 - Introduction to Interphase Mass Transfer

Lecture 45 - Interphase mass transfer - Application to Environmental Interfaces

Lecture 46 - Interphase mass transfer - Flux and mass transfer resistance

Lecture 47 - Interphase mass transfer - Boundary Layer and Mass Transfer Coefficient

Lecture 48 - Interphase mass transfer - Individual and Overall Mass Transfer Coefficients

Lecture 49 - Overall Mass Transfer Coefficient

Lecture 50 - Estimation of the Mass Transfer Coefficients

Lecture 51 - Air-Water Exchange

Lecture 52 - Evaporation from different surfaces

Lecture 53 - Sediment-Water exchange

Lecture 54 - Application of Interphase mass transfer

Lecture 55 - Contamination of Sediments

Lecture 56 - Release from Sediments

Lecture 57 - Unsteady state release from sediments

Lecture 58 - Other mechanisms of chemical release from sediments - Part 1

Lecture 59 - Other mechanisms of chemical release from sediments - Part 2

Lecture 60 - Soil - Air Transfer

Lecture 61 - Remediation of contaminated sediments - Application of transport models

NPTEL : Synthetic and Natural Supramolecular Architectures: An Approach Towards Molecular Technology (Chemical Engineering)

Co-ordinators : Prof. ChebroluPulla Rao

Lecture 1 - Impetus

Lecture 2 - Introduction to Supramolecular Science and Technology

Lecture 3 - Introduction to Supramolecular Science and Technology

Lecture 4 - A quickwalk - through the Supramolecular Architectures

Lecture 5 - A quickwalk - through the Supramolecular Architectures

Lecture 6 - A quickwalk - through the Supramolecular Architectures

Lecture 7 - Weak intermolecular forces : What, Where, When and How?

Lecture 8 - Weak intermolecular forces : What, Where, When and How?

Lecture 9 - Weak intermolecular forces : What, Where, When and How?

Lecture 10 - Weak intermolecular forces : What, Where, When and How?

Lecture 11 - Weak intermolecular forces : What, Where, When and How?

Lecture 12 - Weak intermolecular forces : What, Where, When and How?

Lecture 13 - Chemistry concepts of Immediate relevance - Part 1

Lecture 14 - Chemistry concepts of Immediate relevance - Part 2

Lecture 15 - Chemistry concepts of Immediate relevance - Part 3

Lecture 16 - Chemistry concepts of Immediate relevance - Part 4

Lecture 17 - Chemistry concepts of Immediate relevance - Part 5

Lecture 18 - Chemistry concepts of Immediate relevance - Part 6

Lecture 19 - Chemistry concepts of Immediate relevance - Part 7

Lecture 20 - Molecular recognition - Part 1

Lecture 21 - Molecular recognition - Part 2

Lecture 22 - Molecular recognition - Part 3

Lecture 23 - Molecular recognition - Part 4

Lecture 24 - Molecular recognition - Part 5

Lecture 25 - Molecular recognition - Part 6

Lecture 26 - Molecular recognition - Part 7

Lecture 27 - Molecular recognition - Part 8

Lecture 28 - Molecular recognition - Part 9

Lecture 29 - Molecular recognition - Part 10

Lecture 30 - Property driven functions of Supramolecular assembly

Lecture 31

Lecture 32

Lecture 33 - Metal coordinated architectures

Lecture 34 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 1

Lecture 35 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 2

Lecture 36 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 3

Lecture 37 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 4

Lecture 38 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 5

Lecture 39 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 6

Lecture 40 - From molecules to machines : A glimpse at the travel

NPTEL : NOC:Artificial Lift (Chemical Engineering)

Co-ordinators : Prof. Abdus Samad

Lecture 1 - Introduction to oil and gas

Lecture 2 - Drilling and Completion

Lecture 3 - Well completion

Lecture 4 - Oil and gas production systems

Lecture 5 - Pumps, compressors and flow through pipes

Lecture 6 - Reservoir fluid

Lecture 7 - Fluid properties and Phase diagram - Part 1

Lecture 8 - Fluid properties and Phase diagram - Part 2

Lecture 9 - Nodal analysis

Lecture 10 - Reservoir deliverability - Single phase flow

Lecture 11 - Reservoir deliverability - Two phase flow

Lecture 12 - Flow over a flat surface or flow through pipe - Part 1

Lecture 13 - Flow over a flat surface or flow through pipe - Part 2

Lecture 14 - Single-Phase, Multi-Phase-Emulsion

Lecture 15 - Emulsification and demulsification

Lecture 16 - Single and Multi Phase flow-flow regimes

Lecture 17 - Multi phase flow-flow models

Lecture 18 - Choke Performance

Lecture 19 - Pump classifications

Lecture 20 - Classification of artificial lifts - Part 1

Lecture 21 - Classification of artificial lifts - Part 2

Lecture 22 - Sucker rod pump (SRP) - Part 1

Lecture 23 - Sucker rod pump (SRP) - Part 2

Lecture 24 - Sucker rod pump (SRP) - Part 3

Lecture 25 - Sucker rod pump (SRP) - Part 4

Lecture 26 - Sucker rod pump (SRP) - Part 5

Lecture 27 - Sucker rod pump (SRP) - Part 6

Lecture 28 - SRP-Pump performance analysis - Part 1

Lecture 29 - SRP-Pump performance analysis - Part 2

Lecture 30 - SRP-Pump performance analysis - Part 3

Lecture 31 - Introduction to progressive cavity punp

Lecture 32 - Progressive cavity Pump - Part 1

Lecture 33 - Progressive cavity Pump - Part 2

Lecture 34 - Progressive cavity Pump - Part 3

Lecture 35 - Progressive cavity Pump - Part 4

Lecture 36 - Progressive cavity Pump - Part 5

Lecture 37 - Electric submersible pump - Part 1

Lecture 38 - Electric submersible pump - Part 2

Lecture 39 - Electric submersible pump - Part 3

Lecture 40 - ESP- basic electrical systems - Part 1

Lecture 41 - ESP- basic electrical systems - Part 2

Lecture 42 - ESP- basic electrical systems - Part 3

Lecture 43 - ESP- numerical problems - Part 1

Lecture 44 - ESP- numerical problems - Part 2

Lecture 45 - ESP- numerical problems - Part 3

Lecture 46 - ESP- numerical problems - Part 1

Lecture 47 - ESP- numerical problems - Part 2

Lecture 48 - Gas lift basics - Part 1

Lecture 49 - Gas lift basics - Part 2

Lecture 50 - Gas lift valves and installartion - Part 1

Lecture 51 - Gas lift valves and installartion - Part 2

Lecture 52 - Plunger lift and design

Lecture 53 - Hydraulic jet pump fundamentals - Part 1

Lecture 54 - Hydraulic jet pump fundamentals - Part 2

Lecture 55 - Hydraulic engine pumps and design - Part 1

Lecture 56 - Hydraulic engine pumps and design - Part 2

Lecture 57 - Surface pump units for jet pump - Part 1

Lecture 58 - Surface pump units for jet pump - Part 2

Lecture 59 - Surface pump units for jet pump - Part 3

Lecture 60 - Surface compressor for gas lift - Part 1

Lecture 61 - Surface compressor for gas lift - Part 2

Lecture 62 - Surface compressor for gas lift - Part 3

NPTEL : NOC:Interfacial Engineering (Chemical Engineering)

Co-ordinators : Prof. Manigandan

Lecture 1 - Introduction to interfaces

Lecture 2 - Importance of surface; Application of interfaces

Lecture 3 - Basics of classical and emerging tools

Lecture 4 - Concepts of capillarity and surface tension (ST) and measurement of ST and contact angle

Lecture 5 - Overview of various surface tension measurement techniques

Lecture 6 - Young-Dupre equation; Tutorial

Lecture 7 - Young-Laplace equation; Tutorial

Lecture 8 - Kelvin equation; Tutorial

Lecture 9 - Contact angle for ideal and non-ideal cases; Application of Young-Dupre

Lecture 10 - Measurement of contact angle of surfaces at fluid-fluid interfaces

Lecture 11 - Washburn approach; Tutorial

Lecture 12 - Work of cohesion, adhesion, and spreading coefficient

Lecture 13 - Girifalco-Good Fowkes equation; Tutorial

Lecture 14 - Demonstration of force tensiometer

Lecture 15 - Demonstration of optical tensiometer

Lecture 16 - Shapes of micelles, critical micelle concentration (CMC); critical packing parameter (CPP)

Lecture 17 - Thermodynamic principles of self-assembly

Lecture 18 - Micellar-enhanced ultrafiltration (MEUF): A surfactant-based separation technique

Lecture 19 - HLB guidelines; Debye plot

Lecture 20 - Surface excess concepts and problem solving

Lecture 21 - Gibbs adsorption isotherm equation

Lecture 22 - Deposition of Langmuir Blodgett (LB) films; Adsorption from solution

Lecture 23 - Demonstration of double barrier LB deposition technique

Lecture 24 - Emulsion and microemulsion; Application of microemulsion

Lecture 25 - Demonstration of emulsification using several emulsifying devices

Lecture 26 - Demonstration of particle size analyzer

Lecture 27 - Demonstration of particle/droplet tracking using an inverted microscope

Lecture 28 - Introduction to colloids

Lecture 29 - Understanding Intermolecular forces

Lecture 30 - van der Waals force

Lecture 31 - Lifshitz approach

Lecture 32 - Electrical double layer (EDL) interaction (Helmholtz)

Lecture 33 - Gouy-Chapman EDL Model

Lecture 34 - Gouy-Chapman-Stern EDL model

Lecture 35 - Overlapping double layer interaction

Lecture 36 - Derjaguin approximation; DLVO forces of interactions

Lecture 37 - Force-measuring techniques: Direct and indirect measurements

Lecture 38 - Steric (Polymer-mediated) forces

Lecture 39 - Electrokinetic phenomena

Lecture 40 - Demonstration of zeta potential measurements

NPTEL : Building Towards a Career in Chemical Industry (Chemical Engineering)

Co-ordinators : Prof. Nagarajan R, Prof. MS Srinivasan

Lecture 1 - Introduction and Need for this course

Lecture 2 - Learning Objectives and schedule

Lecture 3 - Sectors of Chemical Industry

Lecture 4 - Understanding cost by Engineers

Lecture 5 - Investment Cost

Lecture 6 - Understanding Financial Performance of Companies

Lecture 7 - Global perspective of Chemical Industry

Lecture 8 - Nature and Development of Indian Chemical Industry

Lecture 9 - Research, Tech development and Licensing

Lecture 10 - Guest lectuer on skill development

Lecture 11 - Technology Development Process

Lecture 12 - Technology Readiness Level

Lecture 13 - Evolution of Technology - Caustic soda example

Lecture 14 - Evolution of Technology - Caustic soda example

Lecture 15 - Case study of heat recovery

Lecture 16 - Case study of Tech development- auto thermal gasification

Lecture 17 - Guidelines on choosing and completing a project report on Technology Development

Lecture 18 - Guidelines on choosing and completing a project report

Lecture 19 - Example of a case study of an affordable potable water drinking technology described in detail

Lecture 20 - Example of potable water technolohy through desalination of sea water

Lecture 21 - Case study of manufacturing of Polysilicon in India as a example of Technology Development

Lecture 22 - Case study of manufacturing of Polysilicon in India as a example of Technology Development (Continued...)

