B.Tech. (Chem.Engg.)
V to VIII Semester

Prospectus No. 11173

SANT GADGE BABA AMRAVATI UNIVERSITY

(Faculty of Engineering & Technology)

PROSPECTUS

Prescribed for

Four Year Degree Course

Bachelor of Technology

(Chemical Engineering)

V to VIII Semester

Examinations, 2010 -2011

(Semester Pattern)

2010
(www.sgbau.ac.in)

Price Rs. 15/-

PUBLISHED BY
Dineshkumar Joshi
Registrar
Sant Gadge Baba
Amravati University,
Amravati 444 602

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SANT GADGE BABA AMRAVATI UNIVERSITY
SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

(1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects, papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.

(2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinances Booklet the various conditions/ provisions pertaining to examinations as prescribed in the following Ordinances -

Ordinances No.1	:	Enrollment of Students.
Ordinances No.2	:	Admission of Students
Ordinances No.4	:	National Cadet Corps
Ordinances No.6	:	Examination in General (relevant extracts)
Ordinance No.7-A	;	Condonation of Deficiency of Marks for passing an Examination or for improvement of Division there at in the Faculties of Arts, Science, Commerce, Education, Social Science, Law, Home Science and Engg. & Technology and Examinations in Pharmaceutical Sciences.
Ordinance No. 7-B	;	Condonation of Deficiency of Marks for Passing an Examination in the faculty of Medicine (Excluding examinations in Pharmaceutical Science)
Ordinance No. 9	:	Conduct of Examinations (Relevant Extracts)
Ordinance no.10	:	Providing for Exemptions and Compartments.
Ordinance No.19	:	Admission of Candidates to Degrees

Ordinance No.109	:	Recording of a change of name of a University Student in the records of the University.
Ordinance No.5/2010:		For improvement of Division.
Ordinance No.159	:	Prescribed rules for Revaluation of Answer Books of Examinees at University Examinations.

Dineshkumar Joshi
Registrar
Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM

The Pattern of question paper as per unit system will be broadly based on the following pattern

(1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each Unit there will be a question either a long answer type or a short answer type.

(2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.

(3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.

(4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.

(5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

APPENDIX-C
FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY (CHEMICAL ENGINEERING)
SEMESTER PATTERN
FIFTH SEMESTER

ABBRIVATIONS :-
S - SEMESTER PATTERN
CE - CHEMICAL ENGG.
CT - Chemical Technology including Food/Pulp & Paper/Oil & Paint/ Petrochemical and Polymer (Plastic)
FPOPC- Food Tech., Pulp & Paper Tech., Oil & Paint Tech., Petrochemical Tech.

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week (Hrs)	Examination Scheme: Theory Duration of Papers	Maximum Marks Theory	College Assessment	Total	Min. Pass Marks	Practical Maximum Marks External	Internal	Total Marks	Mininum Passing Marks
1.	5SCECT1	Heat Transfer	4	1	2	7	3	80	20	100	40	25	25	50	25
2.	5SCE(FPO-PC)T2	Chemical Engineering (Mechanical Opertion)	4	1	2	7	3	80	20	100	40	25	25	50	25
3.	5SCE(FPO-PC)T3	Chemical Engineering thermodynamics	4	1	2	7	3	80	20	100	40	25	25	50	25
4.	5SCE 4	Inorganic Chemical Technology (Chemical Engg. Process-I)	4	-	-	4	3	80	20	100	40	--	--	--	--
5.	5SCECT5	Economics & Management	3	-	-	3	3	80	20	100	40	--	--	--	--
6.	5SRNCECT6	Communication Skills	2	1	-	3	2	40	10	50	20	15	10	25	12
		TOTAL	21	04	06	31				550				125	

GRAND TOTAL : 725

SIXTH SEMESTER

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week (Hrs)	Examination Scheme: Theory Duration of Papers	Maximum Marks Theory	College Assessment	Total	Min. Pass Marks	Practical Maximum Marks External	Internal	Total Marks	Mininum Passing Marks
1.	6SCE1	Chemical Engineering Operation-II (Mass Transfer-I)	4	1	2	7	3	80	20	100	40	25	25	50	25
2.	6S(FPO-PC)T2	Process Equipment Design & Drawing)	4	-	2	6	3	80	20	100	40	25	25	50	25
3.	6SCECT3	Instrumentation and Control	4	1	2	7	3	80	20	100	40	25	25	50	25
4.	6SCE 4	Organic Chemical Technology (Chemical Engg. Process-II)	4	-	-	4	3	80	20	100	40	--	--	--	--
5.	6SCECT5	Computer Programming and Application	3	1	2	6	3	80	20	100	40	25	25	50	25
6.	6SCECT6	Mini Project	-	-	2	2	-	--	--	---	--	25	25	50	25
		TOTAL	19	03	10	32				500				250	

GRAND TOTAL : 750

APPENDIX-D

L : Theory Lecture
T : Tutorial
P : Practical
D : Drawing / Design

FOUR YEAR DEGREE COURSE
BACHELOR OF TECHNOLOGY (CHEMICAL ENGINEERING)
SEMESTER PATTERN
SEVENTH SEMESTER

ABBRIVATIONS :-
S - SEMESTER PATTERN
CE - CHEMICAL ENGG.
FPOPC- Food Tech., Pulp & Paper Tech., Oil & Paint Tech., Petrochemical Tech.
Pp - Polymer(Plastic)

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week (Hrs)	Examination Scheme: Theory: Duration of Papers	Maximum Marks: Theory Papers	College Assessment	Total	Min. Pass Marks	Practical: Maximum Marks: External	Internal	Total Marks	Mininum Passing Marks
1.	7SCE1	Chemical Engineering Operation-III (Mass Transfer-II)	4	1	2	7	3	80	20	100	40	25	25	50	25
2.	7SCE(FPOPC)T2	Chemical Reaction Engineering-I	3	1	2	6	3	80	20	100	40	25	25	50	25
3.	7SCE3	Process Dynamic & Control	3	1	2	6	3	80	20	100	40	25	25	50	25
4.	7SCE(FPOPC)T4	Industrial Waste Treatment	3	1	2	6	3	80	20	100	40	25	25	50	25
5.	7SCEPP5	Plant Design & Project Engg.	3	1	-	4	3	80	20	100	40	--	--	--	--
6.	8SCE5	Project and Seminar	-	-	2	2	-	--	--	---	--	--	--	--	--
		TOTAL	16	05	10	31				500				200	

GRAND TOTAL : 700

EIGHTH SEMESTER

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week (Hrs)	Examination Scheme: Theory: Duration of Papers	Maximum Marks: Theory Papers	College Assessment	Total	Min. Pass Marks	Practical: Maximum Marks: External	Internal	Total Marks	Mininum Passing Marks
1.	8SCE1	Transport Phenomenon	4	1	-	5	3	80	20	100	40	--	--	--	--
2.	8SCE(FPO-PC)T2	Chemical Reaction Engineeing-II	4	1	-	5	3	80	20	100	40	--	--	--	--
3.	8SCE3	Elective	4	1	2	7	3	80	20	100	40	25	25	50	25
4.	8SCE4	System Modelling	4	1	-	5	3	80	20	100	40	--	--	--	--
5.	8SCE5	Project and Seminar	-	-	6	6			(1) College Assessment:-						
									(i) Project				50		
									(ii) Seminar				25	150	75
									(2) University Oral Exam.				75		
		TOTAL	16	04	08	28				400				200	

GRAND TOTAL : 600

List of electives : Note : One Subject is to be offered out of the following :

1) Polymer Science & Engineering 2) Petroleum & Natural Gas 3) Corrosion Engineering 4) Biochemical Engineering 5)Petroleum Processing Engineering 6) Petrochemical Process Technology 7) Cellulose Technology 8) Fuel Technology 9) Bio Fuels 10) Industrial Piping 11) Wine Making

SYLLABUS
PRESCRIBED FOR
B.TECH. (CHEMICAL ENGG.)
FIFTH SEMESTER

5 SCECT 1 HEAT TRANSFER

SECTION-A

Unit I : Importance of heat transfer in chemical process industries. Modes of heat transfer, steady state conduction in one dimension.

Fourier's law.

Heat transfer through plane, cyclindrical and spherical walls, compound resistance in series, thermal insulation, critical and economic thickness. Extended surface equipments, types, their design & operation, introduction to unsteady state heat transfer.

