MECM201-PROCESS PLANT OPTIMIZATION TECHNIQUES

UNIT- I

Introduction to optimization and its scope in chemical process design, Developing Models for Optimization, Formulation of objective function, Optimization Theory and Methods:Basic concept of optimization of Unconstrained Function,One dimensionalsearch, Unconstrained Multivariable optimization.

UNIT- II

Linear programming and Applications, Simplex Method,Nonlinear programming with constraints, quadratic programming, successive quadratic programming.

UNIT- III

Mixed integer programming, Optimization in large scale plant design and operation, integrated planning, scheduling and control in the process industries.

UNIT- IV

Application of optimization:Heat transfer and Energy conservation, SeparationProcess, Fluid flow system, chemical reaction design and operation.

UNIT- V

Optimization and Functions of a Complex Variable and Numerical Analysis:Gauss siedal method, Gauss elimination method, Eulers Method, Modified Euler Method and Runga-Kutta Method for Ordinary Differential Equations, Tranzoidal Rule and Simpson's 1/3 and 3/8 Rules.

Reference Books

1. Optimization of the Chemical Process Edgar, Himmelblau, Lasden.

2.Numerical Methods in Engineering and Science Dr B.S Garewal

3. Optimization theory and practice, G.S. Beveridge and R.S.Schechter, McGraw Hill, Newyork.

4. Engineering Optimization-Methods and Applications, Reklaitis,G.V., Ravindran, A., and Ragsdell, K.M., John Wiley, New York

MECM 202 -COMPUTER AIDED DESIGN FOR PROCESS EQUIPMENTS

Unit- I

General design consideration, Optimum design, Property estimation, Material and Energy balance, introduction to special software for steady and dynamic simulation of chemical engineering systems

Unit- II

Computer aided design of heat transfer equipment. Design of double heat exchangers, shell and tube heat exchangers, condensers and evaporators.

Unit- III

Computer aided design of mass transfer equipment. Design of mass transfer equipments: Design of distillation column, Absorption tower bothplate as well as packed type

Unit- IV

Computer aided design of chemical reactors, Batch reactor, continuous stirred tank reactor and Plug flow reactor.

Unit- V

Interactive computer graphics and drafting Simulation software, spread sheeting,Flowsheeting software, Integrated software system, development of software programs.

REFERENCES

1. Bruce A Finlayson “Introduction to Chemical Engineering Computing”, Wiley Student Edition.
2. James M. Douglas “Conceptual Design of Chemical Processes”, McGraw Hill, New York.
3. M.S Peter and K.D. Timmerhaus, R.E West, “Plant design and economics for chemical engineers”, McGraw Hill
4. B.C. Bhattacharyya and C.M. Narayanan, “Computer Aided Design of Chemical Process Equipment", New Central Book Agency (P) Ltd., New Delhi.
5. Robert G. Squires,“Computer Applications in chemical Engineering: Process Design & simulation”
6. Alexandre C. Dimian, “Integrated Design and Simulation of Chemical Processes”, Elsevier.
7. B. Wayne Bequette, “Process Dynamics: Modeling, Analysis and Simulation”, Prentice Hall International Series.

MECM 203 - ADVANCED PROCESS DYNAMICS & CONTROL

Unit-I

Review of first and higher order systems, closed and open loop response. Dynamic behavior, stability analysis and design of feedback controllers and Cohen-Coon controller tuning. Control valve types linear, equal percentage and quick opening valve. Design of valves.

Unit-II

Frequency response analysis, design of control system, Controller tuning and process identification. Zigler-Nichols tuning methods, Bode-Nyquist Plots, Bode stability Criterion, Nyquist stability Criterion. Feedback Control of systems with large dead time or inverse response.

Unit-III

Control systems with multiple loops, Advance control techniques cascade, selective and split – Range control, feed forward and ratio control, adaptive and inferential control systems.