Lecture 23 - Industrial R&D ecosystem in India

Lecture 24 - Technology Tranfer - prospects and challenges

Lecture 25 - Guidelines on choosing and completing a project report

Lecture 26 - Jobs and career options in Industry

Lecture 27 - Continuation of Jobs and career options in Industry

Lecture 28 - Application of Taguchi Quality Function analysis to industrial processes

Lecture 29 - Course review and Introduction to Taguchi Quality Function Development

Lecture 30 - Preparing for Job interviews

NPTEL : Chemical Technology - I (Chemical Engineering)

Co-ordinators : Dr. I.D. Mall

Lecture 1 - Introduction to Chemical process Industries

Lecture 2 - Raw material for Organic Chemical Industries

Lecture 3 - Unit processes and unit operations in organic chemical Industries

Lecture 4 - Coal and coal as chemicals feed stock

Lecture 5 - Coal carbonization and Coke oven plant

Lecture 6 - Gasification of Coal,Petrocoke and Biomass

Lecture 7 - Introduction to Pulp and paper Industry, Raw material for paper industry and Technological development

Lecture 8 - Pulping and Bleaching

Lecture 9 - Recovery of Chemicals

Lecture 10 - Stock preparation and paper making

Lecture 11 - Introduction to Soap and detergent, Soap making and Recovery of Glycerine

Lecture 12 - Synthetic detergent and Linear alkyl benzene

Lecture 13 - Sugar and Fermentation industry

Lecture 14 - Ethanol as Biofuel and Chemical feed stock

Lecture 15 - Introduction : Staus of Petroleum refinery, Crude oil and Natural gas origin, occurrence, exploration, drilling and processing, Fuel norms

Lecture 16 - Evaluation of Crude oil,Petroleum Products and Apetrochemicals

Lecture 17 - Crude oil Distillation

Lecture 18 - Thermal Cracking: Visbreaking and Delayed Coking

Lecture 19 - Catalytic cracking: Fluid Catalytic cracking and Hydro cracking

Lecture 20 - Catalytic reforming

Lecture 21 - Alkylation, Isomerisation and Polymerisation

Lecture 22 - Desulphurisation Processes and Recovery of Sulphur

Lecture 23 - Profile of petrochemical Industry and its structure

Lecture 24 - Naphtha and gas cracking for production of olefins

Lecture 25 - Recovery of chemicals from FCC and steam cracking

Lecture 26 - Synthesis gas and its derivatives: Hydrogen, CO, Methanol, Formaldehyde

Lecture 27 - Ethylene derivatives: Ethylene Oxide, Ethylene glycol, Ethylene dichloride and Vinyl chloride

Lecture 28 - Propylene, Propylene oxide and Isopropanol

Lecture 29 - Aromatics Production

Lecture 30 - Aromatics product profile, Ethyl benzene & Styrene, Cumene and phenol, Bisphenol, Aniline

Lecture 31 - Introduction to polymer, Elastomer and Synthetic Fibre, Polymerisation

Lecture 32 - Polymers:Polyolefins, Polyethylene, Polypropylene Polystyrene

Lecture 33 - Polyvinylchloride, polycarbonate, thermoset resin: phenolformaldehyde, uriaformaldehyde and melamineformaldehyde

Lecture 34 - Elastomers: Styrene butadiene Rubber(SBR), Poly butadiene, Nitrile rubber

Lecture 35 - Polymides or Nylons(PA)

Lecture 36 - DMT and Terephtalic Acid, Polyester, PET resin, PTB resin

Lecture 37 - Acrylic Fibre, Modified Acrylic Fibre, Acrylonitrile, Acrolein, Propylene Finber, Polyurethane

Lecture 38 - Viscose Rayon and Acetate rayon

Lecture 39 - Pesticide

Lecture 40 - Dye and Intermediates

NPTEL : Process Integration (Chemical Engineering)

Co-ordinators : Dr. B. Mohanty

Lecture 1 - Process integration, methods and area of application

Lecture 2 - Fundamental concepts related to heat integration - Part 1

Lecture 3 - Fundamental concepts related to heat integration - Part 2

Lecture 4 - Data extraction

Lecture 5 - Hot composite curves

Lecture 6 - Cold composite curves

Lecture 7 - Hot and cold composite curves and the pinch

Lecture 8 - Threshold problems

Lecture 9 - Energy targeting procedure

Lecture 10 - Problem Table Algorithm - Part 1

Lecture 11 - Grand composite curve

Lecture 12 - Problem Table Algorithm - Part 2

Lecture 13 - Number of units target

Lecture 14 - Shell targeting - Part 1

Lecture 15 - Area targeting - Part 1

Lecture 16 - Area targeting - Part 2

Lecture 17 - Coast targeting - Part 1

Lecture 18 - Coast targeting - Part 2

Lecture 19 - Supertargeting- optimization of Î” t min

Lecture 20 - Global & stream specific Î”t min and its relevance

Lecture 21 - Topology Trap

Lecture 22 - Rules for Pinch Design Method (PDM) - Part 1

Lecture 23 - Rules for Pinch Design Method (PDM) - Part 2

Lecture 24 - Application of PDM for MER Hen Synthesis

Lecture 25 - Design for threshold problems

Lecture 26 - Design for single pinch problems

Lecture 27 - Design for multi pinch problems

Lecture 28 - HEN optimization

Lecture 29 - Remaining problem analysis

Lecture 30 - Driving Force Plot

Lecture 31 - Low Temperature process Design - Part 1

Lecture 32 - Low Temperature process Design - Part 2

Lecture 33 - Integration of Gas turbine with process - Part 1

Lecture 34 - Integration of Gas turbine with process - Part 2

Lecture 35 - Placement and Integration of Distillation Column

Lecture 36 - Heat Integration of evaporators

Lecture 37 - Integration of heat pump

Lecture 38 - Placement of Heat Engine, Heat pump and Reactors

Lecture 39 - Integration of Furnace

Lecture 40 - Problem solving using HINT Software - Part 1

Lecture 41 - Problem solving using HINT Software - Part 2

Lecture 42 - Problem solving using HINT Software - Part 3

Lecture 43 - Problem solving using HINT Software - Part 4

NPTEL : Mechanical Operations (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

Lecture 1 - Introduction

Lecture 2 - Characterization of a single particle - 1

Lecture 3 - Characterization of a single particle - 2

Lecture 4 - Characterization of collection of particles - 1

Lecture 5 - Characterization of collection of particles - 2

Lecture 6 - Fine grain size distribution

Lecture 7 - Effectiveness of screen - 1

Lecture 8 - Effectiveness of screen - 2

Lecture 9 - Industrial screening equipment

Lecture 10 - Size reduction

Lecture 11 - Laws of comminution

Lecture 12 - Examples of Laws of comminution - 1

Lecture 13 - Examples of Laws of comminution - 2

Lecture 14 - Size reduction equipment - 1

Lecture 15 - Size reduction equipment - 2

Lecture 16 - Particle dynamics - 1

Lecture 17 - Particle dynamics - 2

Lecture 18 - Particle dynamics-Examples

Lecture 19 - Classification and Jigging - 1

Lecture 20 - Classification and Jigging - 2

NPTEL : NOC:Waste to Energy Conversion (Chemical Engineering)

Co-ordinators : Prof. P. Mondal

Lecture 1 - Introduction - 1

Lecture 2 - Introduction - 2

Lecture 3 - Characterization of wastes - 1

Lecture 4 - Characterization of wastes - 2

Lecture 5 - Characterization of wastes - 3

Lecture 6 - Tutorial on Chatacterization of wastes

Lecture 7 - Energy production from wastes through incineration - 1

Lecture 8 - Energy production from wastes through incineration - 2

Lecture 9 - Tutorial on incineration

Lecture 10 - Energy production from wastes through gasification - 1

Lecture 11 - Energy production from wastes through gasification - 2

Lecture 12 - Syngas utilization - 1

Lecture 13 - Syngas utilization - 2

Lecture 14 - Energy production from wastes through pyrolysis - 1

Lecture 15 - Energy production from wastes through pyrolysis - 2

Lecture 16 - Tutorial on gasification

Lecture 17 - Tutorial on Pyrolysis

Lecture 18 - Densification of solids - 1

Lecture 19 - Densification of solids - 2

Lecture 20 - Efficiency improvement of power plant - 1

Lecture 21 - Efficiency improvement of power plant - 2

Lecture 22 - Energy production from waste plastics - 1

Lecture 23 - Energy production from waste plastics - 2

Lecture 24 - Gas clean up - 1

Lecture 25 - Gas clean up - 2

Lecture 26 - Energy production from organic wastes through anaerobic digestion - 1

Lecture 27 - Energy production from organic wastes through anaerobic digestion - 2

Lecture 28 - Design of anaerobic digester

Lecture 29 - Introduction to Microbial fuel cells

Lecture 30 - Energy production from organic wastes through fermentation - 1

Lecture 31 - Energy production from organic wastes through fermentation - 2

Lecture 32 - Tutorial on anaerobic digestion

Lecture 33 - Tutorial on fermentation

Lecture 34 - Energy production from wastes through transesterification - 1

Lecture 35 - Energy production from wastes through transesterification - 2

Lecture 36 - Tutorial on transesterification

Lecture 37 - Cultivation of algal biomass and treatment of waste water - 1

Lecture 38 - Cultivation of algal biomass and treatment of waste water - 2

Lecture 39 - Energy production form algal biomass - 1

Lecture 40 - Energy production form algal biomass - 2

NPTEL : NOC:Unit Operations of Particulate Matter (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

Lecture 1 - Introduction

Lecture 2 - Sedimentation and Batch Sedimentation Test - 1

Lecture 3 - Sedimentation and Batch Sedimentation Test - 2

Lecture 4 - Centrifugal Sedimentation and Equipment - 1

Lecture 5 - Centrifugal Sedimentation and Equipment - 2

Lecture 6 - Filtration - 1

Lecture 7 - Filtration - 2

Lecture 8 - Filtration - 3

Lecture 9 - Continuous Filtration - 1

Lecture 10 - Continuous Filtration - 2

Lecture 11 - Fluidisation - 1

Lecture 12 - Fluidisation - 2

Lecture 13 - Liquid Fluidisation

Lecture 14 - Gas Fluidisation - 1

Lecture 15 - Gas Fluidisation - 2

Lecture 16 - Flotation - 1

Lecture 17 - Flotation - 2

Lecture 18 - Transportaion of solids - 1

Lecture 19 - Transportaion of solids - 2

Lecture 20 - Transportaion of solids - 3

NPTEL : NOC:Introduction to Polymer Physics (IIT-R) (Chemical Engineering)

Co-ordinators : Prof. Prateek Kumar Jha

Lecture 1 - Introduction to the course, Macromolecules and Life, Molecular flexibility

Lecture 2 - Classification of polymers, Types of polymerization, Average molecular weights and polydispersity

Lecture 3 - Motivation to study polymer physics

Lecture 4 - Random Walk Models of Single Chain I: end-to-end distance of a polymer chain, freely jointed chain, drunkard walk

Lecture 5 - Random Walk Models of Single Chain II: general random walk on a lattice

Lecture 6 - Random Walk Models of Single Chain III: Freely rotating chain, definition of persistence length

Lecture 7 - Models of semiflexible chains (Kratky Porod Model) - Part I

Lecture 8 - Models of semiflexible chains (Kratky Porod Model) - Part II

Lecture 9 - Probability density of an ideal chain - Part I

Lecture 10 - Probability density of an ideal chain - Part II

Lecture 11 - Entropic Elasticity, Bead-Spring Model, Simulations of random walk models

Lecture 12 - Derivation of Diffusion equation, Einstein notation

Lecture 13 - Definition of Radius of gyration

Lecture 14 - Radius of gyration for an ideal chain, concept of ideality

Lecture 15 - Nonbonded interactions, hydrophobic and hydrophilic behaviour

Lecture 16 - Definition of excluded volume; good, bad, and theta solvent

Lecture 17 - Virial expansion, Flory theory for good solvent

Lecture 18 - Flory theory for bad solvent, self-similarity and fractal nature of polymers

Lecture 19 - Derivation of fractal dimension, concentration regimes and overlap concentration

Lecture 20 - Size, shape, and structure. Gyration tensor and measures of asphericity.