Unit II : Heat transfer by convection, film concept, individual and overall coefficients and factors affecting them. Natural and forced convection dimensional analysis applied to heat transfer. Dittus-Boelter equation. Limitations and application.

Unit III : Heat transfer by parallel and counter current flow, concept of log mean tempeature difference, rate of heat transfer. Heat transfer by film wise and dropwise condensation in horizontal & vertical tube.

SECTION-B

Unit IV : Heat exchange equipments and their design, double pipe, parallel, counter current, shell and tube heat exchangers, condensers, fouling factors, concepts of transfer units in heat exchangers, NTU concept for heat exchangers.

Unit V : Boiling & Evaporators : Classification of types and field applications of evaporators single and multiple effect evaporators.

Heat transfer through submerged coils, jacketted vessels.

Unit VI : Heat transfer by radiation, concept of black body, Kirchoff's law, Stefan's law, Black and gray body radiation, view factors luminous and non-luminous gases. Heat transfer in packed and fluidised beds.

Recent developments in heat transfer.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED :

1) Heat Trasnfer : Mc Adams
2) Heat Transfer : Sukhatme
3) Basic Heat Transfer : Necati Orisik, McGraw Hill Co., Kogakusha.
4) Heat Transfer : J.P.Hokman, McGraw Hill Co., Kogakusha.
5) Unit Operations of Chemical Engg. : McCab and Smith.
6) Introduction to Chemical Engg. : Bedger and Banchero.
7) Chemical Engg. : Coulson & Richardson, Vol. I (ELBS, Pergamon Press, Latest Edition)
8) Heat Transfer : Gebhart, McGraw Hill, Latest Edition
9) Fundamentals of Engg. : R.C.Sachdeva, Wiley Eastern.
10) Heat Transfer : R.C.Sachdeva.

5 SCE(FPOPC)T2 CHEMICAL ENGINEERING (MECHANICAL OPERATIONS)

SECTION - A

Unit I Relevance of mechanical operations in industry.

1. Size reduction, stages of reduction, Equipments operating variables, laws of energies, energy requirements.
2. Screening: Screen analysis, particle size distribution.

Unit II
1. Classification: Equal falling particals, equipments, jigging, tabling.
2. Gravity settling, drag force, terminal settling velocity.
3. Sedimentation : Continous thickners.

Unit III
1. Storage and handling of solids, transporation
2. Mixing, Mixers, agitation, types of equipments.

SECTION - B

UnitIV
1. Filtration : Theory, operation, types, Flotation agents, flotation cells.
2. Filter Calculations, filtration equation for compressible and non-compressible cakes, specific cake resistance.
3. Filtration - Constant pressure and constant rate and their equipments.

Unit V
1. Centrifuges: Theory, Equipments, types and calculations.
2. Cyclones: Hydrocyclones, liquid scrubbers and electronic precipitators.

Unit VI
1. Adsorption, theory, type and application, Langmuir's Freundlich's equation, nature of adsorbents, industrial adsorbents.
2. Adsorption on fixed bed, fluidised beds. Adsorption equilibria calculations for vapour, gas & liquid adsorption. Adsorption, operation such as single stage, multi stage, cross current &

multistage counter current operation & equipments.

3. Recent developments in mechanical operation equipments.

PRACTICALS: based on above syllaubs.

BOOKRECOMMENDED :

1. Momentum Transfer Operation:S.K.Gupta, TMC, Latest edition.
2 Unit Operations of Chemical Engineering: McCabe and Smith, TMC 3. Chemical Engineering Vol. I : Coulson & Richardson, Pergamon, Latest edition.
4. Principles of Unit Operations: A.S.Foust, et-al.
5. Unit Operations: C.G.Brown.
6. Introduction to Chemical Engg. : Beder & Bachero.
7. Mass Transfer Operations: R.E. Treybal
8. Mechanical Operations Vol-I : R.S.Hiremath & A.P.Kulkami.

5 SCE (FPOPC) T3 CHEMICAL ENGINEERING THERMODYNAMICS

SECTION-A

Unit I : Scope of thermodynamics and its importances to chemical Engineers, Basic concepts, extensive & intensive properties. state function & chemical systems. Definition, symbols & interrelation, concepts of Entropy, Enthalpy & internal energy. First law of thermodynamics, Equations of state, critical properties, Vander Wall's constants, Virial expansions, Redlich-Kwong equation, Beattie-Bridgeman equation.

Unit II : First law applied to thermodynamic processes & calculation of Workdone, free energy & heat changes. Maxwell relation equation, second law and third law of thermodynamics. Thermodynamics relations based on second law. Relation between Cp & Cv, compressibility factor & coefficient of thermal expansion, concept of residual entropy & entropy of equilibrium.

Unit III : Partial molar and apparent molar properties, Gibbs Duhem equation, Chemical potential, effect of temperature and pressure fugacity, excess thermodynamic properties and thermodynamic properties of mixing. Gibbs-Duhem-Morgules equation, Konovalov laws. Colligative properties. Ebulliometric constant. Determination of Molecular Weight of unknown chemical substances. Solubility law.

SECTION-B

Unit IV : Vapour liquid equilibrium, T-X-Y diagrams & X-Y diagram for ideal & non ideal system. Raoult's law and Henry's law. Deviations from Raoult's law. Comparision of ideal & non-

ideal systems. Phase equilibria in non reaching multi-comonents, Binary, ternary systems. Graphical representation of L/L, L/S & G/S systems. Right angled triangular diagrams. Equilateral triangular diagrams, Janecke diagram, Effect of temp. & pressure on ternary equilibrium, Phenol-Wafer systems. auiline-water-chlorobenzene systems.

Unit V : Statistical thermodynamics, thermodynamics probability, its relation with Entropy, partition function and its relation with termodynamics functions, the Boltzman distribution law, Distribution law for chemically reactive system. Thermodynamics charts & their uses. Searching of thermodynamics data.

Unit V : Chemical Equilibrium, feasibility of chemical reaction, free energy change, Reaction co-ordinate, equilibrium constant, Effect of temp. & pressure, Relation between Kp, Kc & Kv, Le-Chatelier's principle, Endo-Exothermic relations, Heterrogeneous equilibria, various methods of calculating free energy charge. Equilibrium conversiions, case study of feasibility report for manufacture of industrial chemicals.

BOOKS :

1)	An Introduction to Chemical Thermodynamics	:	R.P.Rastogi, R.R.Misra.
2)	Chemical Engineering Process	:	Houghen-Watson.
3)	Introduction to Chemical Engg. Thermodynamics	:	J.M.Smith, H.C.Vauhess
4)	Thermodynamics for Chemical Engg.	:	H.C.Weber, J.P.Meissner
5)	Engineering Thermodynamics	:	P.K.Nag.

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5 SCE 4 INORGANIC CHEMICAL TECHNOLOGY (CHEMICAL ENGINEERING PROCESS-I)

SECTION-A

Unit I : 1. Coal Chemicals: The destructiv~ Distillation of Coal, cooking of coal; Distillation of Coal Tar. Coal &Chemicals. .

2. Fuel Gases: Natural gas, coke-oven gas; Producer gas; water gas; synthesis gas; substitute Natural gas; Liquified Petroleum Gases.

Unit II 1. Surface - Coating Industries - Paints; Varnishes; Lacquers; Industrial Coatings; Marine Antifouling coatings; Printing Inks and Industrial Polishes.

2. Oils, Fats and Waxes - Vegetable oils; Animal Fats and oils; Waxes.

Unit III : 1. Soap and Detergents - Detergents; Soap; Glycerin.

2. Sugar & starches industries - Sugar; Starches & Related products.

SECTION.B

Ut1it IV Fertilizers - Nitrogenous. Phosphatic and Potassium fertilizer. Raw materials, composition, Manufacture, properties, storage.

Unit V Principle of electrochemical technological processes. Electrolytic process in igneous and molten system, caustic soda, Chlorine. I

tJ\lit VI Electrothermal industries, Aluminium, Magnesium, Lithium, Titanium etc., Electro-Chemical sources of energy and storage.

Note *Subject be taught with reference to Stoichiometry* Thermodynamics, Kinetics, Chemical Engineering principles involved.

BOOKS RECOMMENDED :

1) Chemical Process Industries : R.N.Shreve, McGraw Hill, Latest Edition
2) Electro-Chemical Engineering : C.I.Mante, McGraw Hill, Latest Edition
3) Chemical Technology Manual, Chemical Tech., Vol. III, Ed. D.Venkateshwarhe, Chemical Engg. Ed. Dev. Centre, 117, Madras.
4) Outline of Chemical Technology : C.E.Deyden, Affiliated East-West Press, Latest Edition
5) Industrial Chemistry - Vol. I & II : Rodgers.
6) Regiles Industrial Chemistry : Kent.

