

PANDIT DEENDAYAL PETROLEUM UNIVERSITY
SCHOOL OF TECHNOLOGY
COURSE STRUCTURE FOR B. TECH. CHEMICAL ENGINEERING

SEMESTER IV			B.TECH. CHEMICAL ENGINEERING										
Sr No	Course Code	Course Name	Teaching Scheme					Examination Scheme					
			L	T	P	C	Hrs/wk	Theory			Practical		Total marks
								MS	ES	IA*	LW	LE/Viva	
1	MA 203T*	Numerical Techniques in Chemical Engineering	3	1	0	7	4	30	60	10	--	--	100
2	EE 214T	Electrical and Electronics Technology	3	0	--	6	3	30	60	10	--	--	100
	EE 214P		--	--	2	1	2	--	--	--	25	25	50
3	CH 205T	Solid Fluid Operation	3	0	--	6	3	30	60	10	--	--	100
	CH 205P		--	--	2	1	2	--	--	--	25	25	50
4	CH 206T	Chemical Engineering Thermodynamics II	3	1	--	7	4	30	60	10	--	--	100
5	CH 207T	Process Heat Transfer Design	3	1	--	7	4	30	60	10	--	--	100
6	CH 208T	Chemical Process Technology I (Organic)	3	0	--	6	3	30	60	10	--	--	100
	CH 208P		--	--	2	1	2	--	--	--	25	25	50
7		Industrial Orientation (3 weeks)											
		Total	18	3	6	42	27						750

MS = Mid Semester, **ES** = End Semester;

LW = Laboratory work; **LE** = Laboratory Exam

* **IA** = Internal assessment (like quiz, assignments etc)

T = Theory, **P**= Practical

MA 203T* Numerical Techniques in Chemical Engineering										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100
<p>UNIT I</p> <p>Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation.</p> <p>Numerical integration, composite rules, error formulae. Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-Seidel methods</p> <p>UNIT II</p> <p>Nonlinear Algebraic Equations: Fixed point method, Multivariable successive substitutions, Single variable Newton-Raphson Technique, Multivariable Newton-Raphson Technique</p> <p>Partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms. Solution of a nonlinear equation, bisection and secant methods.</p> <p>UNIT III</p> <p>Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations.</p> <p>Eigen value problem, power method, QR method, Gershgorin's theorem, Faddeev-Leverrier method, Power method</p> <p>UNIT IV</p> <p>Special probability distributions – Binomial, Poisson's, Normal, Chi-square, mean and variance.</p> <p>Scale up studies, Regression analysis, characterization of mathematical models and selection of appropriate numerical techniques for chemical engineering processes</p> <p>Exposure to software packages like IMSL subroutines, MATLAB.</p> <p>Texts and References</p> <ol style="list-style-type: none"> 1. M.E. Davis, "Numerical Methods & Modeling for Chemical Engineers", Wiley, 1984. 2. S.D. Conte and C. de Boor, Elementary Numerical Analysis- An Algorithmic Approach, 3rd ed., McGraw-Hill, 1980 3. S.K. Gupta, "Numerical Methods for Engineers", Wiley Eastern, 1995. 4. M. B. Cutlip and M. Shacham, "Problem Solving in Chemical Engineering with Numerical Methods", Prentice Hall, 1999 5. B. A. Finlyason, "Introduction to Chemical Engineering Computing", Wiley-Interscience, 1st edition, 2006 6. C.E. Froberg, Introduction to Numerical Analysis, 2nd ed., Addison-Wesley, 1981 7. Beers Kenneth, Numerical methods for chemical engineers: application in MATLAB, Cambridge university press, 2006 										

EE 214T Electrical and Electronics Technology										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	6	3	30	60	10	--	--	100
UNIT I					08 HRS					
<p>DC machines: Construction, working principle of D.C. generator, emf equation of D C generator. (Theoretical concept only). Working principle of D.C. motor. Types of D. C. motor, back emf , torque equation for D.C. motor, characteristics of D. C. motor (series, shunt and compound), methods for speed control of D.C shunt and series motors, Industrial applications</p>										
UNIT II					13 HRS					
<p>AC Machines: Synchronous Generator: Constructional features (Salient and non- salient), working principle, e m f equation, synchronous speed of an alternator, concept of synchronous reactance and impedance, phasor diagram of loaded alternator Three phase Induction Motor:- Constructional feature, working principle of three phase induction motors, types; torque equation, torque slip characteristics; power stages; efficiency; types of starters; methods of speed control & Industrial applications. Single phase induction motors: Types, construction, working principle of split phase and shaded pole type induction motors, applications. Specifications of induction motors (KW rating, rated voltage, current rating, frequency, speed)</p>										
Unit III					8 HRS					
<p>Basic of electronics: Introduction of PN junction diodes, Characteristics of semiconductor diodes, Analysis of simple diode circuits: Zener diode Characteristics and applications in regulators. Application of diodes, Rectifiers: Half wave rectifier, full wave rectified with filter, Clipping and clamping circuits: elementary diode clippers, Fundamentals of Transistors: Introduction to transistor circuits for CB, CE, CC configurations. Transistor biasing and bias stability</p>										
Unit IV					12 HRS					
<p>Analog, Digital and Power Electronics : Differential Amplifier, transfer Characteristics, Voltage gain Input and Output impedance of Inverting and Non-inverting amplifiers using OP-AMP, Linear and Non-Linear applications of OP-AMP: Voltage follower, Integrator, Differentiator, comparators, A to D -D to A Converters, PLL Fundamentals of Digital Electronics: Number system Binary, Decimal Octal, Hexadecimal and Conversion systems addition and subtraction processes. Boolean Algebra Logic gates, flip flops. Power Semiconductor Devices SCR: Construction detail, V-I Characteristics, Methods to turn ON, switching action during ON & OFF, specification, Concept of commutation of SCR, Applications.</p>										
Texts and References										
<ol style="list-style-type: none"> 1. B. L. Theraja, S Chand, Electrical Technology Publication Co Ltd. 2. Ashfaq Husain, Fundamentals of Electrical Engineering, Dhanpat Rai & Co. 3. D P Kothari and I J Nagrath, Electrical machines Tata McGraw Hill ,Third Edition 4. Dr. P.S. Bhimbra, Power Electronics Khanna Publication 5. V. K. Mehta, Principles Of Electrical Engineering And Electronics, 6. Y. N. Bapat, Electronic Devices and Circuits, Tata McGraw Hill 9th reprint 1988. 7. M. D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw Hill 										