Lecture 21 - Order-disorder transition

Lecture 22 - Scattering experiments, Pair correlation function

Lecture 23 - Structure of polymer chain, Introduction to Monte Carlo simulations of polymer chains

Lecture 24 - Monte Carlo algorithm: Detailed Balance, Metropolis algorithm

Lecture 25 - Practical aspects of Monte Carlo simulation

Lecture 26 - Molecular Dynamics Simulations, Review of Thermodynamics

Lecture 27 - Solution Thermodynamics - I

Lecture 28 - Solution Thermodynamics - II

Lecture 29 - Solution Thermodynamics - III

Lecture 30 - Solution Thermodynamics - IV

Lecture 31 - Phase separation regime, Introduction to lattice model of solutions

Lecture 32 - Lattice Model of Solutions - I

Lecture 33 - Lattice Model of Solutions - II

Lecture 34 - Phase behaviour of liquid solutions

Lecture 35 - Lattice models of polymeric systems

Lecture 36 - Brownian motion - I

Lecture 37 - Brownian motion - II

Lecture 38 - Brownian motion - III

Lecture 39 - Brownian motion - IV

Lecture 40 - Brownian motion - V

Lecture 41 - Rouse Model - I

Lecture 42 - Rouse Model - II

Lecture 43 - Rouse Model - III

Lecture 44 - Rouse Model - IV

Lecture 45 - Problems in Rouse Model, Hydrodynamic Interactions

Lecture 46 - Zimm Model - I

Lecture 47 - Zimm Model - II

Lecture 48 - Continuum Mechanics - I

Lecture 49 - Continuum Mechanics - II

Lecture 50 - Kuhnâ€™s Theory of Rubber Elasticity

Lecture 51 - Elasticity of polymer network

Lecture 52 - Microscopic definition of stress tensor - I

Lecture 53 - Microscopic definition of stress tensor - II, Dumbbell model, introduction to Rouse model

Lecture 54 - Models for entangled polymeric systems - I

Lecture 55 - Models for entangled polymeric systems - II

Lecture 56 - Rheology of complex fluids

Lecture 57 - Rheometers and rheological tests - I

Lecture 58 - Rheometers and rheological tests - II

Lecture 59 - Maxwell model - I

Lecture 60 - Maxwell model - II, Closing notes

NPTEL : NOC:Equipment Design: Mechanical Aspects (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

Lecture 1 - Introduction

Lecture 2 - Stress and Strain Relationship - 1

Lecture 3 - Stress and Strain Relationship - 2

Lecture 4 - Terminologies

Lecture 5 - Design of shell

Lecture 6 - Design of heads - 1

Lecture 7 - Design of heads - 2

Lecture 8 - Design of heads - 3

Lecture 9 - Compensation for Opening - 1

Lecture 10 - Compensation for Opening - 2

Lecture 11 - L D ratio

Lecture 12 - Design of Flanges - 1.1

Lecture 13 - Design of Flanges - 1.2

Lecture 14 - Design of Flanges - 2.1

Lecture 15 - Design of Flanges - 2.2

Lecture 16 - Design of support - 1

Lecture 17 - Design of support - 2

Lecture 18 - Vessel under external pressure - 1

Lecture 19 - Vessel under external pressure - 2

Lecture 20 - Vessel under very high pressure

NPTEL : NOC:Chemical Process Safety (Chemical Engineering)

Co-ordinators : Dr. Shishir Sinha

Lecture 1 - Safety and Accident Loss Statistics

Lecture 2 - Risk Management and Hazardous Substance Rules

Lecture 3 - Nature of Accident and major disasters

Lecture 4 - Fundamental Principles: Scale up and Runaway Reactions

Lecture 5 - Problems related to Safety and Accident Loss Statistics

Lecture 6 - Toxicology: Introduction, Routes and Exposure

Lecture 7 - Toxicology: Elimination, Responses, Treatment

Lecture 8 - Dose Response Relationship

Lecture 9 - Dose Response and Threshold Dose: Predictive models and Extrapolation

Lecture 10 - Industrial Hygiene: Regulations and Identification

Lecture 11 - Material Safety Data Sheet - I

Lecture 12 - Material Safety Data Sheet - II

Lecture 13 - Industrial Hygiene: Evaluation

Lecture 14 - Noise, vibration and Radiation

Lecture 15 - Industrial Hygiene: Control

Lecture 16 - Problems related to Industrial Hygiene

Lecture 17 - Introduction to Source Models

Lecture 18 - Source Models for Gas

Lecture 19 - Source Models for Pool Boiling

Lecture 20 - Source Model Problems

Lecture 21 - Fire and Explosions: Introduction

Lecture 22 - Fire and Explosions: Flammability Characteristics

Lecture 23 - Explosion and its Classification - I

Lecture 24 - Explosion and its Classification - II

Lecture 25 - Fire Extinguishers - I

Lecture 26 - Fire Extinguishers - II

Lecture 27 - Problems related to Fire and Explosion

Lecture 28 - Designs to prevent Fire and Explosion: Inerting and Purging

Lecture 29 - Designs to prevent Fire and Explosion: Static Electricity

Lecture 30 - General Design Methods to prevent Fire

Lecture 31 - Sprinklers - I

Lecture 32 - Sprinklers - II

Lecture 33 - Introduction to Reliefs

Lecture 34 - Type of Reliefs

Lecture 35 - Relief Scenario

Lecture 36 - Relief Sizing

Lecture 37 - Hazard and Hazard Identification: Introduction

Lecture 38 - Hazard Identification Methods and HAZOP

Lecture 39 - Safety Reviews and Risk Assessment - I

Lecture 40 - Risk Assessment - II

Lecture 41 - Review of Probability Theory

Lecture 42 - Event Trees: Quantitative Risk Analysis

Lecture 43 - Fault Trees: Quantitative Risk Analysis

Lecture 44 - Cause Consequence Analysis and Layer of Protection Analysis

Lecture 45 - Bow-Tie Analysis

Lecture 46 - Accident Research: Introduction

Lecture 47 - Accident Causation Theories

Lecture 48 - Accident Investigation Procedure - I

Lecture 49 - Accident Investigation Procedure - II

Lecture 50 - Jaipur Terminal Fire, India: October 29, 2009

Lecture 51 - The Flixborough UK, Cyclohexane Disaster: June 01, 1974

Lecture 52 - Seveso Accident: July 10, 1976

Lecture 53 - The Chernobyl Nuclear Disaster: April 26, 1986

Lecture 54 - Bhopal Gas Tragedy: December 03, 1984

Lecture 55 - Bhopal Gas Tragedy: Investigation

Lecture 56 - Nuclear Radiation

Lecture 57 - Process Safety Management

Lecture 58 - Personal Protective Equipments

Lecture 59 - Safety: Laws and Regulations

Lecture 60 - Nuclear Disaster: Earthquake

NPTEL : NOC:Technologies for Clean and Renewable Energy Production (Chemical Engineering)

Co-ordinators : Prof. P. Mondal

Lecture 1 - Introduction

Lecture 2 - Coal as a Source of Energy

Lecture 3 - Characterization of Coal

Lecture 4 - Conventional Route for Energy Production from Coal

Lecture 5 - Tutorial 1

Lecture 6 - Cleaner Route for Energy Production from Coal

Lecture 7 - Gasification of Coal - 1

Lecture 8 - Gasification of Coal - 2

Lecture 9 - Direct Liquefaction of Coal

Lecture 10 - Tutorial 2

Lecture 11 - Petroleum as a Source of Energy

Lecture 12 - Characteristics of Crude Oil and Petroleum Products

Lecture 13 - Refining of Crude Oil for Liquid Fuels Production

Lecture 14 - Conversion of Intermediate Products

Lecture 15 - Tutorial 3

Lecture 16 - Impurities Removal from Liquid Fuels

Lecture 17 - Residue Upgradation - 1

Lecture 18 - Residue Upgradation - 2

Lecture 19 - Heavy Crude Oil Processing

Lecture 20 - Tutorial 4

Lecture 21 - Properties and Routes for Energy Production

Lecture 22 - Syn Gas Production from Natural Gas

Lecture 23 - Syn Gas to Liquid Fuel Production

Lecture 24 - Hydrogen Production from Natural Gas

Lecture 25 - Tutorial 5

Lecture 26 - Solar Energy - 1

Lecture 27 - Solar Energy - 2

Lecture 28 - Wind Energy - 1

Lecture 29 - Wind Energy - 2

Lecture 30 - Tutorial 6

Lecture 31 - Hydro Energy - 1

Lecture 32 - Hydro Energy - 2

Lecture 33 - Geothermal Energy

Lecture 34 - Tidal Energy

Lecture 35 - Tutorial 7

Lecture 36 - Energy from Biomass and Wastes 1 (Biological Route)

Lecture 37 - Energy from Biomass and Wastes 2 (Chemical Route)

Lecture 38 - Energy from Biomass and Wastes 3 (Physical Route)

Lecture 39 - Energy Conversations

Lecture 40 - Tutorial 8

NPTEL : NOC:Polymer Reaction Engineering (Chemical Engineering)

Co-ordinators : Prof. Shishir Sinha

Lecture 1 - Introduction to Polymerization Process - I

Lecture 2 - Introduction to polymerization process - II

Lecture 3 - A Short History of polymerization process, monomers and its distribution

Lecture 4 - Gradient and graft copolymer, polymer and its compositions, isomerism in polymers - I

Lecture 5 - Gradient and graft copolymer, polymer and its compositions, isomerism in polymers - II

Lecture 6 - Bonding forces in polymers

Lecture 7 - Molecular weight and its distribution

Lecture 8 - Control on Polymer Synthesis - I

Lecture 9 - Control on Polymer Synthesis - II

Lecture 10 - Control on Polymer Synthesis - III

Lecture 11 - Morphology of polymers

Lecture 12 - Introduction to reactor design - I

Lecture 13 - Introduction to reactor design - II

Lecture 14 - Temperature dependent term and Interpretation of batch reactor data - I

Lecture 15 - Temperature dependent term and Interpretation of batch reactor data - II

Lecture 16 - Interpretation of batch reactor data - III

Lecture 17 - Interpretation of batch reactor data - IV

Lecture 18 - Design equation for ideal reactors

Lecture 19 - Design Equation for Single Reaction System

Lecture 20 - Multiple reactor system

Lecture 21 - Recycle reactor and autocatalytic reaction

Lecture 22 - Multiple reactions system - I

Lecture 23 - Multiple reactions system - II

Lecture 24 - Multiple reactions system - III

Lecture 25 - Problem Solving - I

Lecture 26 - Problem Solving - II

Lecture 27 - Problem Solving - III

Lecture 28 - Step-growth polymerization - I

Lecture 29 - Step Growth Polymerization - II

Lecture 30 - Step Growth Polymerization - III

Lecture 31 - Step Growth Polymerization - IV

Lecture 32 - Radical Chain Polymerization Introduction

Lecture 33 - Radical Chain Polymerization Comparison with Ionic Chain Polymerization

Lecture 34 - Radical Chain Polymerization Mode of Propagation

Lecture 35 - Radical Chain Polymerization Rate of Polymerization

Lecture 36 - Radical Chain Polymerization Rate Expression

Lecture 37 - Radical Chain Polymerization Process Analysis - I

Lecture 38 - Radical Chain Polymerization Process Analysis - II

Lecture 39 - Radical Chain Polymerization Half-life, Propagation and Termination - I

Lecture 40 - Radical Chain Polymerization Half-life, Propagation and Termination - II

Lecture 41 - Radical Chain Polymerization Redox Initiation

Lecture 42 - Radical Chain Polymerization Photochemical and Ionization Initiation

Lecture 43 - Radical Chain Polymerization Other Initiation Techniques - I

Lecture 44 - Radical Chain Polymerization Other Initiation Techniques - II

Lecture 45 - Heterogeneous Polymerization Introduction - I

Lecture 46 - Heterogeneous Polymerization Introduction - II

Lecture 47 - Population Balance Modeling Other Techniques - I

Lecture 48 - Population Balance Modeling Other Techniques - II

Lecture 49 - Emulsion Polymerization Batch Polymerization

Lecture 50 - Emulsion Polymerization Semi-continuous polymerization

Lecture 51 - Emulsion Polymerization Nucleation, Morphology and Reactor Types - I

Lecture 52 - Emulsion Polymerization Nucleation, Morphology and Reactor Types - II

Lecture 53 - Emulsion Polymerization PSD and Implementation of the Process - I

Lecture 54 - Emulsion Polymerization PSD and Implementation of the Process - II

Lecture 55 - Living and dormant Polymerization

Lecture 56 - Ionic Polymerization - I

Lecture 57 - Ionic Polymerization - II

Lecture 58 - Ionic Polymerization - III

Lecture 59 - Ionic Polymerization - IV

Lecture 60 - Ionic Polymerization - V

NPTEL : NOC:Process Equipment Design (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