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5 SCECT 5 ECONOMICS AND MANAGEMENT

SECTION-A

Unit I : Nature and Scope of Economics, introduction to managerial economics.

Demand concepts : Demand specification, types of demand.

Demand analysis : law of diminishing utility, Consumer's surplus.

Demand forecasting : Concept of forecasting, types of forecasts (8)

Unit II : Production Concept, production function, Laws of return, scales of production, factors of production, production planning and control : Its meaning, essential factors for the

success of production planning and control. (8)

Unit III : Meaning of Management, Principles of management, meaning and principles of scientific management, levels of management, delegation and authority,

Organisation, forms of organisation. (8)

SECTION-B

Unit IV : Sources of Finance Banking and Credit structure in India : Financial institutions, promotional polices and programmes of industrialisation, functions of Commercial Banks, functions of Central Bank. (8)

Unit V : Economic and Social Environment : Brief idea about economic environment of business, socio-cultural environment, Health hazards of chemical industries, awareness about AIDS & other diseases.

Brief idea about economic recession & its effect.

Introduction to World Trade,

Globalisation, Libertion and their effects.

Introduction to Patenting & intelleatual property protection (8)

Unit VI : Entrepreneur and Entrepreneurship :

Entrepreneurial competencies, institutional interface for small scale enterprises, opportunity scanning and identification.

Market assessment for SSE, choice of technology and selection of site, Ownership structure and organisational framework, preparation of business plan, main features of Indian factories act & minimum wage act.

Brief idea of Taxation in India. (8)

BOOKS RECOMMENDED :

1) Managerial Economics : K.K.Seo, Richard D. Irwin Inc.
2) Engineering Economics : J.L.Riggs, McGraw Hill, New York, Latest Edition.
3) Managerial Economics : Adhikary M., Khosla Pub. House, New Delhi.
4) Small Business Management Fundamentals : Dan Strenhoff and J.F.Burgess, McGraw Hill Book Company.
5) Effective Small Business Management : Richard M.Hodgills, Academic Press Incorporated, Harcourt, Brace Jovanovich.
6) Marketing Management for Small Units : Jain Vijay K., Management Publishing Co., Latest Edition.
7) Marketing Management :- Analysis, Planning, Implementation and Control : Kotler, Phillip, Prentice Hall of India Pvt. Ltd., Latest Edition.
8) Modern Economics Theory : K.K.Dewett.

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5 SRNCECT 6 COMMUNICATION SKILLS

Unit I : Comprehension over an unseen passage.

Comprehension - A - word study :-

Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.

Comprehension - B - Structure study :-

Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.

Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)

Unit II : Theoretical background - importance of communication, its process, model of communication its components & barriers.

Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Non-verbal communication, types of graphics and pictoral devices. (10 Hours)

Unit III : Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.

Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

BOOKS RECOMMENDED :

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.

COMMUNICATION SKILLS LABORATORY

Objective :

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

TEXT BOOK : Norman Lewis : Word Power Made Easy

http://www.teachingenglish.org.uk

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SIXTH SEMESTER

6 SCE 1 CHEMICAL ENGINEERING OPERATION (MASS TRANSFER-I)

SECTION-A

Unit I : Importance of Mass Transfer Operation.

Classification of mass transfer, operations based on gas-liquid-solid contacts. Concepts of flux, resistance, driving force, equilibrium, direction of mass transfer, Dimensionless nos. in mass transfer.

Diffusion, Fick's law I and II, Dependence of diffusivity on physical properties, Schmidt's no. calculation, Determination of diffusivity in liquid-liquid, gas-gas, gas-liquid diffusion.

Unit II : Interphase mass transfer, various coefficient of mass transfer and their determination, resistance concept, controlling phase concept, Mass transfer in turbulent flow, Analogies of mass transfer, Empirical equations.

Theories of mass transfer, two film theory, Higbies penetration theory, Derivation of flux equation, surface renewal theory, Applications and problems.

Unit III : Absorptions, stagewise absorption, material balance overall,

stepwise minimum irrigation rate, Absorption and stripping factor calculation of no. of stages, McCabe-Thiele graphical method, Kremsor-Brown-Sounder's equation.

Equipments of absorption, tray towers, packed towers.

Continuous absorption, concept of H.T.U., N.T.U., H.E.T.P., comparision with stepwise columns, design concepts, determination of ht. and diameter of packed absorption column.

SECTION-B

Unit IV : Adsorption : Adsorption equilibria, types of adsorption, properties of adsorbents, single and multi-stage adsorption, adsorption isotherms, principles of adsorption, Break through curves, Adsorption of liquids, Basic equations, Adsorber design. Adsorption equipments.

Ion Exchange : Principles of ion exchange, Techniques and applications, Ion exchange equilibria, Rate of ion exchange.

Unit V : Drying and humidification.

Principles of drying, phase equilibrium, cross circulation drying, through circulation drying, drying of suspended particles, rate of drying curve, dryers for solids and pastes, dryers for solutions and slurries i.e. various types of dryers

Humidification : Terms, definitions, wet bulb temp., dry bulb temp. and measurement of humidity, Adiabatic saturation temp., study of temp humidity chart, Enthalpy-humidity charts, Determination of humidity, and concept of dehumidification. Equipments for humidification operations.

Unit VI : Crystallisation : Principles of crystallisation, Equilibria, calculation of yield, heat effects, crystal growth, properties of crystals nucleation, fractional crystallisation, caking of crystals, Various types of crystallise's and their applications.

Membrane separation process, Types of membrane, separation of gases, separation of liquids, Dialysis, Reverse Osmosis pervaporisation, Desalination.

Recent Developments in Mass Transfer Operation.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED :

1) Unit Operation in Chemical Engg. : W.L.McCabe & J.C.Smith, McGraw Hill.
2) Mass Transfer Operation : R.E.Treybal.
3) Mass Transfer : T.K.Sherwood, R.I.Pigford, McGraw Hill.
4) Chemical Engg. : Coulson & Richardson.

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6 SCE (FPOPC) T 2 PROCESS EQUIPMENT DESIGN & DRAWING

SECTION-A

Unit I : Material behaviour under stresses, theories of failures. (8)

Unit II : Fabrication methods and their effects : Design method for atmospheric storage vessels, unfired pressure vessel subjected to internal and external pressure. (8)

Unit III : Vessels for high pressure operations, Agitated vessels. Tail columns, internals of the reactors. (8)

SECTION-B

Unit IV : Design of process equipment accessories and support systems. (8)

Unit V : Complete design and preparation of working drawing for typical process equipment, such as large storage vessels, thick wall pressure vessels. Self supported tall columns, agitated pressure vessels with heat transfer requirements etc. (8)

Unit VI : Design and layout of piping system and preparation of piping diagram for a typical process. Material selection and piping coding. (8)

PRACTICALS : Based on the above syllabus.

BOOKS RECOMMENDED :

1) Process Equipment Design : I.E.Brownell, E.H.Young, John Wiley, Latest Edition.
2) Process Equipment Design : M.V.Joshi, McMillan, Latest Edition.
3) Introduction to Chemical Engg. Design, Mechanical Aspects.
4) I.S.Code for Unfired Pressure : IS No. 2825 - 1969 pressure vessel.
5) Process Equipement Design & Drawing : S.D.Dawande.
6) International & Indian Standard codes for Piping.

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6 SCECT 3 INSTRUMENTATION & CONTROL

SECTION-A

Unit I : Measuring Instruments : Theories, practice and applications of measurements of temperature, mass and levels. (8)

Unit II : Measurement of pressure, vacuum, humidity & pH in process industry. (8)

Unit III : Methods for composition analysis. Principle and techniques of instruments for composition analysis in process industry,

such as chromatography, spectroscopy, refractrometry etc. (8)

SECTION-B

Unit IV : Flow measuring instruments : Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators. (8)

Unit V : Introduction to Simple system analysis : Laplace Transformation. Block diagrams, linearization. First and higher order system. (8)

Unit VI : Frequency response, distributed parameter system, dead time.

Feed back control, servo and regulator control. Time domain closed loop responses, closed loop frequency response.