EE 214P Electrical and Electronics Technology										
Teaching Scheme					Examination Scheme					Total marks
L	T	P	C	Hrs/Week	Theory			Practical		
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Excitation characteristic of dc machines 2. Polarity & Voltage ratio Test on Single Phase Transformer 3. Load Test on Single Phase Transformer 4. Speed Control Methods of D C shunt motors 5. Speed Control Methods of D C series motors 6. Study CE characteristics of Transistor 7. Study of OP-Amp characteristics 8. Study of logic gates and Flip-flops 9. Study of inverting, non-inverting OP-Amp 10. Study of non-linear applications of OP-Amp 11. Study of linear applications of OP-Amp as integrators and differentiator 12. Realization of combinational logic using gates 13. Study of VI characteristics of SCR 										

CH 205T Solid Fluid Operation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	6	3	30	60	10	--	--	100
<p>UNIT I Particulate Solids - Particle Characterization, Particulate Solids in Bulk, Blending of Solid Particle, Classification of Solid Particles, sieving operation, Size Reduction of Solids - Mechanism of Size Reduction. Energy for Size Reduction, Methods of Operating Crushers, Nature of Material to be Crushed, Types of Crushing Equipments, pulverization Sedimentation - Gravitational Sedimentation, Centrifugal Separation, Flocculation.</p> <p>UNIT II Fluidization - Characteristics of Fluidized Systems, Liquid-Solid and Gas-Solid Systems, Applications of the Fluidized Solids Technique. Packed Columns - Flow of a Single Fluid through a Granular Bed, Dispersion, Packed Columns</p> <p>UNIT III Solid handling: Pneumatic and Hydraulic Conveying, Theory and Industrial Applications. Filtration - The Theory of Filtration. Filtration Practices, Filtration Equipments, Filtration in a Centrifuge and Filtration Calculations Gas Cleaning and maintenance of Equipments such as Gravity Separators, Centrifugal Separators, cyclone separators, Electrostatic Precipitators, gas scrubbers etc.</p> <p>UNIT IV Particulate matter handling, Flow of solids through silos and hoppers. Storage and transport of powders. Particle size and shape measurement and analysis, shape factor, pneumatic conveyers Principles of agglomeration palletizing (cone and disk), press and tabulating machines and extrusion and granulating machines.</p> <p>Texts and References</p> <ol style="list-style-type: none"> 1. J. M. Coulson and J. F. Richardson, Chemical Engineering, Vol. 2, 4th ed., Pergamon Press 2. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 4th ed. McGraw Hill, 1985 3. W. L. Badger and J. T. Banchero, "Introduction to chemical engineering", McGraw-Hill series in chemical engineering, 4. A. S. Foust, "Principles of unit operations", Wiley, 1980 5. S. K. Gupta, Momentum Transfer Operations, Tata McGraw Hill, 1979. 										

CH 205P Solid Fluid Operation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Study of sedimentation 2. Determination of screen effectiveness 3. Study of cyclone separator 4. To study laws of crushing and grinding using ball mill 5. Dynamics of fluidized bed 6. Power consumption in agitator 7. Study of screen analysis 8. Study of Vacuum leaf filter 9. Study of Conveyors 10. To study laws of crushing and grinding using jaw crusher 11. Study of friction factor in packed column 12. Pressure drop and characteristic studies of Fluidized Bed 										