Lecture 1 - Introduction

Lecture 2 - Classification of exchangers - 1

Lecture 3 - Classification of exchangers - 2

Lecture 4 - Basic Design Parameters - 1

Lecture 5 - Basic Design Parameters - 2

Lecture 6 - Double Pipe Heat Exchanger - 1

Lecture 7 - Double Pipe Heat Exchanger - 2

Lecture 8 - Double Pipe Heat Exchanger - 3

Lecture 9 - Types of Shell and Tube exchangers

Lecture 10 - Exchanger Tubes

Lecture 11 - Exchanger Shell

Lecture 12 - STE design - Kernâ€™s method - 1

Lecture 13 - STE design - Kernâ€™s method - 2

Lecture 14 - STE design - Kernâ€™s method - 3

Lecture 15 - STE design - Kernâ€™s method: Example - 4

Lecture 16 - STE design - Kernâ€™s method: Example - 5

Lecture 17 - STE design - Bellâ€™s method - 1

Lecture 18 - STE design - Bellâ€™s method - 2

Lecture 19 - STE design - Bellâ€™s method - 3

Lecture 20 - STE design - Bellâ€™s method: Example - 4

Lecture 21 - STE design - Bellâ€™s method: Example - 5

Lecture 22 - Design of Condenser - 1

Lecture 23 - Design of Condenser - 2

Lecture 24 - Design of Condenser - 3

Lecture 25 - Design of Condenser - 4

Lecture 26 - Design of Condenser - 5

Lecture 27 - Design of Reboiler - 1

Lecture 28 - Design of Reboiler - 2

Lecture 29 - Design of Reboiler - 3

Lecture 30 - Design of Reboiler - 4

Lecture 31 - Design of Reboiler - 5

Lecture 32 - Design of Reboiler - 6

Lecture 33 - Design of Reboiler - 7

Lecture 34 - Design of Evaporator - 1

Lecture 35 - Design of Evaporator - 2

Lecture 36 - Design of Evaporator - 3

Lecture 37 - Design of Evaporator - 4

Lecture 38 - Design of Evaporator - 5

Lecture 39 - Design of Crystallizer - 1

Lecture 40 - Design of Crystallizer - 2

Lecture 41 - Design of Crystallizer - Examples

Lecture 42 - Design of Crystallizer - Types

Lecture 43 - Design of Packed Column - 1

Lecture 44 - Design of Packed Column - 2

Lecture 45 - Design of Packed Column - 3

Lecture 46 - Design of Packed Column - 4

Lecture 47 - Design of Packed Column - 5

Lecture 48 - Distillation Column - 1

Lecture 49 - Distillation Column - 2

Lecture 50 - Distillation Column - 3

Lecture 51 - Distillation Column - 4

Lecture 52 - Distillation Column - 5

Lecture 53 - Distillation Column - 6

Lecture 54 - Distillation Column - 7

Lecture 55 - Distillation Column - 8

Lecture 56 - Distillation Column - Mechanical Design - 1

Lecture 57 - Distillation Column - Mechanical Design - 2

Lecture 58 - Distillation Column - Mechanical Design - 3

Lecture 59 - Distillation Column - Mechanical Design - 4

Lecture 60 - Distillation Column - Mechanical Design - 5

NPTEL : NOC:Advanced Thermodynamics and Molecular Simulations (Chemical Engineering)

Co-ordinators : Prof. Prateek Kumar Jha

Lecture 1 - Introduction to the course

Lecture 2 - Molecular basis of energy and entropy

Lecture 3 - Probability and probability distributions

Lecture 4 - Probability distributions and thermodynamic equilibrium

Lecture 5 - Energy distribution in molecular systems

Lecture 6 - First and second law of thermodynamics

Lecture 7 - Reversible and irreversible processes; third law of thermodynamics; legendre transformation; thermodynamic functions for one component system

Lecture 8 - Thermodynamic functions for multi-component systems; chemical potential; why do we minimize thermodynamic functions?

Lecture 9 - Extensive and intensive variables; gibbs duhem relation; euler theorem; maxwell relations

Lecture 10 - Discrete and continuous probabilities; stirling approximation

Lecture 11 - Binomial distribution approaches Gaussian distribution for large n; definition of drunkard walk

Lecture 12 - Solution of drunkard walk; Lagrange multipliers

Lecture 13 - Energy distribution in molecular system revisited; introduction to thermodynamic ensembles

Lecture 14 - Canonical ensemble: most probable distribution, partition function

Lecture 15 - Definition of temperature; third law of thermodynamics

Lecture 16 - Canonical ensemble: Helmholtz free energy, averages and fluctuations, specific heat, deriving ideal gas law

Lecture 17 - Partition function of a dense gas; grand canonical ensemble: partition function, most probable distribution

Lecture 18 - Computing properties in grand canonical ensemble

Lecture 19 - Isothermal isobaric ensemble

Lecture 20 - Summary of thermodynamic ensembles; partition function of an ideal gas

Lecture 21 - Mixing and phase separation, phase equilibrium of a multiphase multicomponent system, Gibbs phase rule

Lecture 22 - Pure component phase diagram; solution thermodynamics: Helmholtz free energy density

Lecture 23 - Characterizing mixing and phase separation using Helmholtz free energy density

Lecture 24 - Common tangent construction, definition of binodal, spinodal, and critical point

Lecture 25 - Osmotic pressure and chemical potential

Lecture 26 - Lattice model of liquid solutions - I

Lecture 27 - Lattice model of liquid solutions - II

Lecture 28 - Lattice model of liquid solutions - III

Lecture 29 - Critical review of Lattice model, theoretical basis of molecular dynamics simulation

Lecture 30 - Theoretical basis of molecular dynamics simulation

Lecture 31 - Interaction energy and force field

Lecture 32 - Liouiville theorem; theoretical basis of Monte Carlo simulation

Lecture 33 - Introduction to Monte Carlo simulation method

Lecture 34 - Markov chain algorithm, condition for equilibrium and detailed balance

Lecture 35 - Metropolis algorithm, periodic boundary condition

Lecture 36 - Numerical implementation of Monte Carlo simulation: Python Examples - I

Lecture 37 - Numerical implementation of Monte Carlo simulation: Python Examples - II

Lecture 38 - Numerical implementation of Monte Carlo simulation: Python Examples - III

Lecture 39 - Numerical implementation of Monte Carlo simulation: Python Examples - IV

Lecture 40 - Numerical implementation of Monte Carlo simulation: Python Examples - V

Lecture 41 - Particle simulations: comparison with quantum chemical and continuum simulations; bridging length and time scales

Lecture 42 - Pair potentials

Lecture 43 - Saving CPU time: short range and long range interactions

Lecture 44 - Bonded and non-bonded interactions, force fields

Lecture 45 - Practical aspects of molecular simulations

Lecture 46 - Numerical implementation of MD; thermostat and barostat

Lecture 47 - MD simulations - efficiency and parallelization, sampling and averaging, analysis of simulation trajectories

Lecture 48 - MD simulations - analysis of simulation trajectories (continued), Case Studies - I

Lecture 49 - MD simulations - Case Studies - II

Lecture 50 - MD simulations - Case Studies - III

Lecture 51 - Free energies and phase behavior; extension of canonical ensemble Monte Carlo to other ensembles

Lecture 52 - Extension of canonical ensemble Monte Carlo to other ensembles (Continued...)

Lecture 53 - Monte Carlo in Gibbs ensemble and semi-grand canonical ensemble, thermodynamic integration

Lecture 54 - Thermodynamic integration (continued); Widom's particle insertion; overlapping distribution method

Lecture 55 - Multiple histogram method; umbrella sampling; thermodynamic cycle; potential of mean force; pulling simulations; metadynamics; tackling time scale issues

Lecture 56 - Tackling time scale issues (continued); nonequilibrium molecular dynamics; mesoscale simulations: Langevin dynamics and Brownian dynamics, kinetic Monte Carlo simulations; dissipative particle dynamics

Lecture 57 - Multiparticle collision dynamics; lattice Boltzmann method; coarse-graining

Lecture 58 - Case studies

Lecture 59 - Simulations of chemical reactions using Kinetic Monte Carlo simulations

Lecture 60 - Reactive force fields; Ab initio molecular dynamics and other advanced methods; molecular simulations in chemical engineering; concluding remarks

NPTEL : NOC:Chemical Process Utilities (Chemical Engineering)

Co-ordinators : Prof. Shishir Sinha

Lecture 1 - Introduction to Chemical Process Utilities

Lecture 2 - Energy Perspective to the Utilities

Lecture 3 - Power Cycle

Lecture 4 - Fuel Analysis

Lecture 5 - Practice problems related to power cycle and fuel analysis

Lecture 6 - Heat Transfer Utilities - I

Lecture 7 - Heat Transfer Utilities - II

Lecture 8 - Plate and Frame Heat Exchangers Types

Lecture 9 - Solar Energy - I

Lecture 10 - Solar Energy - II

Lecture 11 - Heat Transfer Media and Solar energy

Lecture 12 - Water

Lecture 13 - Water Chemistry

Lecture 14 - Inhibition and Water Treatment

Lecture 15 - Boiler Water treatment

Lecture 16 - Water Governance

Lecture 17 - Water Quality standards - I

Lecture 18 - Water Quality Standards - II

Lecture 19 - Steam

Lecture 20 - Boilers

Lecture 21 - Industrial Boiler Types

Lecture 22 - Boilers

Lecture 23 - Boilers- Question Practice

Lecture 24 - Steam Generation Unit

Lecture 25 - Steam Generation Unit-Heaters

Lecture 26 - Attemperator and Steam Drum

Lecture 27 - Steam Traps, Centralization, and Fuel Selection

Lecture 28 - Economizer, Super heaters, and Safety devices

Lecture 29

Lecture 30 - Insulation of Steam Generators

Lecture 31 - Air

Lecture 32 - Air Filtration and Pneumatic Conveying

Lecture 33 - Introduction to Pneumatic Conveying System

Lecture 34 - Conveying System Types

Lecture 35 - Material Properties and Pipeline Feeding Devices

Lecture 36 - Feeding devices

Lecture 37 - Gas-solid flows

Lecture 38 - Design of Pipelines Elements of Pipeline Design

Lecture 39 - Natural Gas Transmission - I

Lecture 40 - Natural Gas Transmission - II

Lecture 41 - Natural Gas Transmission - III

Lecture 42 - Pipeline Mechanical design - Natural Gas Transmission - IV

Lecture 43 - Cooling Tower; Theory and Some Basic Calculations

Lecture 44 - Concept of Heat Transfer in Cooling Tower and itâ€™s Components

Lecture 45 - Types and Components of Cooling Tower

Lecture 46 - Components and Materials of Construction and Applications of Cooling Tower

Lecture 47 - Control and Maintenance in cooling towers

Lecture 48 - Pressure Levels and Terminology - I

Lecture 49 - Pressure Levels and Terminology - II

Lecture 50 - Gauges for Pressure Measurement

Lecture 51 - Refrigerants and Refrigeration

Lecture 52 - Introduction to Refrigeration

Lecture 53 - Refrigeration System Components

Lecture 54 - Refrigeration System Components and Refrigeration Cycle

Lecture 55 - Refrigeration Systems

Lecture 56 - Refractories

Lecture 57 - Thermodynamic Principles and Corrosion in Refractories

Lecture 58 - Slag Attack and Kinds of Refractories in Uses

Lecture 59 - Brief history of Insulations and itâ€™s fundamental principles

Lecture 60 - Heat transfer in Insulations materials

NPTEL : NOC:Physico-Chemical Processes for Waste Water Treatment (Chemical Engineering)