BOOKS RECOMMENDED :

1) Industrial Instrumentation : Eckman, Wiley Eastern
2) Instrumental Methods of Chemical Analysis : Erwing, McGraw Hill.
3) Instrumentation & Process Measurements : W.Bottom, Orient Longman.
4) Industrial Control & Instrumentation : W.Bottom, Orient Longman.
5) Outlines of Chemical Instrumentation & Process Control : A. Suryanarayan, Khanna Pub., New Delhi.

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6SCE4 ORGANIC CHEMICAL TECHNOLOGY

(Chemical Engg. Process-II)

SECTION.A

Unit I : Fermentation Industries -Industrial Alcohol; Absolute Alcohol; liquors: Vinegar and Acetic Acid; Citric Acid Enzymes. Pulp and Paper Industries - Manufacture of Pulp, Manufacture of Paper; Structural Boards.

Unit II : Plastic Industries - Raw materials, Manuf acturing Process. Rubber Industries - Natural Rubber; Synthetic Rubber; Compounding Rubber, Fabrication Latex Compounds, Rubber Derivatives.

Unit III : Petroleum Processing - Constituents ot Petroleum; Products ot Retinlng: Processing.

Petrochemicals . Chemical Conversions, Manufacture of Petrochomicals: Reactions Producing Petrochemicals with special reference to halogenation of C1.C2. & Benzene.

SECTION - B

Unit IV : Chemical Engg. processes, Chemical Engg, unit operations schematic representation of all the units involved in processing, Different processes.

Amination by reducti.on.

Various methods of reduction, Factors *affecting* the Batch Vs. continuous Manufacture of Anilin Nitrobenzene with fIow diagram, material of constructi for Reductian process

Unit V : Amination by Ammanolysis :

Types of Ammonytic reactions, Amizating agents, survey of amization reactions physical and chemical factors affecting ammolysis. Types of equipments materials of construction catalysts, uses, manufacture of aniline from chlorobenzene nitroanline from PCNE Recovery of Ammonia.

Oxidation :

Types of oxidative reaction oxidizing agents liquid phase vapour phase oxidatian, oxidatian of toluare, manufacture of acetaldhyde acetic acid and oxidation of liquid hydrocarbon vapour phase oxidatian of methand liquid hydrocarbon Benzene, Toluene, equipments used for oxidation, problems of heat transfer in vapaur phase reaction material of construction.

Unit VI 1. Hydrogenation :

Scope of reaction, brief survey, sources.of hydrogen gas properties of hydrogen catalytic hydrogenation and hydrogenlysis of actylene. Olefine. Diolefins, aromatics carbonyls, acid chlorides esters, Materials construction, Industrial hydrogenation of fat petroleum and coal.

2. Hydrolysis:

Types. hydrolysing agents equipments, Industrial hydrolysis-hydrolysis of fat, carbohydrate, starch manufacture of ethern from ethylene-shell process manufacture of phenol

3. Esterificatian:

Equipmems Industrial processes, intersterification of land.

BOOKS RECOMMENDED: ,

1. Unit process in Organic Synthesis: Groggins P.H.McGraw Hill Kogakusha
2. Chemical Process Industries: Shreve Rn McGraw Hill Co, New York - Students Edition, Latest Edition.
3. Outlines of Chemical Technology: Dryden CE, 2nd edition, Affiliate East West Press Latest Edition.

4. Manual of Chemical Technology. Vol., I & II : Venkateshwarlu, IIT, Madras.
5. A text book of Chemical Technology: 3rd edition: S.D. Shukla & G N Pandey.

6 SCECT 5 COMPUTER PROGRAMMING AND APPLICATIONS

Note : Application of the following techniques for problems of interest in chemical engineering, writing and testing of programs written in C Language.

SECTION-A

Unit I : Numerical solution of first order differential equations with initial condition, Euler's method, Runge-Kutta method.

Unit II : Systems of linear equations, solution by the method of determinants, matrix inversion for the solution of linear equations, Gauss elimination method.

Unit III : Roots of algebric and transcendental equation, iteration methods, Regula-Falsi method, Newton-Raphson method, roots of simultaneous and solution set of transcendental and algebric equations. Development of equations for heat transfer, fluid mechanics and reaction engineering problems.

SECTION-B

Unit IV : Regression analysis - Least Square, error approach, approximation by Chebychev orthogonal polynomial.

Unit V : Elements of optimization techniques, single variable function, optimization-direct search, with and without acceleration, method of regular intervals and fibonacci search method, gradient methods.

Unit VI : Computer programming in modular form, use of subroutine libraries, Block diagrams of preliminary aids in programming, capacity optimization.

PRACTICALS : Based on above theory.

TEXT BOOK : Digital Computation for Chemical Engineering by Leon Lapidas, McGraw Hill, Latest Edition.

6 SCECT 6 MINI PROJECT

Students are required to prepare and submit report on mini project on Software Development / Market Survey / Design / Fabrication / Site Visit / Some Experimental Investigation / Validation in the relevant field under the guidence of teacher.

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SEVENTH SEMESTER

7 SCE 1 CHEMICAL ENGINEERING OPERATION -III (MASS TRANSFER - II)

SECTION A

Unit I : Liq-liq extraction : Liquid equilibria, Representation in equilateral triangular and rectangular coordinates, choice of solvent: Selectivity Distribution *coeff*, Recoverability, Density, Determination of plait point liver rule, single and multistage extraction: 1) cross current extraction 2) counter current extraction, fractional extraction. Applications in petrochemical industries, extraction of nuclear fuels and recent advancements in applications.

Unit II : Continueous or differential extraction, Calculation of NTU. & HTU., Classification of extraction equipments. stagewise : 1) The mixer settle, Baffle plate columns, scheibel columns. Differential i) Spray column, Sieve Iray column, packed columns, pulsed columns, centrifugal extractors. and their applications, Design of continuous-contact towers.

Unit III : Principles cf leaching, Types of equilibrium, Multistage cross-current, counter current leaching and their graphical and RAT representation. Continuous contercurrent decantation varify types of solid liq extractors, shank system, Rotocel, Ballmamn extractor, Extractor for cellular material, exiraction of oil from cellular material, agricultural material and seeds.

SECTION B

Unit IV : Distillation: Thermodynamics of vapour-liq equilibrium, Relative volatality, partial pressures, Dalton's, Raoult's and Henry's laws Methods of distillations: - Differential, Flash or equilibrium, Rectification and Batch distillations No. of plates by McCabe Thiele method.

Unit V : Panchon savarit, Lewis method, Reflux ratio, minimum reflux ratio, and Azeotroes, Antonic, Vanlaar. Consistency of system, Generation of Vapour-liq equilibria for unknown system Herington's consistency test.

UnitVI : Introduction to rnulticomponent distillation Azeotroic distillation, extractive distillation, steam distillation of plate columns, Sieve trays, valve trays. plate efficiency, factors determining column performance, Bubble cap trays, Packed column : Packings, calculation of enrichment in packed column and design of distillation column.

PRACTICALS : Based on above Sylalbus.

BOOKS RECOMMENDED:

1) Unit Operation in Chemical Engg : W.L.McCabe & J.C.Smith, Mc Graw Hill.
2) Mass Transfer Operation: R.E.Treybal
3) Mass Transfer: TKSherwood, R.I.Pigford, McGraw Hill.
4) Chemical Engg. Vol. II : Coulson & Richardson.
5) Transport Phenomena and Unit Operations: Geankoplis.

7SCE(FPOPC) T2 CHEMICAL REACTION ENGINEERING-I

SECTION - A

Unit I : Classification of chemical reactions. Variables affecting the rates of reaction. Kinetics & Thermodynamics. Thermodynamics of chemical reactions. Classification of reactors. Order of reaction & rate constant.

Unit II : Rates of Homogeneous Reactions. Fundamentals of rate equation. Rate equations from proposed mechanism Analysis of simple & complex rate equation. Evaluation of rate equation from Laboratory data.

Unit III : Interpretation of rate data, Scaleupard Design. Constant volume batch reactor. Variable volume Batch reactor. Temperature and reaction rate.

SECTION - B

Unit IV : Single ideal reactors. Ideal Batch Reactor. space time and space velocity, steady state mixed flow reactors, steady state plug flow reactor, Holding-time & space time for flow system.

Unit V : Design for single reactions
Size comparison of single reactors Batch reactor, Mixed verses plug flow reactors Variation of reactant rates. General Graphical comparison. Autocatalytic reactions.

Unit VI : Design for multiple reactor system. Reactions in parallel & in series, series-parallel reactions. Batch recycle reactor, Flow-recycle reactor. Temperature & pressure effects in single and multiple reactions. Optimum temperature profile.
Practicals based on above syllabus.

