

SYLLABUS :-

Syllabus Topics Lectures
Module 1: Fundamentals of Energy Systems Modelling (6 lectures)
Introduction; Second Law Analysis: concepts of energy, entropy and work
2Types of Energy Systems Model: Continuum, Stochastic and Network Models
1Continuum Model: Equations of Energy 1Stochastic Models: Overview of Molecular Dynamics and Population Balance Models 1Process Optimization Methods for Energy Conservation 1Module 2: Thermal Systems Modelling (9 lectures)Design and Simulation Methodology for Heat exchangers, refrigerators and air conditioners
2Steady state system simulation 1Non-linear Systems: Modelling and Simulation
2Dynamic System Simulation, Numerical Integration, Parametric Estimation
2Optimization Methods: Lagrange Multiplier, Search Techniques, Geometric Programming 2Module 3: Chemical Energy Systems Modelling (9 lectures)Non-isothermal Chemical Reaction Systems 1Heating and Cooling of Reactors, Ignition and Extinction Temperatures, Multiplicity and HotSpot Formation in Reactors
2Fossil Fuel Pyrolysis and Combustion Models, Adiabatic Combustion Temperature, Thermogravimetric Analysis
2Design of Petroleum Refinery Distillation Units 2Heat Exchanger Network Analysis 11Module 4: Bioenergy Systems Modelling (9 lectures)Enzyme Kinetics, Product and Substrate Inhibition
2Models for Cellulosic Fuel Production: Hydrolysis and Fermentation 2Microbial Fuel Cell Design 1Bioreactor Design and Stability Analysis 2Modeling of Gaseous Fuel Production (Biomethane and Biohydrogen) 2Module 5: Electrical Energy Systems Modelling (9 lectures)Introduction toElectrical Systems and Electrical Elements 1Lumped and Distributed Parameter Models 1Laplace Transforms, Transfer Functions, Electrical and Electro-mechanical System Transfer Functions
2Examples of Modelling and Transfer Functions 1State variables and the State-Space Representation 1Solving the equations of Time and Space Domain 1State Equation examples 1Controllability and Observability 1TOTAL 42Text Books:1. Holman, J. P. and Bhattacharyya, Souvik (2011), Heat Transfer. 10th Edition. McGraw Hill Education (India).2. Aris, Rutherford (1999). Mathematical Modeling: A Chemical Engineer's Perspective. Academic Press3. Fogler, H. Scott (2008), Elements of Chemical Reaction Engineering. 4th Edition, PHI4. Bailey, J and Ollis, D. F. (2010), Biochemical Engineering Fundamentals, 2nd Edition, McGraw Hill Education (India)5. Treybal, R (2012), Mass Transfer Operations, 3rd Edition, McGraw Hill Education (India)6. Gupta, S.K. (2012), Numerical Methods for Engineers, 3rd Edition, New Age International (P) Ltd.7. F. Milano, Power System Modelling and Scripting, Springer, London, August 2010.8. Olle Elgerd, ELECTRIC ENERGY SYSTEMS THEORY, McGraw Hill Education (India) Private Limited, 2001