Co-ordinators : Prof. Vimal Chandra Srivastava

Lecture 1 - Introduction to Water Pollution and Control

Lecture 2 - Environmental Acts and Standards

Lecture 3 - Water Quality Monitoring: Physical Parameters

Lecture 4 - Water Quality Monitoring: Physical and Chemical Parameters

Lecture 5 - Water Quality Monitoring: Chemical Parameters - I

Lecture 6 - Water Quality Monitoring: Chemical Parameters - II

Lecture 7 - Water Quality Monitoring: Biological/Biochemical Parameters - I

Lecture 8 - Water Quality Monitoring: Biological/Biochemical Parameters - II

Lecture 9 - Water Quality Monitoring: Bacteriological Parameters

Lecture 10 - Treatment of Water and Wastewater

Lecture 11 - Flow Equalization

Lecture 12 - Aeration - I

Lecture 13 - Aeration - II

Lecture 14 - Aeration - III

Lecture 15 - Aeration - IV

Lecture 16 - Aeration - V

Lecture 17 - Aeration - VI

Lecture 18 - Coagulation and Flocculation - I

Lecture 19 - Coagulation and Flocculation - II

Lecture 20 - Coagulation and Flocculation - III

Lecture 21 - Coagulation and Flocculation - IV

Lecture 22 - Settling and Sedimentation - I

Lecture 23 - Settling and Sedimentation - II

Lecture 24 - Settling and Sedimentation - III

Lecture 25 - Settling and Sedimentation - IV

Lecture 26 - Settling and Sedimentation - V

Lecture 27 - Settling and Sedimentation - VI

Lecture 28 - Filtration - I

Lecture 29 - Filtration - II

Lecture 30 - Filtration - III

Lecture 31 - Adsorption - I

Lecture 32 - Adsorption - II

Lecture 33 - Adsorption - III

Lecture 34 - Adsorption - IV

Lecture 35 - Adsorption - V

Lecture 36 - Adsorption - VI

Lecture 37 - Ion-exchange - I

Lecture 38 - Ion-exchange - II

Lecture 39 - Ion-exchange - III

Lecture 40 - Ion-exchange - IV

Lecture 41 - Wastewater treatment by membrane processes - I

Lecture 42 - Wastewater treatment by membrane processes - II

Lecture 43 - Wastewater treatment by membrane processes - III

Lecture 44 - Wastewater treatment by membrane processes - IV

Lecture 45 - Wastewater treatment by membrane processes - V

Lecture 46 - Advanced Oxidation Processes (AOP) - Introduction

Lecture 47 - AOP - Photocatalytic wastewater treatment

Lecture 48 - AOP - Fenton, ozone and catalytic treatment

Lecture 49 - AOP - Electrochemical wastewater treatment - I

Lecture 50 - AOP - Electrochemical wastewater treatment - II

Lecture 51 - AOP - Sono-hybrid wastewater treatment

Lecture 52 - Disinfection - I

Lecture 53 - Disinfection - II

Lecture 54 - Disinfection - III

Lecture 55 - Case Study - Wastewater treatment in sugar industry

Lecture 56 - Case Study - Wastewater treatment in distillery

Lecture 57 - Case Study - Wastewater treatment in fertilizer industry

Lecture 58 - Case Study - Wastewater treatment in petroleum refining industry

Lecture 59 - Case Study - Common effluent treatment plant (CETP)

Lecture 60 - Choice of technology and summary

NPTEL : NOC:Basic Environmental Engineering and Pollution Abatement (Chemical Engineering)

Co-ordinators : Prof. P. Mondal

Lecture 1 - Introduction

Lecture 2 - Ecology, Environment and Biodiversity

Lecture 3 - Ecosystem services and its risks - 1

Lecture 4 - Ecosystem services and its risks - 2

Lecture 5 - Tutorial-1

Lecture 6 - Pollution types and sources

Lecture 7 - Pollution: Impacts/Consequences

Lecture 8 - Transmission of pollutants in environment - 1

Lecture 9 - Transmission of pollutants in environment - 2

Lecture 10 - Tutorial-2

Lecture 11 - Environmental quality and standards - 1

Lecture 12 - Environmental quality and standards - 2

Lecture 13 - Instrumental techniques of environmental analysis - 1

Lecture 14 - Instrumental techniques of environmental analysis - 2

Lecture 15 - Tutorial-3

Lecture 16 - Sampling and characterization - 1 (Gas, air ,emission)

Lecture 17 - Sampling and characterization - 2 (water, wastewater, effluents)

Lecture 18 - Sampling and characterization - 3 (solid waste and soil)

Lecture 19 - Environmental laws and regulatory framework

Lecture 20 - Tutorial-4

Lecture 21 - Air pollution control - 1

Lecture 22 - Air pollution control - 2

Lecture 23 - Air pollution control - 3

Lecture 24 - Air pollution control - 4

Lecture 25 - Tutorial-5

Lecture 26 - Treatment of surface and ground water for drinking water generation

Lecture 27 - Treatment of domestic and industrial wastewater: Schemes

Lecture 28 - Primary treatment equipment

Lecture 29 - Secondary treatment processes

Lecture 30 - Tutorial-6

Lecture 31 - Secondary treatment equipment - 1

Lecture 32 - Secondary treatment equipment - 2

Lecture 33 - Advanced secondary processes - 1

Lecture 34 - Advanced secondary processes - 2

Lecture 35 - Tutorial-7

Lecture 36 - Advanced secondary processes - 3

Lecture 37 - Tertiary treatment - 1

Lecture 38 - Tertiary treatment - 2

Lecture 39 - Tertiary treatment - 3

Lecture 40 - Tutorial-8

Lecture 41 - Sludge management - 1

Lecture 42 - Sludge management - 2

Lecture 43 - Sludge management - 3

Lecture 44 - Industrial Pollution Control in GPI - 1 (General aspect and pollution control in sugar industry)

Lecture 45 - Tutorial-9

Lecture 46 - Industrial Pollution Control in GPI - 2 (Pollution control in Distillery)

Lecture 47 - Industrial Pollution Control in GPI - 3 (Pollution control in Tannery)

Lecture 48 - Pollution control in Petroleum refinery and petrochemicals industry

Lecture 49 - Industrial Pollution Control in GPI - 4

Lecture 50 - Tutorial 10

Lecture 51 - Solid waste and hazardous waste management - 1

Lecture 52 - Solid waste and hazardous waste management - 2

Lecture 53 - Solid waste and hazardous waste management - 3

Lecture 54 - Solid waste and hazardous waste management - 4

Lecture 55 - Tutorial-11

Lecture 56 - Air Pollution Management, Air quality survey, NAAQI - 1

Lecture 57 - Air Pollution Management, Air quality survey, NAAQI - 2

Lecture 58 - Management of special category wastes - 1

Lecture 59 - Management of special category wastes - 2

Lecture 60 - Tutorial-12

NPTEL : NOC:Biological Process Design for Wastewater Treatment (Chemical Engineering)

Co-ordinators : Prof. Vimal Chandra Srivastava

Lecture 1 - Introduction to Biological Process Design for Wastewater Treatment

Lecture 2 - Microorganisms in Biological Wastewater Treatment

Lecture 3 - Fundamentals of Biochemical Operations

Lecture 4 - Wastewater Characterization - I

Lecture 5 - Wastewater Characterization - II

Lecture 6 - Wastewater Characterization - III

Lecture 7 - Wastewater Characterization - IV

Lecture 8 - Wastewater Characterization - V

Lecture 9 - Stoichiometry of Microbial Growth - I

Lecture 10 - Stoichiometry of Microbial Growth - II

Lecture 11 - Stoichiometry of Microbial Growth - III

Lecture 12 - Reaction Kinetics

Lecture 13 - Bacterial Growth Kinetics - I

Lecture 14 - Bacterial Growth Kinetics - II

Lecture 15 - Reactor Hydraulics - I

Lecture 16 - Reactor Hydraulics - II

Lecture 17 - Treatment of Water and Wastewater - I

Lecture 18 - Treatment of Water and Wastewater - II

Lecture 19 - Coagulation, Flocculation, and Sedimentation - I

Lecture 20 - Coagulation, Flocculation, and Sedimentation - II

Lecture 21 - Lagoon

Lecture 22 - Activated Sludge Process

Lecture 23 - Sequential Batch Reactor

Lecture 24 - Trickling Filter

Lecture 25 - Rotating Disc Reactor

Lecture 26 - Up-flow Anaerobic Sludge Blanket (UASB) reactor

Lecture 27 - UASB and Biotower

Lecture 28 - Advanced Biological Wastewater Treatment: Fluidized Bed Bioreactors

Lecture 29 - Advanced Biological Wastewater Treatment: Membrane Bioreactors

Lecture 30 - Advanced Biological Wastewater Treatment: Moving Bed Biofilm Reactor (MBBR)

Lecture 31 - Sludge Management - I

Lecture 32 - Sludge Management - II

Lecture 33 - Sludge Management - III

Lecture 34 - Sludge Management - IV

Lecture 35 - Sludge Management - V

Lecture 36 - Sludge Management - VI

Lecture 37 - Sustainable Development and Environmental Impact Assessment

Lecture 38 - Management of Wastewater from Dairy Industry

Lecture 39 - Management of Wastewater from Slaughterhouse

Lecture 40 - Common Effluent Treatment Plant (CETP)

NPTEL : NOC:Advanced Reaction Engineering (Chemical Engineering)

Co-ordinators : Prof. Taraknath Das

Lecture 1 - Introduction

Lecture 2 - Introduction_Various Reactors_BR

Lecture 3 - Design Equation_Continuous reactor (CSTR_PFR_PBR)

Lecture 4 - Design Equation_Continuous reactor (CSTR_PFR_PBR)_Sizing

Lecture 5 - Reaction Rate with Conversion, Temperature, and pressure (Batch/Flow system)

Lecture 6 - Space time Space velocity and CSTRs in series/parallel

Lecture 7 - Effect of Pressure Drop on reactor design (PBR)_(X vs W) and (P vs W)

Lecture 8 - Effect of Pressure Drop on Reactor design (PBR)_(X vs W)_ (P vs W)

Lecture 9 - Effect of Pressure Drop in PBR reactor_Analytical solution of Differential equation

Lecture 10 - Effect of Pressure Drop in PBR reactor_Analytical solution for Reaction With Pressure drop

Lecture 11 - Effect of Pressure Drop in PBR reactor_Example

Lecture 12 - Differential Reactor_rate of reaction_catalyst deactivation

Lecture 13 - Catalyst deactivation

Lecture 14 - Catalyst Deactivation_Temperature (T) - Time (t) trajectories

Lecture 15 - Moving Bed Reactor_Catalyst deactivation

Lecture 16 - STTR_Catalyst deactivation

Lecture 17 - Multi phase reactors-1: Slurry reactor - 1

Lecture 18 - Multi phase reactors-1: Slurry reactor - 2

Lecture 19 - Multi phase reactors-1: Slurry reactor - 3

Lecture 20 - Multi phase reactors-2: Trickle bed reactor - 1

Lecture 21 - Multi phase reactors-2: Trickle bed reactor - 2

Lecture 22 - Multi phase reactors-2: Trickle bed reactor - 3

Lecture 23 - Bioreactor_Cell Growth and Rate laws

Lecture 24 - Bioreactors_Stoichiometry_Yield coefficients_rate of substrate consumption

Lecture 25 - Bioreactors_Example_Yield coefficients and rate law parameters estimation

Lecture 26 - Bioreactors_Mass Balances (Cell, Substrate, Product)

Lecture 27 - Bioreactors_Chemostats

Lecture 28 - Steady State Non Isothermal reactor design_EB equation

Lecture 29 - Steady State Non Isothermal reactor design_Example

Lecture 30 - SS Non Isothermal reactor design_Reaction with Heat Exchange

Lecture 31 - SS Non Isothermal reactor design_Heat Exchange_ T-profile for a few cases

Lecture 32 - SS Non Isothermal reactor design_Equilibrium conversion

Lecture 33 - SS Non Isothermal reactor design_Optimum feed temperature

Lecture 34 - SS Non Isothermal reactor design_Multiple Steady States

Lecture 35 - SS Non Isothermal reactor design_Ignition Extinction Curves

Lecture 36 - SS Non Isothermal reactor design_Runaway reaction in a CSTR

Lecture 37 - SS Non Isothermal reactor design_Energy Balance:Multiple rxn in a CSTR/PFR (Examples)

Lecture 38 - Non-ideal flow - 1

Lecture 39 - Basics of Non-ideal flow - 2

Lecture 40 - Basics of Non-ideal flow - 3

Lecture 41 - Non-ideal flow-Segregation model

Lecture 42 - One parameter Model-Tank in Series model (TIS)

Lecture 43 - Non-ideal flow-Dispersion model - Part 1

Lecture 44 - Non-ideal flow-Dispersion model - Part 2

Lecture 45 - Non-ideal flow-Dispersion model - Part 3

Lecture 46 - Two parameter Models-Modeling real reactors with Combinations of Ideal Reactors