BOOKS RECOMMENDED:

1) Chemical Reaction Engg. : Octane Levenspiel, Wiley Eastern LId
2) Chemical Engg. Kinetics: Smith J.M. McGraw Hil:
3) Reaction Kinetics for Chemical Engineers. Walas. McGraw Hill.
4) Elements of Chemical Reaction Engg., H.Scott Fogler, Prentice Hall.

7 SCE 3 PROCESS DYNAMICS AND CONTROL

SECTION - A

Unit I : Transmit response of control systems, optimization.

Unit II : Stability, Root locus, Transient response. Application of root locus to control system. Frequency response methods. Design of Nyquist criteria.

Unit III : Process applications Controller mechanisms

SECTION - B

Unit IV : Development & control systems for various chemical industries case studies.

Unit V : Introduction on advanced control techniques as feed forward, control, cascade control, ratio control adaquative control and digital computer control.

Unit VI : Dynamics & control of chemical equipments such as heat exchangers, distillation columns, absorption colurnn etc.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED:

1) Process Control- Pater Harriott, McGraw Hill, New York, Latest Edition.

2) Process System Analysis and Control : Koppel Conghawoner McGraw Hill.

3) Automatic Process Control, D.P.Eckman, Wiley.

4) Chemical Process Control, George Stephanopoulos - Prentice Hall of India Pvt. Ltd.

5) Process Systems Analysis & Control, Donald R.Coughanour, McGraw Hill.

7SCE(FPOPC) T4 INDUSTRIAL WASTE TREATMENT

SECTION A

Unit I : Environment, pollution, pollutant, Zero pollution, production waste, consumption waste, by product waste salvageb!e waste, types of pollution causes by wastes, greenhouse effect, Acid rains, Causes of acid rains, effects. Chloroflurocarbon, application of CFC's in industry role of CFC's in depletion atmospheric ozone. Other effects of air pollution. Agencies working on pollution control, their constitution, ageing of lakes and resvoirs, thermal stratification of lakes and reservoirs. example of wasteless processing.

Unit II : Legislations of Environment protection, Indian standards for driklng water, effluent discharge, Indian Standard Codes for disposal of Wastes, Micro-organisms present in water, water

borne diseases, determination of the dissolved solids, sus-pended solids, turbidity, PH, conductivity, DO, BOD by direct method & dilution method, cae sampling methods, Sampling procedures and precaution.

Unit III : General Treatment: Screening and grease removal, NeutralIzation, Proportioniry, Chemical Coagulation, Sedimaltation, filtration.

Biological Treatment: Kinetics of Biological grouth, various suspended and attached grouth processes for the treatment of industrial effluent.

Advanced Waste Water Treatment : Ion exchange, Activated carbon adsorption, Electro dialysis reverse Osmosis. Disinfection of Water: Sterlization and methods for disinfec-tion.

Sludge Disposal: Various alternatives for Sludge disposal.

SECTION-B

Unit-IV : Solid waster management, land pollution, composting, lanfilling, incineration, types of hazardous waaste, treatment of hazardous waaste, sources of radioactive wastes, treatment of radio active waste. effects of radiations. Rewashable and recyclable solid waste, recycling in chemical industries.

Unit-V : Removal of particlated matter, comparative study of method employed e.g. cyclones, bag filters, precipitators, scrubbers, collectors etc., Pollutions control for fly ash, combustion and gasification plants. Various process for reducing SOx, NOx emissions.

Unit-VI : Waste management for industries like Food Industry, Dairy Industry, Sugar Mill, Fertilizer, Pulp and Paper. Sulphonic acid Cement, Tanneries.

Case studies and corrective measures taken in industry to prevent environmental hazards. ,

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED:

1) Dr.S.P.Mahajan : Environmental Pollution Contral

2) Matcaff and Eddy : WasteWater Treatment

3) Rao & Datta : WasteWater Treatment

4) V. V. Kafarov : Wasteless Chemical Processing

7SCEPP5 PLANT DESIGN AND PROJECT ENGINEERING

SECTION A

Unit I : Basic considerations in Chemical Engineering Plant Design. Project identification, preliminary teachno-economic

feasibility. Process design aspects-process selection, factors affecting. Importance of laboratory development, pilot plant. scale-up methods. safety factors, flow diagrams.

Unit II : Selection of process equipments-standard Vs special equipments, materials of construction of process equipment, selection criteria, specification sheets

Process auxillaries - piping design, layoyt, process control and instrumentation.

Process utilities-process water, boiler feed water, waste treatment & disposal, Oil heating system, chilling plant compressed air vaccum.

Unit III : Plant location and layout principles, factors affecting, using scale methods, case studies.

SECTION B

Unit IV : Cost estimation-factors involved in project cost estirnation, total capital investment. fixed capital working capital, Methods of estimation investment. Cost index and scaling for equipment cost. Estimation of total product cost-factors involved. Interest-types & calculations.

Unit V Depreciation-types & methods of determination. Profitability-alternative investment and replacement methods, practical factors in alternative & replacement investment.

Unit VI Inventory control, scheduling a project using CPM/PERT. Project management. Optimum conditions-optimum production rates in plant operations, optimum conditions in cyclic operations. Design reports.

BOOKS RECOMMENDED:

1. Plant design and Economics for Chemical Engineers - Max S.Peters & Klaus D. Timmerhaus, Fourth Edition, Mc Graw Hill, Latest Edition.
2) Chemical Engineering Plant Design - F.C.Vibrandt & C.E.Dryden, Mc Graw Hill Latest Edition.

Note: Industrial visits and case studies are expected.

EIGHTH SEMESTER

8 SCE TRANSPORT PHENOMENON

SECTION-A

Unit I : Transport properties and mechanism, Rate process, flux, types of fluids, phenomenological laws, Rheology of non-Newtonian fluids, flow through circular pipes, Mathematical foundation, types of time derivatives, Divergence, Operators.

Unit II : Control Volume, Overall mass, momentum and energy balances, Extended Bernoulli's equation, Reynold's transport

equation, mass balance with chemical reaction.

Unit III : Equation of change based on differential balance, equation of continuity, Navier-Stokes equation, energy equation, application of Narier-Stokes equations to various flows through different geometric shapes, applications of energy equation, potential streamline, creeping and ideal flow.

SECTION-B

Unit IV : Flow around submerged solids, flow past flat plate, boundary layer, Prandtl equation, expressions for viscous drag, thermal boundary layer. Von Karmon's integral momentum equation, analysis of integral equation, displacement thickness.

Unit V : Turbulent flow mechanism, intensity of turbulence, Reynold's sitresses, Prandtl mixing length, turbulent flow through circular pipes.

Analogies of transfer processes, profiles of gradients, Reynold's Prandtl, Von Karmon, Chilton-Coulburn analogies, J.factors, Dittus-Boelter's equation.

Unit VI : Review of classical mass transfer problems, mass transfer in binary systems with or without chemical reactions. Theories of interphase mass transfer. Mass transfer analogies.

PRACTICALS : Based on above syllabus.

BOOKS RECOMMENDED:

1) Transport Phenomenon: Bird, Stayward, Light Foot, John Wiley, Latest Edition.
2) Momentum, Heat and Mass Transport: Benett and Mayers, McGraw Hill, Latest Edition.
3) Principles Qf Unit Operations: A.S.Foust, et-al, Wiley Toppan Int. Ed., Latest Edition.
4) Fluid Dynamics and Heat Transfer: J.G.Kundsen and Katz, McGraw Hill, Latest Edition.
5) Transport Phenomlenon and Unit Operations: Geankoplis.

8SCE(FPOPC) T2 CHEMICAL REACTION ENGINEERING-II

SECTION B

Unit I : Residence time distribution. Models for non-ideal flow.

Unit II : Mixing concept and models: Rate equation for Heterogeneous reactions, fluid particle Reactions. Determination of rate controlling step. Application to Design.

Unit III : Fluid-Fluid reaction: The rate equation for different cases and application to design. 8 design.

SECTION B

Unit IV : Heterogenous processes, catalysis an d adsorptionl

Determination of surface area, void volumn. Pore volume distribution catalyst preparation, promoters and inhibitation catalyst reactivation.

Unit V : Rate equation for third solid catalytic, reactions. Internal External transport process in Heterogeneous Reactions.

Unit VI : Design of Heterogeneous catalytic reactors, fixed broad reactors, isothermal & adiabatic fixed bed reactor, non-isothermal & non-adabatic fixed bed rector. fludized bed, Drickle bed, slurry reactor.

