Program Elective-I

UG	Department: **Chemical Engineering**
Course Code: **CH403**	Course Name: **Modelling and Simulation**
Credit: **3**	L-T-P: **3-0-0**
Version: **1**	Approved on:
Prerequisite Course: **Nil**	

Introduction and fundamentals of process modeling and simulation; industrial usage of process modeling and simulation; Macroscopic mass, energy and momentum balances; incorporation of fluid thermodynamics, chemical equilibrium, reaction kinetics and feed/ product property estimation in mathematical models.

Simulation of steady state lumped, modeling of chemical process equipments like reactors, distillation, absorption, extraction columns, evaporators, and heat exchangers.

Unsteady state lumped systems and dynamic simulation; Computer algorithms for numerical solution of steady state and unsteady state models.

Microscopic balances for steady state and dynamic simulation; process modeling with dispersion; axial mixing; diffusion, etc.

Modeling and simulation of complex industrial systems in petroleum, petrochemicals, polymer, basic chemical industries; Commercial steady state and dynamic simulators; Simulation of process flowsheets.

Introduction to application of artificial intelligence based modeling methods using Artificial Neural Networks, Fuzzy logic, etc.

Text/Reference Books

1. Luyben, W. L., "*Process Modeling, Simulation and Control for Chemical Engineers*," McGraw Hill.
2. Babu, B.V., "*Process Plant Simulation*," Oxford Unicversity Press, 2004.
3. Ramirez, W.F., "*Computational Methods for Process Simulation*," Butterworth-Heinemann, 1997.
4. Ingham, J., Dunn, I. J., Heinzle, E., Prenosil, J.E., Snape, J.B., "*Chemical Engineering Dynamics: An Introduction to Modelling and Computer Simulation*," 3rd ed., Wiley-VCH Verlag GmbH & Co. KGaA, 2007.
5. Holland, C. D., "*Fundamentals and Modeling of Separation Processes*", Prentice Hall, 1975.
6. Himmelblau, D. M., & Bischoff, K. B., "*Process analysis and simulation: Deterministic systems*," John Wiley, New York, 1968.
7. Aris, R. and Varma, A. (Editors), "*The Mathematical Understanding of Chemical Engineering Systems: Selected Papers of N. R. Amundson*," Pergamon Press, 1980.

UG Department: **Chemical Engineering**
Course Code: **CH405** Course Name: **Introduction to Plastic Materials**
Credit: **3** L-T-P: **3-0-0**
Version: **1** Approved on:
Prerequisite Course: **Nil**

Additives for plastics: Stabilizers, fillers, plasticizers, lubricants, flame retarders, foaming agents, cross-linking agents, etc.

Manufacture, properties and applications of major thermoplastic: polyethylene, polypropylene, polyvinyl choloride, polystyrene and other styrenics, polyamides, polyesters.

Thermosetting polymers: phenolformaldehyde, urea and melamine - formaldehyde, unsaturated polyester, epoxy resins.

Definition. Characteristics of engineering plastics. Important engineering thermoplastics such as acrylics, ABS, Polyesters, Polycarbonate, polyamides, polyphenylene oxide, polystyrene, polyphenylene sulfide, PEK .Processing and application of engineering plastics

Definition and characteristics of speciality polymers Important speciality polymers such as fluropolymer, silicone, liquid crystalline polymers, conducting polymers, polymeric hydrogels Processing and application of speciality polymers.

Books

1. J.A.Brydson, Plastics materials, Butterworth- Heinemann – Oxford, 6th Ed., 1995.
2. Irvin .I. Rubin, Hand Book of Plastic Materials and Technology, Wiley Interscience, NY, 1990.

UG Department: **Chemical Engineering**
Course Code: **CH407** Course Name: **Nanotechnology**
Credit: **3** L-T-P: **3-0-0**
Version: **1** Approved on:
Prerequisite Course: **Nil**

- Introduction
- Important concepts in nanoscience and nanotechnology
- Technology that enables science
- Current themes in nanoscale science and technology
- Commercial applications of nanotechnology
- The social dimensions of nanotechnology
- CMOS
- Si processing/fabrication
- Non-traditional nano-fabrication
- Carbon nanotube
- Self-organization and self-assembly
- Quantum dots and wires
- Mesoscopic transport
- Optical spectroscopy of nanostructures
- Scanning probe microscopy

Books

1. Poole, C. P. Jr. and Owens, F. J. Introduction to Nanotechnology, John Wiley, 2003
2. Plummer, J.D., Deal, M.D. and Griffin, P.B., Silicon VLSI Technology, Prentice Hall, 2000
3. Kittel, C., Introduction to Solid State Physics, a chapter about nanotechnology, John Wiley, 2004

UG Department: **Chemical Engineering**
Course Code: **CH409** Course Name: **Operations Research**
Credit: **3** L-T-P: **3-0-0**
Version: **1** Approved on:
Prerequisite Course: **Nil**

Introduction: Nature and meaning of operations research, general methods for solving operations research problems, main characteristics of operations research in decision making, Role of computers in operations research.

Linear Programming Problem: Formulation of LP problem, graphical solution of LP problem, general formulation of LP problem, slack and surplus problem, standard form of LP problem, matrix form of LP problem, some important definitions, assumptions in LPP, limitations of LP, Applications of LP.

Simplex Method: Definition and notations, computational procedure, artificial variable technique- two phase method, Big-M method, disadvantages of Big M method over two phase method, degeneracy problem, method to resolve degeneracy, special cases- alternative solution, unbounded solutions, non-existing solution, solution of simultaneous equations by simplex method, flow chart of simplex method.

Duality in Linear Programming: Concept of duality, primal-dual problems, rules for converting any primal problem into its dual, duality theorems, primal and dual correspondence, duality and simplex method, shadow prices in LP, advantages of duality.

Dual Simplex Method: Computational procedure of dual simplex method, advantages of dual simplex over simplex method, different between simplex and dual simplex methods.

Assignment Problem: Introduction, mathematical formulation of assignment problem, fundamental theorems, Hungarian method, unbalanced assignment problem, variations of assignment problem- maximal assignment problem, restriction on assignment, traveling salesman problem- formulation and solution procedure.

Transportation Models: Introduction, mathematical formulation, feasible, basic feasible and optimum solutions, tubular representation, loops in table, IBFS to transportation problem, moving towards optimum solution, degeneracy in transportation problem, unbalanced transportation problem, time minimizing transportation problem, transshipment problem.

Network Scheduling by PERT/CPM: Introduction, Networks and basic components, Rules of network construction, Time calculations in networks, Critical Path Method (CPM), PERT, PERT calculations, Negative float and negative slack, Advantages of network.

Books

1. Taha, H.A., " Operations Research, an introduction", 6th edition, Prentice Hall, 1997.
2. Rao, S.S., “Engineering Optimization: Theory and Practice,” 3rd ed., New Age International, New Delhi, 2000.
3. Sharma, S.D., “Operations Research”.
4. Kanti Swaroop, “Operations Research”.