Lecture 47 - Solid Catalyzed Reaction: Reaction and Diffusion - Part 1

Lecture 48 - Solid Catalyzed Reaction: Reaction and Diffusion - Part 2

Lecture 49 - Solid Catalyzed Reaction: Reaction and Diffusion - Part 3

Lecture 50 - Catalysis and Catalytic Reactors - Part 1

Lecture 51 - Catalysis and Catalytic Reactors - Part 2

Lecture 52 - Catalysis and Catalytic Reactors - Part 3

Lecture 53 - Collection and Analysis of Rate - Part 1

Lecture 54 - Collection and Analysis of Rate - Part 2

Lecture 55 - Collection and Analysis of Rate - Part 3

Lecture 56 - Polymath and ODE solver

Lecture 57 - Catalyst Synthesis - Part 1

Lecture 58 - Catalyst Synthesis - Part 2

Lecture 59 - Catalyst Characterization Techniques: BET, Pore size, Pore volume

Lecture 60 - Catalyst Characterization Techniques

NPTEL : NOC:Polymer Process Engineering (Chemical Engineering)

Co-ordinators : Prof. Shishir Sinha

Lecture 1 - Introduction to Polymers

Lecture 2 - Polymers and Polymerization Techniques

Lecture 3 - Characteristics of Polymers - I

Lecture 4 - Characteristics of Polymers - II

Lecture 5 - Applications of Polymers

Lecture 6 - Thermodynamics of Polymer Systems - I

Lecture 7 - Thermodynamics of Polymer Systems - II

Lecture 8 - Thermodynamics of Polymer Systems - III

Lecture 9 - Thermodynamics of Polymer Systems - IV

Lecture 10 - Thermodynamics of Polymer Systems - V

Lecture 11 - Applied polymer rheology: Fluid behavior

Lecture 12 - Applied polymer rheology: Structure and properties of deforming polymer

Lecture 13 - Applied polymer rheology: Flow of polymers with supermolecular structure

Lecture 14 - Applied polymer rheology: Transport phenomena

Lecture 15 - Applied polymer rheology: Rheometry

Lecture 16 - Heat Transfer Phenomenon in polymer systems: Introduction

Lecture 17 - Heat Transfer Phenomenon in polymer systems: Thermal properties

Lecture 18 - Heat Transfer Phenomenon in polymer systems: Thermal properties and conduction

Lecture 19 - Heat Transfer Phenomenon in polymer systems: Conduction and Convection

Lecture 20 - Heat Transfer Phenomenon in polymer systems: Convection and Radiation

Lecture 21 - Mass Transfer Phenomenon in Polymers: Introduction

Lecture 22 - Steady State Diffusion in Polymers

Lecture 23 - Mass transfer coefficient and dimensionless numbers

Lecture 24 - Mass transfer phenomenon in polymers: Laminar flow and boundary layer conditions

Lecture 25 - Mass transfer phenomenon in polymers: Diffusivity and solubility of gases

Lecture 26 - Chemical reaction engineering in polymers: Introduction

Lecture 27 - Chemical reaction engineering in polymers: Condensation (Step-growth) polymerization

Lecture 28 - Chemical reaction engineering in polymers: Addition (Chain-Growth) Polymerization - I

Lecture 29 - Chemical reaction engineering in polymers: Addition (Chain-Growth) Polymerization - II

Lecture 30 - Chemical reaction engineering in polymers: Addition (Chain-Growth) Polymerization - III

Lecture 31 - Injection Moulding - 1

Lecture 32 - Injection Moulding - 2

Lecture 33 - Extrusion

Lecture 34 - Blow moulding

Lecture 35 - Calendaring and Fiber spinning

Lecture 36 - Polymer Testing - 1

Lecture 37 - Polymer testing - 2 (Standardization, Sample preparation)

Lecture 38 - Polymer testing - 3

Lecture 39 - Polymer testing - 4 (Measuring of rheological properties)

Lecture 40 - Polymer testing - 5 (Mechanical properties; Hardness, tensile and compression)

Lecture 41 - Polymer testing - 6

Lecture 42 - Polymer Testing - 7

Lecture 43 - Polymer Testing - 8

Lecture 44 - Polymer Testing - 9

Lecture 45 - Polymer Testing - 10

Lecture 46 - Polymeric Materials Used in Electronics

Lecture 47 - Polymers in Electronics: Epoxies

Lecture 48 - Epoxies, Phenoxies, and Silicones

Lecture 49 - Polyimides

Lecture 50 - Fluorocarbons, Polyxylyenes, and Polyesters

Lecture 51 - Polymer Materials in Electronics

Lecture 52 - Functions of Coatings - I

Lecture 53 - Functions of Coatings - II

Lecture 54 - Natural fibers reinforced composites - I

Lecture 55 - Natural fibers reinforced composites - II

Lecture 56 - NFRCs and Polymer Applications

Lecture 57 - Polymer Applications in Building Materials

Lecture 58 - Polymer applications in different fields: Polymer in textile

Lecture 59 - Polymer applications in different fields: Polymer in cosmetics

Lecture 60 - Polymer applications in different fields: Polymer and food packaging

NPTEL : Chemical Reaction Engineering (Chemical Engineering)

Co-ordinators : Prof. Jayant M Modak

Lecture 1 - Introduction & Overview

Lecture 2 - Basic concepts : Representation of Chemical Reactions

Lecture 3 - Thermodynamics of Chemical Reactions - Part I

Lecture 4 - Thermodynamics of Chemical Reactions - Part II

Lecture 5 - Chemical Reaction Kinetics - Overview

Lecture 6 - Chemical Reaction Kinetics & Reactor Design

Lecture 7 - Chemical Reactor Design

Lecture 8 - Problem Solving: Thermodynamics & Kinetics

Lecture 9 - Complec Reactions - Introduction

Lecture 10 - Complex Reactions - Yield & Selectivity

Lecture 11 - Complex Reactions - Quasi Steady State and Quasi Equilibrium Approximations

Lecture 12 - Complex Reactions - Kinetics of Chain Reactions & polymerization

Lecture 13 - Catalytic reactions - Introduction

Lecture 14 - Catalytic reactions - Adsorption & Desorption

Lecture 15 - Catalytic reactions - Kinetics

Lecture 16 - Monomolecular Reaction Network & Lumping Analysis

Lecture 17 - Problem solving: Complex reactions

Lecture 18 - Gas-solid Catalytic Reactions - External diffusion

Lecture 19 - Gas-solid Catalytic Reactions - Transport in Catalyst Pellet

Lecture 20 - Gas-solid Catalytic Reactions - Diffusion & Reaction - I

Lecture 21 - Gas-solid Catalytic Reactions - Diffusion & Reaction - II

Lecture 22 - Gas-solid Catalytic Reactions - Diffusion & Reaction - III

Lecture 23 - Gas-solid Catalytic Reactions - Nonisothermal effects

Lecture 24 - Gas-solid Noncatalytic Reactions

Lecture 25 - Gas-Liquid Reactions

Lecture 26 - Problem solving: Heterogenous reactions

Lecture 27 - Chemical Reactor Design: Mass & Energy Balances

Lecture 28 - Chemical Reactor Design: Mass & Energy Balances for Heterogenous Reactions

Lecture 29 - Nonisothermal Reactor Operation

Lecture 30 - Case Study - Ethane dehyrogenation

Lecture 31 - Case Study - Hydrogenation of Oil

Lecture 32 - Case Study - Ammonia Synthesis

Lecture 33 - Autothermal reactors

Lecture 34 - Parametric Sensitivity

Lecture 35 - CSTR - multiple steady states

Lecture 36 - Stability Analysis - Basics

Lecture 37 - Stability Analysis - Examples

Lecture 38 - Nonideal flow and reactor performance - I

Lecture 39 - Nonideal flow and reactor performance - II

Lecture 40 - Problem solving: Reactor Design

NPTEL : Fundamentals of Transport Processes (Chemical Engineering)

Co-ordinators : Prof. V. Kumaran

Lecture 1 - Introduction

Lecture 2 - Dimensional Analysis

Lecture 3 - Dimensional Analysis (Continued...)

Lecture 4 - Dimensionless Groups

Lecture 5 - Continuum description

Lecture 6 - Mechanisms of diffusion - I

Lecture 7 - Mechanisms of diffusion - II

Lecture 8 - Unidirectional Transport Cartesian Coordinates - I

Lecture 9 - Unidirectional Transport Cartesian Coordinates - II Similarity Solutions

Lecture 10 - Unidirectional Transport Cartesian Coordinates - III Similarity Solutions

Lecture 11 - Unidirectional Transport Cartesian Coordinates - IV Seperation of Variables

Lecture 12 - Unidirectional Transport Cartesian Coordinates - V Seperation of Variables

Lecture 13 - Unidirectional Transport Cartesian Coordinates - VI Oscillatory Flows

Lecture 14 - Unidirectional Transport Cartesian Coordinates - VII Momentum Source in the Flow

Lecture 15 - Unidirectional Transport Cartesian Coordinates - VIII Heat & Mass Sources

Lecture 16 - Unidirectional Transport Cylindrical Coordinates - I Conservation Equations

Lecture 17 - Unidirectional Transport Cylindrical Coordinates - II Similarity Solutions

Lecture 18 - Unidirectional Transport Cylindrical Coordinates - III Seperation of Variables

Lecture 19 - Unidirectional Transport Cylindrical Coordinates - IV Steady flow in a pipe

Lecture 20 - Unidirectional Transport Cylindrical Coordinates - V Oscillatory flow in a pipe

Lecture 21 - Unidirectional Transport Cylindrical Coordinates - VI Oscillatory flow in a pipe Regular Perturbation Expansion

Lecture 22 - Unidirectional Transport Cylindrical Coordinates - VII Oscillatory flow in a pipe Singular Perturbation Expansion

Lecture 23 - Unidirectional Transport Spherical Coordinates - I Balance Equation

Lecture 24 - Unidirectional Transport Spherical Coordinates - II Seperation of Variables

Lecture 25 - Mass & Energy Conservation Cartesian Coordinates

Lecture 26 - Mass & Energy Conservation Cartesian Coordinates Heat Conduction in a Cube

Lecture 27 - Mass & Energy Conservation Spherical Coordinates Balance Laws

Lecture 28 - Mass & Energy Conservation Cylindrical Coordinates

Lecture 29 - Diffusion Equation Spherical Co-ordinates Seperation of Variables

Lecture 30 - Diffusion Equation Spherical Co-ordinates Seperation of Variables (Continued...)