CH 206T Chemical Engineering Thermodynamics II										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100
<p>UNIT I Phase equilibrium and stability, Criteria of equilibrium, phase equilibrium, phase diagrams, Phase rule, Vapour liquid equilibrium (VLE) and liquid liquid equilibrium (LLE), solid vapour equilibrium (SVE), solid liquid phase behavior characteristic and qualitative behavior of these equilibrium systems</p> <p>UNIT II Solution Thermodynamics, Excess properties, heat effect of mixing process. Systems of Liquid-liquid phase miscibility.</p> <p>UNIT III Chemical reaction Equilibrium- Equilibrium constant and equilibrium conversion and their estimation, single reactions and multi reactions, phase rule and Duhem's theorem for reacting system. Electrochemical reactions</p> <p>UNIT IV Partition function of a perfect Gas, Schrodinger's equation, the translational partition function, Maxwell- Boltzmann distribution, Maxwell velocity distribution, and principle of equipartition. Estimation of thermo physical properties especially by group contribution methods</p> <p>Texts and References</p> <ol style="list-style-type: none"> 1. S. I. Sandler. "Chemical Engineering Thermodynamics", Wiley, New York, 1999 2. J. M. Smith and H. C. Van Ness "Introduction to Chemical Engineering Thermodynamics" 4th ed. McGraw Hill, 1987. 3. J. M. Prausnitz, R. N. Lichtenthaler, and E.G.de Azevedo, "Molecular Thermodynamics of Fluid-Phase Equilibria", Prentice Hall, Inc., 1986. 4. B. E. Poling, J. M. Prausnitz, J. P. O'Connell, " The properties of liquids and gases", McGraw Hill, 2001 										

CH 207T Process Heat Transfer Design										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100
<p>UNIT I Heat exchanger design: Design of single and multi pass shell and tube type exchangers using LMTD and effectiveness – NTU methods, Bell-Delaware and Kern method</p> <p>UNIT II Spiral coil and plate type heat exchangers. Single and multi phase condenser. Design of Reboilers vapourisers. Kettle type and Thermosiphon reboilers, forced circulation vaporizers.</p> <p>UNIT III Heat transfer in agitated vessels both, jacketed and with coil, Determination of overall heat transfer coefficient, transient heating or cooling, Heat transfer in packed and fluidized beds. Furnaces and furnace designs</p> <p>UNIT IV Use of computers in heat exchanger equipment and design TEMA codes Introduction to heat exchanger networking and analysis, case studies, pinch technology</p> <p>Texts and References</p> <ol style="list-style-type: none"> 1. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. 1 ELBS, Pergamon press, 1970 2. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. 2, ELBS, Pergamon press, 1970 3. W. L. McCabe J. C. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 4th ed. McGraw Hill 1985. 4. D. Q. Kern, "Process Heat Transfer", McGraw Hill, 1950 5. Uday V. Shenoy, "Heat exchanger network synthesis", Gulf Professional Publishing, 1995 										

CH 209T Chemical Process Technology I (organic)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	6	3	30	60	10	--	--	100
<p>UNIT I Unit Processes: Principles of a few selected unit processes such as oxidation, reduction, alkylation, halogenations, sulphonation, nitration and polymerization and important organic products related to the same.</p> <p>UNIT II Petrochemicals: Raw materials and principles involved in the production of olefins and aromatics. C1, C2, C3, C4, compounds, Aromatics, Acetylene, butadiene and typical intermediates from olefins and aromatics such as ethylene glycol, ethyl benzene, phenol, cumene, and DMT.</p> <p>UNIT III Organic chemicals: Resins, Plastic and rubber chemicals, Dyes and intermediates, coal chemicals. Soap and detergents, starch, alcohol, cellulose, paper, vegetable oils soaps, detergents</p> <p>UNIT IV Surface coatings: Paints, varnishes lacquers, surfactants, resins. Pharma and Biotech industry: - Introduction to enzymes. Basic concepts of drug design; some drug types (antimalarials, antibiotics, antiseptic), structure and synthesis; Importance in synthesis of organic chemicals (alcohols), Single cell protein (SCP), Manufacture of alcohol and major pharmaceuticals, Enzymatic hydrolysis of cellulosic substances, penicillin, paracetamol etc, manufacturing of biological products like insulin</p> <p>Texts and References</p> <ol style="list-style-type: none"> 1. George T. Austin, Shreve's Chemical process Industries, 5th ed. McGraw Hill, 1984 2. C. E. Dryden, outlines of chemical technology edited and revised by M. Gopala Rao and Marshall sitting end ed. Affiliated East-West press, New Delhi, 1973. 3. D. Venkateswarlu, Chemical Technology III manual of chemical technology, chemical engineering education curriculum development center, I. I. T. Madras, 1977. 4. Kirk-Othmer, Encyclopedia of chemical Technology, 3rd ed. John-Willey, New York, 1981. 5. McKetta, Encyclopedia of Chemical Processing and Design, Marcel Dekker Inc., New York, 1994. 										

CH 208P Chemical Process Technology I (Organic)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50
<p>List of Experiments:</p> <ol style="list-style-type: none"> 1. Synthesis of phenol resin 2. Study the manufacturing of soap 3. Synthesis of aspirin drug 4. Identification of polymeric materials 5. Solution viscometry (study the effect of viscosity and temperature) 6. Manufacturing of paint 7. Organic detection of Salicylic acid, Naphthalene, Aniline, Glycerol etc 8. 9. 10. 										