Unit- IV

Synthesis of alternative control configurations for MIMIO processes. Interaction and Decoupling of control loops, RGA and the selection of loops .Design of non-interacting control loops. Design of control systems for complete plants.Tuning of multivariable controllers.

Unit-V

Sample Data Controllers: Basic review of Z transforms, Response of discrete systems to various inputs. Open and closed loop response to step, impulse and sinusoidal inputs, closed loop response of discrete systems. Design of digital feed back controllers. Introduction to control of non-linear systems

REFERENCE BOOKS

1. 'Process Systems analysis and Control', D.R. Coughanour, Mc.Graw Hill, II Edition, 1991.
2. 'Process Dynamics and Control', D.E.Seborg, T.F.Edger, and D.A.Millichamp, John Wiley and Sons, II Edition, 2004.
3. 'Principle and Practice of Automatic Process Control', C.A.Smith and A.B.Corripio, John Wiley and Sons, 1985.
4. 'Process Modelling Simulation and Control for Chemical Engineers', W.L.Luyben, McGraw Hill, II Edition, 1990.
5. Chemical Process Control – Theory and Practice', Stephanopoulous, Prentice Hall of India Ltd.1984.
6. Process control: Modeling, Design and simulation, B.Wayne Bequette PHI, 2003.
7. Chemical Process Control " An Introduction to theory & Practices, Stephanopoulos, PHI.
8. Process Dynamics, Modeling and Control, Babatunde O, W. Harmon Ray, Oxford University Press.
9. Process Dynamics and control. D.E. Seborg, T.F. Edgar, D.A. Mellichamp Wiley.

MECM 204 - PRODUCTIVITY AND MANAGEMENT

Unit- I

Introduction to operations research – Development of operational research, definition, characteristics, scopes, opportunity and operation research in problem solving. Limitations of operational research and applications. Differences between manufacturing and service operations.

Unit- II

Model, types of model, constructing model and deriving solution from model, operations research model in practices, computer software for operational research. Approach of the assignment model, models with price Breaks, with Restrictions.

Unit- III

Duality theory, Primal Dual relationships in formulation and their solutions, Sensitivity Analysis, Dual Simplex Method. Transportation problem – Formulation, Optimal solution, unbalanced transportation problem.

Unit- IV

Optimization- Techniques, planning and control models (Network techniques), deterministic case. Maximization and Minimization problem – Development and construction. PERT and CPM analysis Difference between CPM and PERT.

Unit- V

Analysis for operations management, cost data for operations management – Break even analysis, investment analysis

Reference books

J.K.Sharma Operations Research Theory & Applications
Pream Kumar Gupta, D.S. Hira, Operations Research
J.K Sharma Operations Research Theory and Application

MECM205- INDUSTRIAL POLLUTION CONTROL

Unit-I

Major problems and pollution in environment, Environmental gradients, Tolerance and adaptation, Environmental laws and Provisions, Guidelines for pollution and health aspects for different industries, environmental impact assessment, environmental auditing

Unit- II

Problems concerned to air pollution and its effects, meteorological aspects of air pollution, chemical and photochemical reactions in atmosphere, Principles and designing of air pollution controlling and abating instruments, Mitigating measures

Unit-III

Sources of water pollution and standards for waterfor different purposes, water treatment, effect of waste water on ecology Noise pollution, its measurement and mitigating measures

Unit-IV

Sources and classification of solid waste, properties of solid waste, transportation and treatment of MSW and ISW (Industrial Solid Waste), Hazardous waste, its storage and treatment

Unit-V

Basic concepts of LCA, Waste minimization by reuse and recycling, Case study for different industries for waste minimization and environmental perspectives.

References:

1. Environmental Engineering, Gerard Keily; Tata McGraw Hill Pub.
2. C. S. Rao, Environmental Pollution Control Engineering; New Age International Publishers
3. H.S.Peavy, D.R.Rowe and George Tchobanoglous, Environmental Engineering; McGraw Hill International