Lecture 31 - Diffusion Equation Spherical Co-ordinates Effective Conductivity of a Composite

Lecture 32 - Diffusion Equation Spherical Harmonics

Lecture 33 - Diffusion Equation Delta Functions

Lecture 34 - Diffusion Equation Multipole Expansions

Lecture 35 - Diffusion Equation Greens Function Formulations

Lecture 36 - High Peclet Number Transport Flow Past a Flat Plate

Lecture 37 - High Peclet Number Transport Heat Transfer from a Spherical Particle - I

Lecture 38 - High Peclet Number Transport Heat Transfer from a Spherical Particle - II

Lecture 39 - High Peclet Number Transport Heat Transfer from a Gas Bubble

Lecture 40 - Summary

NPTEL : Fundamentals of Transport Processes - II (Chemical Engineering)

Co-ordinators : Prof. V. Kumaran

Lecture 1 - Review of Fundamentals of Transport Processors I

Lecture 2 - Introduction

Lecture 3 - Vectors and Tensors

Lecture 4 - Vector calculus

Lecture 5 - Vector calculus

Lecture 6 - Curvilinear co-ordinates

Lecture 7 - Kinematics

Lecture 8 - Rate of deformation tensor

Lecture 9 - Mass conservation equation

Lecture 10 - Momentum conservation equation

Lecture 11 - Angular momentum conservation equation

Lecture 12 - Boundary conditions

Lecture 13 - Mechanical energy conservation

Lecture 14 - Unidirectional flow

Lecture 15 - Viscous flows

Lecture 16 - Viscous flows

Lecture 17 - Flow around a sphere

Lecture 18 - Force on moving sphere

Lecture 19 - Torque on rotating sphere

Lecture 20 - Effective viscosity of a suspension

Lecture 21 - Flow in a corner

Lecture 22 - Lubrication flow

Lecture 23 - Lubrication flow

Lecture 24 - Inertia of a low Reynolds number

Lecture 25 - Potential flow

Lecture 26 - Potential flow around a sphere

Lecture 27 - Two-dimensional potential flow

Lecture 28 - Two-dimensional potential flow

Lecture 29 - Flow around a cylinder

Lecture 30 - Conformal transforms in potential flow

Lecture 31 - Boundary layer theory

Lecture 32 - Boundary layer past a flat plate

Lecture 33 - Stagnation point flow

Lecture 34 - Falkner-Skan Boundary Layer Solutions

Lecture 35 - Falkner-Skan Boundary Layer Solutions

Lecture 36 - Vorticity Dynamics

Lecture 37 - Vorticity Dynamics

Lecture 38 - Turbulence

Lecture 39 - Turbulence

Lecture 40 - Turbulent flow in a channel

NPTEL : Modern Instrumental Methods of Analysis (Chemical Engineering)

Co-ordinators : Dr. J.R. Mudakavi

Lecture 1 - Introduction to the Modern Instrumental Methods of Analysis

Lecture 2 - Atomic Structure

Lecture 3 - Physical Properties of Electromagnetic Radiation

Lecture 4 - Interaction of Matter with Radiation

Lecture 5 - Ultraviolet and Visible Spectrophotometry-1 (i. Theoretical Aspects)

Lecture 6 - Ultraviolet and Visible Spectrophotometry-2 (ii. Theoretical Aspects)

Lecture 7 - Ultraviolet and Visible Spectrophotometry-3 (iii. Theoretical Aspects)

Lecture 8 - Ultraviolet and Visible Spectrophotometry-4 (iv. Instrumentation)

Lecture 9 - Ultraviolet and Visible Spectrophotometry-5 (v. Instrumentation)

Lecture 10 - Ultraviolet and Visible Spectrophotometry-6 (vi. Applications)

Lecture 11 - Fluorescence and Phosphorescence Spectrophotometry-1 (i. Theoretical Aspects)

Lecture 12 - Fluorescence and Phosphorescence Spectrophotometry-2 (ii. Instrumentation)

Lecture 13 - Fluorescence and Phosphorescence Spectrophotometry-3 (iii. Application)

Lecture 14 - Atomic Fluorescence (i. Theoretical aspects)

Lecture 15 - X- Ray Analytical Techniques-1 (ii. Instrumentation)

Lecture 16 - X- Ray Analytical Techniques-2 (iii. Applications)

Lecture 17 - Atomic Absorption Spectrometry-1 (i. Theoretical Aspects)

Lecture 18 - Atomic Absorption Spectrometry-2 (ii.Theoretical Aspects)

Lecture 19 - Atomic Absorption Spectrometry-3 (iii. Instrumentation)

Lecture 20 - Atomic Absorption Spectrometry-4 (iv. Instrumentation)

Lecture 21 - Atomic Absorption Spectrometry-5 (v. Instrumentation)

Lecture 22 - Atomic Absorption Spectrometry-6 (vi. Signal handling)

Lecture 23 - Atomic Absorption Spectrometry-7 (vii. Interferences)

Lecture 24 - Atomic Absorption Spectrometry-8 (viii. Hydride Generation AAS)

Lecture 25 - Atomic Absorption Spectrometry-9 (ix.Cold Vapour Mercury AAS)

Lecture 26 - Electrothermal Atomic Absorption Spectrometry-10 (x. Electrothermal Aspects)

Lecture 27 - Electrothermal Atomic Absorption Spectrometry-11 (xi. Practical Aspects)

Lecture 28 - Inductively Coupled Plasma Atomic Emission Spectrometry-1 (i. Theoretical Aspects)

Lecture 29 - Inductively Coupled Plasma Atomic Emission Spectrometry-2 (ii. Instrumentation)

Lecture 30 - Inductively Coupled Plasma Atomic Emission Spectrometry-3 (iii. Comparison of ICP & AAS)

Lecture 31 - Infrared Spectroscopy-1 (i. Theoretical Aspects)

Lecture 32 - Infrared Spectroscopy-2 (ii. Practical Aspects)

Lecture 33 - Infrared Spectroscopy-3 (iii. Nondispensive IR, Mass spectrometer)

Lecture 34 - Introduction to Mass Spectrometry

Lecture 35 - Introduction to Nuclear Magnetic Resonance Spectroscopy

Lecture 36 - Fundamentals of Electrochemical Techniques-1 (i. Introduction)

Lecture 37 - Fundamentals of Electrochemical Techniques-2 (ii. Introduction) (Continued...)

Lecture 38 - Polarography-1 (i. Introduction)

Lecture 39 - Polarography-2 (ii. Applications)

Lecture 40 - Chromatography-1 (i. Introduction)

Lecture 41 - Gas chromatography-1 (i. Instrumentation)

Lecture 42 - Gas chromatography-2 (ii. Applications)

Lecture 43 - Gas chromatography-3 (iii. Applications)

NPTEL : NOC:Transport Processes I: Heat and Mass Transfer (Chemical Engineering)

Co-ordinators : Prof. V. Kumaran

Lecture 1 - Transport by convection and diffusion

Lecture 2 - Non-dimensional analysis of beams

Lecture 3 - Dimensional analysis: Force on a particle settling in a fluid

Lecture 4 - Dimensional analysis: Heat transfer in a heat exchanger

Lecture 5 - Dimensional analysis: Mass transfer from a particle suspended in a fluid

Lecture 6 - Dimensional analysis: Power of an impeller

Lecture 7 - Dimensional analysis: Scaling up of an impeller

Lecture 8 - Dimensional analysis: Convection and diffusion

Lecture 9 - Dimensional analysis: Physical interpretation of dimensionless groups

Lecture 10 - Dimensional analysis: Correlations for dimensionless groups

Lecture 11 - Dimensional analysis: Natural and forced convection

Lecture 12 - Continuum description of fluids

Lecture 13 - Conservation equations and constitutive relations

Lecture 14 - Diffusion: Mechanism of mass diffusion in gases

Lecture 15 - Diffusion: Estimation of mass diffusion coefficient

Lecture 16 - Diffusion: Momentum diffusion coefficient

Lecture 17 - Diffusion: Thermal diffusion coefficient

Lecture 18 - Unidirectional transport: Conservation equation for heat and mass transfer

Lecture 19 - Unidirectional transport: Conservation equation for momentum transfer

Lecture 20 - Unidirectional transport: Similarity solution for infinite domain

Lecture 21 - Unidirectional transport: Similarity solution for infinite domain (Continued...)

Lecture 22 - Unidirectional transport: Similarity solution for mass transfer into a falling film

Lecture 23 - Unidirectional transport: Similarity solution for decay of a pulse

Lecture 24 - Unidirectional transport: Similarity solution for decay of a pulse (Continued...)

Lecture 25 - Unidirectional transport: Separation of variables for transport in a finite domain

Lecture 26 - Unidirectional transport: Separation of variables for transport in a finite domain (Continued...)

Lecture 27 - Unidirectional transport: Separation of variables for transport in a finite domain (Continued...)

Lecture 28 - Unidirectional transport: Separation of variables for transport in a finite domain (Continued...)

Lecture 29 - Unidirectional transport: Balance laws in cylindrical co-ordinates. Heat transfer across the wall of a pipe

Lecture 30 - Unidirectional transport: Balance laws in cylindrical co-ordinates. Unsteady heat conduction from a cylinder

Lecture 31 - Unidirectional transport: Balance laws in cylindrical co-ordinates. Unsteady heat conduction from a cylinder (Continued...)

Lecture 32 - Unidirectional transport: Balance laws in cylindrical co-ordinates. Unsteady heat conduction from a cylinder (Continued...)

Lecture 33 - Unidirectional transport: Balance laws in cylindrical co-ordinates. Similarity solution for heat conduction from a wire

Lecture 34 - Unidirectional transport: Effect of body force in momentum transfer. Falling film

Lecture 35 - Unidirectional transport: Effect of pressure in momentum transfer. Flow in a pipe

Lecture 36 - Unidirectional transport: Friction factor for flow in a pipe

Lecture 37 - Unidirectional transport: Laminar and turbulent flow in a pipe

Lecture 38 - Unidirectional transport: Laminar and turbulent flow in a pipe

Lecture 39 - Unidirectional transport: Oscillatory flow in a pipe. Solution using complex variables

Lecture 40 - Unidirectional transport: Oscillatory flow in a pipe. Solution using complex variables

Lecture 41 - Unidirectional transport: Oscillatory flow in a pipe. Solution using complex variables (Continued...)

Lecture 42 - Unidirectional transport: Oscillatory flow in a pipe. Low and high Reynolds number solutions

Lecture 43 - Unidirectional transport: Spherical co-ordiantes. Heat conduction from a sphere

Lecture 44 - Mass and energy balance equations in Cartesian co-ordinates

Lecture 45 - Mass and energy balance equations in Cartesian co-ordinates

Lecture 46 - Mass and energy balance equations in spherical co-ordinates

Lecture 47 - Mass and energy balance equations in spherical co-ordinates

Lecture 48 - Momentum balance: Incompressible Navier-Stokes equations

Lecture 49 - Balance equation: Convection and diffusion dominated regimes

Lecture 50 - Diffusion equation: Heat conduction in a rectangular solid

Lecture 51 - Diffusion equation: Heat conduction in a rectangular solid (Continued...)

Lecture 52 - Diffusion equation: Heat conduction around a sphereical inclusion

Lecture 53 - Diffusion equation: Heat conduction around a spherial inclusion

Lecture 54 - Diffusion equation: Effective conductivity of a composite

Lecture 55 - Diffusion equation: Spherical harmonic solutions

Lecture 56 - Diffusion equation: Conduction from a point source

Lecture 57 - Diffusion equation: Method of Greens functions

Lecture 58 - Diffusion equation: Method of images

Lecture 59 - Diffusion equation: Equivalence of spherical harmonics and multipole expansion

Lecture 60 - High Peclet number forced convection: Boundary layer in flow past a heated plate

Lecture 61 - High Peclet number forced convection: Boundary layer in flow past a heated plate (Continued...)

Lecture 62 - High Peclet number forced convection: Flow past a heated sphere

Lecture 63 - High Peclet number forced convection: Flow past a heated sphere (Continued...)