BOOKS RECOMMENDED:

1. Chemical Reaction Engineering, Octove Levelspil, Wiley Easten Ltd.
2. Chemical Engineering Kinetics, Smith J.M., Mc Graw Hill.
3 Elements of Chemical Reaction Engineering - H.Scott Fogler, Prentice hall.
4. Chemical Reactor Analysis & Design, Gilberth F. Froment & Kenneth B.Bischoof, John Wiley & Sons.
5. Chemical Reactor Design, Vol I & II, M W.Rase.

8SCE3 ELECTIVE

List of Electives :

1) Polymer Science and Engineering
2) Petroleum and Natural gas
3) Corrosion Engineering
4) Biochemical Engineering
5) Petroleum Processing Engineering
6) Petrochemical Process Technology
7) Cellulose Technology
8) Fuel Technology
9) Bio Fuels
10) Industrial Piping
11) Wine making

8SCE3 (1) POLYMER SCIENCE AND ENGINEERING

Basic structures and fundamentals of polymers:

Industrially important polymers. Polymerization Reaction Kinetics Phenomena; Morphology and J Transitions in Polymers, Solution thermodynamics of polymers; Experimental techniques in polymer characterisation; Introduction to Theology and Viscoelasticity of polymers; fundamentals of polymer processing.

Practicals : Based on above Syllabus.

Books commended:

1. Williams, L.J.- "Polymer Science and Engineering" Prentice Hall, Inc., Vol.I
2. Rotrigues, F, "Principles of Polymer Systems, Tata-McGraw Hill Pub., Latest Edition.
3. Ooken, G. "Principles of Polymerization," Mc Graw Hill, Latest Edition.
4. Colins, E.A. Bares, J. and Billimeryer. FW. "Experiments in Polymer Science", Wiley-Interscience, Latest Edition.
5. Kumar, A. and Gupta, S.K. "Fundamentals of Polymer Science and Engineering" Tata-McGraw Hill Pub. Latest Edition.
6. Middleman, S. "Fundmentals of Polymer Processing" McGrawHill New York, Latest Edition.

8SCE3 (2) PETROLEUM AND NATURAL GAS

Prilling and testing of natural gas well, control of well fluid production, size of gas reservoir. Steady and unsteady state flow in reservoir, bottom hold pressure, single and two phase flow through orifices and chokes Storage transmission and distribution net work of natural gas. Commercial gas metering. Compressor Stations, layout, transient flow of gas. Determination of gas product specifications, water and acid gases content Hydrate forming conditions and permissible expansion, dehydration of natural gas. Compression refrigeration, gas well, chokes, gas sweetening.

Practicals : Based on above Syllabus.

BOOKS RECOMMENDED: Natural Gas Production, Transmission. Manual. Institute of Gas. Technology, L.G.T. Chicago, 1974.

8SCE3 (3) CORROSION ENGINEERING

Corrosion, direct, two stage attack, electrochemical attack, Environment conditioning. Higher corrosion resistance through proper selection of material, Isolation of corrosion, prone materials from destructive environment, Technologies of anodisation. enamelling, rubber lining, glass lining, refractory lining, painting and other surface protective measures. Corrosion Engineering in special applications such as material transport, pumping, filtration, condensation, boiling, rivetting welding. high, temperature environments, electrochemical environmental etc. Cost factor in competitive corrosion prevention/inhibition techniques.

PRACTICAL: Experiments based on theory.

BOOKS RECOMMENDED;

1. Uhilig, H.H."Corrosion and Corrosion Control", John Wiley and Sons Latest Edition.
2. Bultar G. and Ison' HC. K 'Corrosion and its Prevention in Waters",

Leonard Hill-London. Latest Edition.
3. Maslov, P, "Chemical Materials for Construdion" Structures Publishing Co. Latest Edition.
4. Fontane, M.G, and Greehnee. N.D. "Corrosion Engineering" Mc Graw Hill. Latest Edition.
5. Payne, H.F., "Organic **Coatings** Technology" John Wiley and Sons.
6. Rajgopalan, K.S.Corrosion and its Prevention", Chemical Engineering Education Development Centre, I.I.T. Madras. Latest Edition.

8SCE3 (4) BIOCHEMICAL ENGINEERING

Scope and possibilities. characteristics and classification of biological matter, kinetics of microbial growth, balance equations for batch and continuous cultures, kinetics of enzyme catelysed reactions. Analysis of mixed microbial populations. Design and analysis of biological reactors. Production, Isolation and utilisation of enzymes. Transport phenomenas in biological systems.

BOOKS RECOMMENDED:

1. Aiba, A.E. Humpharey, N.F. Mills: Biochemical Engineering, 2nd Edition, Academic Press, New York. Latest Edition.
2. J.E.Bailey, D.F. Oltes : Biochemical Engineering Fundamentals, Mc Graw Hill, Latest Edition.
3. B.Atkinson : Biochemical Reactors, Pion Ltd. London, Latest Edition.

Practicals : Based on above Syllabus.

8SCE3 (5) PETROLEUM PROCESSING ENGINEERING

Introduction to petroleum industry. World petroleum resources, petroleum industry in India. Origin, exploration, drilling andproduction of petroleum crudes, Transportation of crudes and products. Crude treatment-Composition and classification of crudes; methods of evaluation; ASTM, TBP and EFV distillation. Properties and specifications of petroleum Products such as LPG, gasoline, naphtha, kerosene, Diesel, oils, lubricating oils, waxes and the like.

Separation 2 processes:

Design and operation of topping and vaccum distillation units. Tube still furnaces. Solvent extraction processes for lube oil base stocks and for aromatics from naphtha and kerosene streams, solvent dewaxing. Conversion Processes.

Thermal cracking, visbreaking and cooking processes. catalytic cracking reforming, hydroprocessing alkylation, polymerisation and isomerisation, safety and pollution considerations in refineries.

BOOKS RECOMMENDED:

1. Nelson, W.L. : Petroleum Refinery Engineering, Mc Graw Hill.

2. Hobson, G..D., Phol, W. : Modern Petroleum Technology, Halsted Press, Division of Wiley Eastern.
3. Gathrie, V.B.: Petroleum Products Handbook, McGraw Hill.
4. Kobew, K.A., Mcketta. J.J. : Advances in Petroleum Chemistry and Refining Interscience.

Practicals : Based on above Syllabus.

8SCE3 ELECTIVE

(6) PETROCHEMICAL PROCESS TECHNOLOGY

The following topics to be dealt with respect to raw materials, processes, thermodynamics, kinetics, reactor type, catalyst, heat & mass transfer rates, separation, punfication, storage, transport.

Unit I : Raw materials for petrochemical industry, production of olefin containing gases. Details and variations in cracking and other processes for petrochemical feed stocks.
Unit II : Manufacture of important petrochemicals such as fertilizers.
Unit III : Plastics, detergents.
Unit IV : Fibers, synthetic rubber and solvents.
Unit V : Fermentation of hydrocarbons.
Unit VI : Outlook for petroleum-derived feed stock for the manufacture of chemicals.

BOOKS RECOMMENDED:

1. Steiner H. : Introduction to Petroleum Chemicals, Pergamon Press.
2. Waddams A.L. : Chemicals from Petroleum, John Murrey.
3. Topchiev A.V : Synthetic Materials from Petroleum, Pergamon Press.
4. Astle M.J. : The Chemistry of Petrochemicals, Reinhold.

Practicals : Based on above Syllabus.

8SCE3 (7) Cellulos Technology

Morphological characteristics of cellulosic raw materiais Methods of pulping, washing, refining and bleaching pulps for different process industries like paper, rayon, derivatives, etc., principles of paper board manufacture. Regeneration of spent liquor from pulping industries

Regenerated cellulose cellulosic derivatives.

Practicals : Based on above Syllabus.

BOOKS RECOMMENDED:

1 R.C. McDonald and others: Pulp and Paper Manufacture. Vol I. II (McGraw Hill)
2. E.Libby: Pulp and paper. Science and Technology, Vol I and II (McGraw Hill). Latest Edition.
3. Emit Ott: Cellulose and Cellulose Derivatives. Vol. III (Interscience), Latest Edition.

8SCE3 (8) FUELTECHNOLOGY

SECTION-A

Unit I : Comparison of various sources of energy Alternatives to non-renewal sources. Characteristics and distribution, production and total deposits of coal and petroleum in India. Classification of Fuels Classification of Coal. Formation of Coal (colification process).