Lecture 64 - High Peclet number forced convection: Transport to a falling film

Lecture 65 - High Peclet number forced convection: Transport to a spherical bubble

Lecture 66 - High Peclet number forced convection: Solutions for an arbitrary geometry

Lecture 67 - High Peclet number forced convection: Taylor dispersion

Lecture 68 - Natural convection: Boussinesq equations for heat transfer

Lecture 69 - Natural convection: Boundary layer equations

Lecture 70 - Natural convection: Boundary layer equations convection

Lecture 71 - Natural convection: Heat transfer correlations

NPTEL : NOC:Atomic and Molecular Absorption Spectrometry for Pollution Monitoring (Chemical Engineering)

Co-ordinators : Dr. J.R. Mudakavi

Lecture 1 - Course Introduction

Lecture 2 - Atomic structure

Lecture 3 - Interaction of EM radiation with matter

Lecture 4 - Atomic and molecular orbitals

Lecture 5 - Interaction of EM radiation with matter - I

Lecture 6 - Interaction of EM radiation with matter - II

Lecture 7 - Interaction of interaction of EM radiation with matter - III

Lecture 8 - Emission and absorption spectra

Lecture 9 - MO theory

Lecture 10 - Structure Â– property relationship of organic compounds

Lecture 11 - Woodword Fieser rules, structure Â– property relationship

Lecture 12 - Beer-Lamberts law

Lecture 13 - Deviations from Beer-Lamberts law, relative concentration error, instrumentation - I

Lecture 14 - UV-Visible spectrophotometry, instrumentation - II

Lecture 15 - UV-Visible spectrophotometry, instrumentation - III

Lecture 16 - UV-Visible spectrophotometry, instrumentation - IV

Lecture 17 - Quantitative analysis Â– I

Lecture 18 - Quantitative analysis Â– II

Lecture 19 - Quantitative analysis Â– III

Lecture 20 - Quantitative analysis Â– IV

Lecture 21 - Fluorescence spectrophotometry Â– I

Lecture 22 - Fluorescence spectrophotometry - II

Lecture 23 - Fluorescence spectrophotometry - III

Lecture 24 - Instrumentation

Lecture 25 - Chemical analysis, applications

Lecture 26 - Chemiluminiscence, principles

Lecture 27 - Status of spectrophotometry vis a vis environment

Lecture 28 - Separations methods

Lecture 29 - Method development

Lecture 30 - Boron, chloride

Lecture 31 - Fluoride

Lecture 32 - Phenols

Lecture 33 - Arsenic, Free chlorine

Lecture 34 - Magnesium

Lecture 35 - Nonionic surfactants, iron, phosphate

Lecture 36 - Nitrite , manganese

Lecture 37 - Cadmium, copper, lead

Lecture 38 - Total hardness, zinc

Lecture 39 - Nitrate, chromium

Lecture 40 - Determination of aluminum, cyanide, sulphate

Lecture 41 - Sulphate, ammonia, Conclusions

NPTEL : NOC:Trace and Ultra-trace Analysis of Metals using Atomic Absorption Spectrometry (Chemical Engineering)

Co-ordinators : Dr. J.R. Mudakavi

Lecture 1 - Course Introduction

Lecture 2 - Atomic structure - I

Lecture 3 - Atomic structure - II

Lecture 4 - Electronic arrangement in the Elements - I

Lecture 5 - Electronic arrangement in the Elements - II

Lecture 6 - Interaction of EM radiation with matter - I

Lecture 7 - Interaction of EM radiation with matter - II

Lecture 8 - Interaction of EM radiation with matter - III

Lecture 9 - Interaction of EM radiation with matter - IV

Lecture 10 - Theoretical basis of AAS - I

Lecture 11 - Theoretical basis of AAS - II

Lecture 12 - Theoretical basis of AAS - III

Lecture 13 - Theoretical basis of AAS - IV

Lecture 14 - Instrumentation in AAS - I

Lecture 15 - Instrumentation in AAS - I (Continued...) Radiation Sources

Lecture 16 - Instrumentation in AAS Radiation Sources: Sample introduction

Lecture 17 - Instrumentation in AAS - III : Burners

Lecture 18 - Instrumentation in AAS - IV : Flame Processes

Lecture 19 - Instrumentation in AAS - V : Atomization Processes

Lecture 20 - Instrumentation in AAS - VI : Optics

Lecture 21 - Instrumentation in AAS - VII : Optics and Detectors

Lecture 22 - Interferences in AAS

Lecture 23 - Background correction on flame AAS - I

Lecture 24 - Interferences in AAS - II

Lecture 25 - Interferences in AAS - III

Lecture 26 - Hydride Generation AAS - I

Lecture 27 - Hydride Generation AAS and Cold Vapour Hg AAS

Lecture 28 - Cold vapor Hg AAS Flame Emission

Lecture 29 - Mercury cold vapour technique, FAES and Electrothermal AAS

Lecture 30 - Electrothermal AAS - II

Lecture 31 - GF AAS Interferences - I

Lecture 32 - GF AAS Interferences - II

Lecture 33 - Interference in ETAAS GF AAS : Individual elements

Lecture 34 - Individual Elements AAS

Lecture 35 - Methods, Nomenclature and techniques : Individual Elements

Lecture 36 - Technology and Applications - I

Lecture 37 - Technology and Applications - II

Lecture 38 - Conclusions

NPTEL : NOC:Inductive Couple Plasma Atomic Emmission Spectrometry for Pollution Monitoring (Chemical Engineering)

Co-ordinators : Dr. J.R. Mudakavi

Lecture 1 - Course introduction and atomic structure - I

Lecture 2 - Course introduction and atomic structure - II

Lecture 3 - Course introduction and atomic structure - III

Lecture 4 - Course introduction and atomic structure - IV

Lecture 5 - Course introduction and atomic structure - V

Lecture 6 - Course introduction and atomic structure - VI

Lecture 7 - Nature of electromagnetic radiation

Lecture 8 - Interaction of EM radiation with matter - I

Lecture 9 - Interaction of EM radiation with matter - II

Lecture 10 - Instrumentation for ICP AES - I

Lecture 11 - Instrumentation for ICP AES - II

Lecture 12 - Instrumentation for ICP AES - III

Lecture 13 - Instrumentation for ICP AES - IV - Optical mountings

Lecture 14 - Instrumentation for ICP AES - V - Detectors

Lecture 15 - Instrumentation for ICP AES - VI - ICP Torches

Lecture 16 - Instrumentation for ICP AES - VII - Plasma characteristics

Lecture 17 - Instrumentation for ICP AES - VIII - Instruments

Lecture 18 - Practice and Applications of ICP AES - I - Nebulizers

Lecture 19 - Practice and Applications of ICP AES - II - Sample handling

Lecture 20 - Practice and Applications of ICP AES - III - Chemical analysis

Lecture 21 - Practice and Applications of ICP AES - IV - Chemical analysis

Lecture 22 - Practice and Applications of ICP AES - V - Chemical analysis

NPTEL : NOC:Infrared Spectroscopy for Pollution Monitoring (Chemical Engineering)

Co-ordinators : Dr. J.R. Mudakavi

Lecture 1 - Introduction to Analytical Science and Infrared Spectroscopy

Lecture 2 - Environmental Analytical Science

Lecture 3 - Techniques of Elemental Analysis

Lecture 4 - Atomic Structure - I

Lecture 5 - Atomic Structure - II

Lecture 6 - Atomic Structure - III

Lecture 7 - Atomic Structure - IV

Lecture 8 - Interaction of electromagnetic radiation with matter - I

Lecture 9 - Interaction of electromagnetic radiation with matter - II

Lecture 10 - Interaction of electromagnetic radiation with matter - III

Lecture 11 - Interaction of electromagnetic radiation with matter - IV

Lecture 12 - Interaction of electromagnetic radiation with matter - V

Lecture 13 - Interaction of electromagnetic radiation with matter - VI

Lecture 14 - Infrared spectroscopy - Introduction

Lecture 15 - Infra Red Instrumentation

Lecture 16 - Fourier Transform Infrared Spectroscopy

Lecture 17 - Sample Handling in IR

Lecture 18 - Instrumentation in IR

Lecture 19 - Applications of IR

Lecture 20 - IR Spectra Interpretation

Lecture 21 - IR Gas Analysers

NPTEL : NOC:Electrochemical Technology in Pollution Control (Chemical Engineering)

Co-ordinators : Prof. J. R. Mudakavi

Lecture 1 - Introduction to Electrochemical technology in Pollution Control

Lecture 2 - Atomic structure - 1

Lecture 3 - Atomic structure - 2

Lecture 4 - Properties of solution - 1

Lecture 5 - Properties of solution - 2

Lecture 6 - Properties of solution - 3

Lecture 7 - Electrogravimetry

Lecture 8 - Conductometry - 1

Lecture 9 - Conductometry - 2

Lecture 10 - Potentiometry - Electrolytic cells - 1

Lecture 11 - Potentiometry - Types of electrode - 2

Lecture 12 - Potentiometry - 3

Lecture 13 - Potentiometry - 4

Lecture 14 - Potentiometry - 5

Lecture 15 - Potentiometry - 6

Lecture 16 - Voltametry and Polarography - 1

Lecture 17 - Voltametry and Polarography - 2

Lecture 18 - Voltametry and Polarography - 3

Lecture 19 - Voltametry and Polarography - 4

Lecture 20 - Karl-Fisher titration - 1, Ion selective electrodes - 1

Lecture 21 - Ion selective electrodes - 2

Lecture 22 - Ion selective electrodes - 3

Lecture 23 - Electrochemical sensors - 1

Lecture 24 - Electrochemical sensors - 2

Lecture 25 - Process waste handling - 1

Lecture 26 - Process waste handling - 2

Lecture 27 - Process waste handling - 3

Lecture 28 - Electroplating - 1

Lecture 29 - Electroplating - 2

Lecture 30 - Electroplating - 3

Lecture 31 - Electroplating - 4

Lecture 32 - Batteries and fuel cells - 1

Lecture 33 - Batteries and fuel cells - 2

Lecture 34 - Batteries and fuel cells - 3

Lecture 35 - Zero liquid discharge

NPTEL : NOC:Transport Processes (Chemical Engineering)

Co-ordinators : Prof. V Kumaran

Lecture 1 - Dimensions and units

Lecture 2 - Dimensions and units, dimension of an equation

Lecture 3 - Dimensional analysis, settling sphere

Lecture 4 - Dimensional analysis, Brownian diffusivity, torque on a particle

Lecture 5 - Mass transfer to suspended particles

Lecture 6 - Heat transfer in a heat exchanger

Lecture 7 - Momentum transfer, flow in a pipe, friction factor

Lecture 8 - Dimensionless groups - ratio of convection and diffusion

Lecture 9 - Dimensionless fluxes, other dimensionless groups

Lecture 10 - Laminar and turbulent flow in a pipe

Lecture 11 - Flow past flat plate

Lecture 12 - Correlations for drag coefficient

Lecture 13 - Correlations for drag coefficient

Lecture 14 - Flow through packed column

Lecture 15 - Unit operations for mixing

Lecture 16 - Droplet breakup

Lecture 17 - Heat and mass transfer, Colburn and Reynolds analogy

Lecture 18 - Low Peclet number heat/mass transfer, high Peclet number laminar flow

Lecture 19 - High Peclet number laminar/turbulent flows. Flow in pipe, flow past flat plate

Lecture 20 - High Peclet number laminar/turbulent flows. Flow past particle

Lecture 21 - Flow past mobile interfaces, flow in packed column

Lecture 22 - Natural convection

Lecture 23 - Mass diffusion in gases

Lecture 24 - Mass diffusion in gases

Lecture 25 - Mass diffusion in liquids

Lecture 26 - Thermal diffusion

Lecture 27 - Momentum diffusion

Lecture 28 - Dispersion

Lecture 29 - Turbulent dispersion, dispersion in packed column, Taylor dispersion

Lecture 30 - Unidirectional transport. Shell balance

Lecture 31 - Unidirectional transport. Common form of transport equations

Lecture 32 - Steady solutions, constant diffusivity, parallel and series conduction

Lecture 33 - Steady solutions, internal source, viscous heating

Lecture 34 - Steady solutions, flow down inclined plane

Lecture 35 - Steady solutions, internal source, electrokinetic flow

Lecture 36 - Steady solutions, internal source, electrokinetic flow

Lecture 37 - Steady solutions, internal source, diffusion-reaction

Lecture 38 - Binary diffusion

Lecture 39 - Binary diffusion

Lecture 40 - Correlations in balance equations. Transport by diffusion

Lecture 41 - Correlations in balance equations. Transport by diffusion

Lecture 42 - Correlations in balance equations. Forced convection

Lecture 43 - Correlations in balance equations. Forced convection

Lecture 44 - Correlations in balance equations. Natural convection

Lecture 45 - Correlations in balance equations. Packed column

Lecture 46 - Cylindrical co-ordinates. Balance equation

Lecture 47 - Cylindrical co-ordinates. Steady conduction

Lecture 48 - Cylindrical co-ordinates. Heat transfer resistance

Lecture 49 - Cylindrical co-ordinates. Examples

Lecture 50 - Spherical co-ordinates. Balance equation

Lecture 51 - Spherical co-ordinates. Heat transfer resistance

Lecture 52 - Laminar flow in a pipe. Momentum balance

Lecture 53 - Laminar flow in a pipe. Velocity profile. Friction factor

Lecture 54 - Laminar flow in a pipe. Friction factor correlation

Lecture 55 - Laminar flow in a pipe. Examples

Lecture 56 - Laminar flow in a pipe. Examples

Lecture 57 - Turbulence. Instability and transition

Lecture 58 - Turbulent flow in a pipe. Dissipation rate, turbulence scales

Lecture 59 - Turbulent flow in a pipe. Turbulence cascade

Lecture 60 - Turbulent flow in a pipe. Structure of turbulence