Unit II : Analysis of coal. Proximate and ultimate analysis. Significance of analysis. Rank of coal relation with moisture, ash, volatile matter. Reporting of coal analysis. Significance, composition of ash and mineral matter. Properties and testing of coal, Calorific value (Gross and net), Bob calorimeter, Boy's gas calorimeter, weathenng index, swelling index, caking index. Grind ability index, specific gravity. Theoretical computations of calorific value.

Unit III : Testing of oils, viscosity, flash point, pour point, aniline point, carbon residue, Diesel index, octane and cetane number moisture content. Preparation of raw of mine coal. Washing of coal, washability curves. methods of coal washing, coal washeries in India, Gravity separation. float and sink test Efficiency of coal washing.

SECTION-B

Unit IV Carbonisation. Physical and chemical changes, high and low temperature carbonisatior.. Modern developments in design of coke ovens. Recovery of by products, Tar distillation, Blending of coals. Fuel economy in steel plants. Properties of metallurgical coke. Straight run distillation of crude oil. Thermal transfer and catalytic cracking. Polymerisation alkylation and ison.

Unit V General principles of combustion. Combustion of grates mechanical stokers, combustion of pulverised coal, Suspenaed bed and fluridised bed combustion. Problems in combustion based on mass and heat transfer with chemical reaction.

Unit VI Gasification of coal. First and second generatior. gasifiers. Design of gasifier. Fixed suspendedand fluidised bed gasifiers. Koppa Totrek, Lurgi Winkler Hygas process. Orsat gas analysis, Gobour gas and sewage gas. Syntheis gas and its uses. Under ground gasification of coal.

BOOKS RECOMMENDED

1. Fuels and Combustion : Samir Sarkar
2. Fuels, furnaces and Refractories : O.P. Gupta

3. An introduction to study of fuels : J.C.Macrae
4 Fuels: J Francis
5. Fules and furnaces : Brame and King.
6. Fuels : Huslam & Russel.

PRACTICALS: Based on above syllabus

8 SCE 3/8S (FPOPC) T4 ELECTIVE

(9) BIOFUELS

History, diesel engine, diesel fuel, alternative diesel fuels, Biodiesel,definition, sources, standards.

Use of straight vegetable oil, dilution with conventional diesel, blending with esters; Structure of triglycerides, transesterification of oils, alcohols and catalysts used, mechanism of reaction, reaction conditions, process, glycerin recovery, raw materials and glycerin use, Fuel related properties of various fats, oils and their esters, comparison with petroleum diesel.

Combustion chemistry lubricity, engine performance, engine problems and deposits using biodiesel in present engines.

Tailpipe emissions using vegetable oil fuel and esters, comparison with petroleum diesel, Health hazards on use of petroleum fuel and biodiesel, Safety and advantages of biodiesel.

Storage conditions for biodiesel.

8S (FPOPC)T4 ELECTIVE

(10) INDUS1RIAL PIPING

Importance of piping in chemical industry.

Classification of pipes: - Pipe codes and specification, Schedule numbers,BWG, NPS. Material of construction of pipes.

Pipe sizing: - Calculation of pipe diameter, thickness. Pipe fittings, advantages, calculation of frictional losses, and empirical correlations for flow of oil. Gasoline, hydrocarbons.

Criteria for selection of pipe joints, pipe joints for similar and dissimilar material, expansion effects and methods for reducing them. Piping lay-out consideration, piping diagrams, types of pipe support, erection and maintenances of supporting, restraining and braing systems. Complex pipe-lines.in series and parallel.

Calculation of equivalent lengths. Pipeline storage capacity. Fundamental considerations in piping vibrations, types of vibrations, their prevention and control. Cryogenic piping.

Single phase and two-phase flow. Piping for slurries..lnsulation for piping systems.

Recommended Books:

l. Piping Design for Process Plants by H. F. Rase, John Wiley.

2 Process Piping Systems,D. J. Deutsch, CJiemical.Engineering . Magazine. McGraw Hill. .
3. Industrial Piping, C.T. Littleton, McGrawHill.

8S (FPOPC) T4 Elective

(11) WINE MAKING

History, definition, wine and wine indusuy, Wine production of selected areas, grape varieties Geographic, geological, and climatic attributes regarding wine production and quality.

Structure and composition of grapes:

Grape structure, chemical composition of grapes, e.g. sugars, acids, an thocyanins, tannins, etc., analytical techniques, fiuit ripeness. noble rot

Processing of grapes: Grape reception, grape handling strategies, e.g. de-stalking, crushing, pressing and skin contact, must treatments, temperature control.

Fermentation: Alcoholic fennentation, role of yeast, enzymes, temperature and fermentation Vessels, strategies for the extraction of colour, aroma, flavour and tannin Carbonic maceration, whole bunch fermentation and thermovinification, theory and practice of malolactic fermentation

Maturation and blending:

Maturation options, types of maturation vessel, inert storage Blending options, timing of bottling

Stabilisation, clarification, packing and labeling:

Movement of wine in bulk, methods of stabilisation and clarification, e.g. fitting, filtration, centrifugation, cold stabilization, etc., use of chemicals in wine making and wine.handling - their function, action and application, international regulations goveming the use of chemicals, packing into bottles and other containers, ingredient labeling, closures.

Production of sparkling wines: Production techniques for sparkling wines, grape selection and pressing, temperature control, selection and blending of base wines, the second fermentation, Maturation, finishing

Production of fortified wines:

Production techniques for fortified wines, selection of base wines,timing of fortification. practice and significance of blending and maturation, fmishing

Quality assurance and quality control: Composition of wine and its faults, analysis of wine, its purpose, use and limitations, QA and QC systems and structures for wine and dry goods, practical issues of QA and QC, Effects of storage and transport on wine after packing.

Recommended Books:

Exploring Wine, 2nd Edition, by Koplan, Smith, & Weiss. Published by John Wiley & Sons, Inc. New York. Ed. Latest Edition.

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8SCE4 SYSTEM MODELLING

SECTION-A

Ordinary Differential Equations,

Unit I, II & III :Applications in (1) Determination in rate of reaction (2) variation of temp with time (3) Heat Transfer through extended surface (4) Diffusion with chemical reaction in tubular reactor 5) Steady state counter-current cooling (6) radial heat transfer through cylindrical conductors (7) Heat transfer and mass transfer with accumulation.

Solutions by Series:-

Applications In (1) Transverse coin fins (2) preheaters 3) Heat loss through pipe flanges.

Laplace Transformation:-

Application in 1) Diameter of tobesttobe installed in fixed bed reactors.

(2) Automatic control theory vector analysis.

Vector analysis:-

Application in (1) Equations of fluid flow

(2) In transport of heat, mass and momentum,

Partial differentiation and Partial differential equations

Applications in (1) Unsteady state heat conduction (2) Continuity equation (3) Flow through packed bed (4) Gas absorption accompained by chemical reactions.

Finite Differences:-

Application in solvent extraction in (1) Solvent extraction in N-stages (2) Gas absorption in N-stages (Kremers eq^{n}) (3) N-stried tank reactors in senes (4) Simple distillation

Treatment of experimental result

Application in (1) Vanations or K temp. (2) Constants of Arhensius eqn by least square method etc

Numerical Methods :-

Application in (1) Solutions of complex rate eqn (Simpsons rope (2) Reactor design eqn (3) Velocity distribution of fluid through ducts

SECTION-B

Unit-IV : Matrices

V & VI Application such as Battery of N-Reactors in series Optimization- Analytical methods of optimization: Application of Langrangian multlplires to heat transfer problem Dynamic prograrnmmg Application to MCSTR M series Gradient methods of optimization method of steepest descent.

Mathematical modelling.-

Reviews at the cases already covered along with the following Model for thermal steady state process. Model for thermal unsteady state process, Model *for* plug flow Isothermal reactor, Mathematlcal Models of mass transfer Principles of sililarity in physical modelling.

Statistical design of Experiments: The principles of experimentation Null hypothesis. Randomisation, Precision, Validity and randomisation. Statistical analysis. Variance. replication. The latin square- systematic square, higher squares, increase of precision by concomitant measurements, statistical control. Tne generalisation of null-hypothesis.

BOOKS ECOMMENDED:

1. Mathematical Methods in Chem:cal Engg.: By V.G.Jonson & G.V Jeffreys. Academic Press.
2 Methods in Chemistry & Chemical Engg . by V. Kaparov, Mir publisher.

8SCE5 PROJECT & SEMINAR

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AMRAVATI UNIVERSITY, AMRAVATI
ORDINANCE NO. 7 OF 2001.

Examinations leading to the Degree of (तांत्रिकी स्नातक रसायन अभियांत्रिकी) Bachelor of Technology (Chemical Engineering)(Four Year Degree Course...Semester Pattern) Ordinance, 2001.

Whereas, it is expedient to provide an Ordinance in respect of Examinations leading to the Degree of (तांत्रिकी स्नातक रसायन अभियांत्रिकी) Bachelor of Technology (Chemical Engineering)(Four Year Degree Course...Semester Pattern) for the purposes hereinafter appearing the Management Council is hereby please to make the following Ordinance.

1. This Ordinance may be called Ordinance in respect of Examinations leading to the Degree of (तांत्रिकी स्नातक रसायन अभियांत्रिकी) Bachelor of Technology (Chemical Engineering) (Four year Degree Course — Semester pattern) Ordinance, 2001.

2. This Ordinance shall come into force from the date of its approval by the Management Council.

3. Subject to the conditions prescribed by the Government from time to time, for admission to First B.Tech. (Chemical Engineering) course the candidate shall be considered eligible:

   Passing 12th Standard Examination of the new pattern means the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with subject:

   1. English (Higher or Lower)
   2. Modern Indian Language (Higher or Lower)
   3. Mathematics and Statistics.
   4. Chemistry
   5. Physics
   6. Any other optional subject from out of the list prescribed by the said Secondary and Higher Secondary Education Board.

   OR

   1. English (HIgher or Lower)
   2. Mathematics and Statistics.
   3. Chemistry
   4. Physics
   5. Vocational subject (Defined by the said Board as a Technical Subject)

   OR

   An Examination recognised by the Amravati University as an equivalent to the above.

4. Subject to the conditions prescribed by the Govt. from time to time for direct admission to the Second B.Tech. (Chemical Engineering) the candidate shall be considered eligible:

   Passing Diploma in respective branch in First Division, awarded by the Board of Technical Examination of Maharashtra State, Mumbai.

   OR

   Any Diploma equivalent to the corresponding Diploma of the Board of Technical Examinations of Maharashtra State, Mumbai.

5. The Degree of Bachelor of Technology (Chemical Engineering) shall be awarded to examinee who, in accordance with the provisions of this Ordinance, qualifies, himself/herself.

6. (i) There shall be Eight Semester Pattern Examinations leading to the Degree of Bachelor of Technology (Chemical Engineering) (First, Second, Third, Fourth, Fifth, Sixth, Seventh & Eight Semester B.Tech.)

   (ii) For the purposes of instructions and examinations, the student shall study sequentially.

7. The period of Academic Session shall be such as may be notified by the University.

8. The main examination of first, third, fifth and seventh semester B.Tech. shall be held by the University in winter & supplementary examination in summer every year. And main examination of second, fourth, sixth & eighth semester B.Tech. will be held in summer & the supplementary examination in winter every year.

9. The Internal Assessment marks for theory should be based on Class

Test and Attendance as follows :-

a) Class Test - 15 Marks will be based upon two Class Tests.

b) Attendance - Marks

75% to 80%	-	1
81% to 85%	-	2
86% to 90%	-	3
91% to 95%	-	4
96% to 100%	-	5

Where ever if internal assessment marks are 'ten (10)' then it should be converted out of "20".

10. Subject to his/her compliance with the provisions of this Ordinance and other Ordinance (pertaining to Examinations) in force from time to time, the applicant for admission, at the end of the course of study of a particular semester, to an Examination specified in Column (1) of the table below, shall be eligible to appear if,

(i) He/she satisfies the conditions in the table and the provisions thereunder.

(ii) he/she complies with the provisions of the Ordinance pertaining to the Examinations in general from time to time.

(iii) he/she has prosecuted a regular course of study in a College affiliated to the University.

(iv) he/she has, in the opinion of the Principal, shown satisfactory progress in his/her studies.

TABLE

Name of Exam	The student should have passed the Exam. of	The Student should have satisfactorily completed the following session/ semester	The student should have passed following examination.
First Semester B.Tech. (Chem.Engg.)	XII standard Examination or equivalent	.....	.....
Second Semester B.Tech. (Chem.Engg.)	.....	I Semester B.Tech. (Chem.Engg.)	.....
Third Semester B.Tech. (Chem.Engg.)	.....	II Semester B.Tech. (Chem.Engg.)	2/3rd heads of I & II Sem. combined together
Fourth Semester B.Tech. (Chem.Engg.)	.....	III Semester B.Tech. (Chem.Engg.)	- do -
Fifth Semester B.Tech. (Chem.Engg.)	I & II Sem. B.Tech. (Chem.Engg.)	IV Semester B.Tech. (Chem.Engg.)	2/3rd heads of III & IV Sem. combined together
Sixth Semester B.Tech. (Chem.Engg.)	- do -	V Semester B.Tech. (Chem.Engg.)	- do -
Seventh Semester B.Tech. (Chem.Engg.)	III & IV Sem. B.Tech. (Chem.Engg.)	VI Semester B.Tech. (Chem.Engg.)	2/3rd heads of V & VI Sem. combined together
Eight Semester B.Tech. (Chem.Engg.)	- do -	VII Semester B.Tech. (Chem.Engg.)	- do -

11. An Examination who has passed 2/3rd heads of passing shall be allowed to keep term in the next higher class.

Explanation :

i) While calculating 2/3rd heads of passing, fraction, if any, shall be ignored.

ii) For Considering the heads of passing, every theory and every practical, shall be considered as separate head of passing.

12. The schemes of Examinations shall be as prescribed by the Regulation.

13. The fees for each B.Tech.(Chem.Engg.) Examination (Theory & Practical) shall be as prescribed by University from time to time.

14. An examinee who is successful at any of the Ist, IInd, IIIrd, IVth, Vth, VIth, VIIth, and VIIIth Semesters B.Tech. (Chem.Engg.) Examinations under this Ordinance and who obtains 75% or more marks in that examination shall be placed in the First Division with distinction, those securing less than 75% but getting 60% or more shall be placed in the First Division and all other successful examinees shall be placed in the Second Division. However the division for the award of degree shall be based on VII and VIII Semester examinations marks taken together.

15. (i) The scope of the subjects shall be as indicated in the syllabi.

(ii) The medium of instruction and Examination shall be English.

16. The provision of the Ordinance No.7-A shall apply to the Examination under this Ordinance.

17. An examinee who does not pass; or who fails to present him/herself for the examination shall be eligible for readmission to the same examination/Semester, on payment of fresh fees and such other fees as may be prescribed.

18. A candidate who could not complete a semester satisfactorily or who has failed will be eligible for readmission to the same semester. However readmission to semester should be allowed only when a regular session is running for the particular semester.

19. As soon as possible after examinations, the Board of Examinations shall publish a result of the examinees. The result of all examination shall be classified as stated in para 14 & 15 above and the branchwise merit list shall be notified as per Ordinance No. 6.

20. Nothwithstanding anything to the contrary in this Ordinance no one shall be admitted to an examinations under this Ordinance,

if he/she has already passed the same examinations or an equivalent examinations of any statutory University.

21. (i) The examinees who have passed in all the subjects prescribed for all the examinations shall be eligible for award of the Degree of Bachelor of Technology (Chemical Engineering).

(ii) The degree in the prescribed form, shall be signed by the Vice-Chancellor.

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REGULATION NO. 5 OF 2001.

Examinations leading to the Degree of Bachelor of Technology (Chemical Engineering) (Four Year Degree Course....Semester Pattern) Regulation, 2001.

Whereas it is expedient to frame the Regulation in respect of Examinations leading to the Degree of Bachelor of Technology (Chemical Engineering) (Four Year Degree Course....Semester Pattern) for the purposes hereinafter appearing the Management Council is hereby pleased to make a following Regulation.

1. This regulation may be called “Examinations leading to the Degree of Bachelor of Technology (Chemical Engineering) (Four Year Degree Course....Semester Pattern) Regulation, 2001.

2. This Regulation shall come into force from the date of its approval by the Management Council.

3. The Schemes of Teachings and Examinations for Ist & IInd, IIIrd & IVth, Vth & VIth and VIIth & VIIIth Semester in respect of Bachelor of Technology (Chemical Engineering) (Four Year Degree Course....Semester Pattern) shall be as per Appendices-A, B, C, and D appended with this Regulation respectively.

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