DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD/SU/B.E./Syllabi/95/2014

It is hereby informed to all concerned that, the syllabus prepared by the Boards of Studies, Ad-hoc Board, Committees and recommended by the Faculty of Engineering and Technology, the Academic Council at its meeting held on 08-07-2014 has accepted the following "**Revised Syllabi for all Branches of [B.E.]**" as appended herewith :-

Sr.No.	Revised Syllabi
[1]	B.E. Civil Engineering,
[2]	B.E. Mechanical Engineering,
[3]	B.E. Electrical Engg. / EEP / EE/EEE.,
[4]	B.E. Computer Science & Engineering,
[5]	B.E. Information Technology,
[6]	B.E. ECT/EC/E&C/I.E,
[7]	B.E. Instrumentation & Control / Instrumentation,
[8]	B.E. Biotechnology,
[9]	B.E. Chemical Engineering.

This is effective from the Academic Year 2014-2015 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ SU/ B.E/
SYLLABI / 2014/
A.C.S.A. I.No.447[03].

Date:- 13-08-2014.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload the above all syllabi on University Website.**

Copy to :-

1] The Controller of Examinations,

2] The Superintendent, [Engineering Unit],

3] The Programmer [Computer Unit-1] Examinations,

4] The Programmer [Computer Unit-2] Examinations,

5] The Superintendent, [Eligibility Unit] ,

6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,

7] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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DR. BABASAHEB AMBEDKAR
MARATHWADA UNIVERSITY,
AURANGABAD.

Revised Syllabus of

B.E.

CHEMICAL ENGINEERING

[Effective from 2014-15 & onwards]

FACULTY OF ENGINEERING AND TECHNOLOGY

Proposed Revised Syllabus

Final Year of Engineering in Chemical

Sub no	Semester VII (Part I)	Contact Hrs/Week				Examination scheme					
	Subjects	L	T	P	Total	CT	TH	TW	P	Total	Duration of theory examination
CHE 401	Process Dynamics and Control	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 402	Process Equipment Design and Drawing-II	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 403	Transport Phenomena	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 404	Industrial Safety and Management	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 405	Elective I*	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 421	Process Dynamics and Control Lab	-	-	2	2	-	-	25	50	75	3 Hrs
CHE 422	Process Equipment Design and Drawing-II Lab	-	-	2	2	-	-	25	50	75	3 Hrs
CHE 423	In-plant Training seminar	-	-	-	-	-	-	50	-	50	-
CHE 424	Project Part -I	-	-	4	4	-	-	50	-	50	-
	Total (Part I)	**20**	**-**	**08**	**28**	**100**	**400**	**150**	**100**	**750**	**-**

Sub no	SEMESTER VIII (Part II)	Contact Hrs/Week				Examination scheme					
	Subjects	L	T	P	Total	CT	TH	TW	P	Total	Duration of theory examination
CHE 451	Process Modeling and Simulation	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 452	Advanced Separation Processes	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 453	Petrochemical Engineering	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 454	Elective II**	4	-	-	4	20	80	-	-	100	3 Hrs
CHE 471	Process Modeling and Simulation Lab	-	-	2	2	-	-	25	50	75	3 Hrs
CHE 472	Advanced Separation Processes	-	-	2	2	-	-	25	50	75	3 Hrs
CHE 473	Project Part 2	-	-	4	4	-	-	100	100	200	3 Hrs
	Total (Part II)	**16**	**-**	**08**	**24**	**80**	**320**	**150**	**200**	**750**	**-**

L: Lecture hours per week P: Practical hours per week CT: Class Test TH: University Theory Examination
TW: Term Work P: Practical/Oral Examination T: Tutorial hours per week

*** Elective Part I**

1. Biochemical Engineering
2. Industrial Piping
3. Energy Engineering

**** Elective Part II**

1. Food Technology
2. Polymer Technology
3. Computer Aided design and optimization

Dr. Shinde Ulhas B.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FORTH YEAR ENGINEERING
SEMESTER VII (Part-I)

CHE 401: Process Dynamics and Control

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objective:

1) To have knowledge of dynamic behavior of first, second and higher order systems,

2) To have proficiency of functioning of Feedback control system and its applications

3) To secure the knowledge of selecting the proper Controllers in Process Industries

Unit I: Control System:

Introduction to control system, parts of control systems, lags inherent in instruments and process. Mathematical Modeling of chemical process. State variables and state equations for a chemical process. The input out put model, Linearization of non-linear systems, solution of linear differential equation using laplace transform. Feedback and feed forward control. Block diagram and development of block diagram. (06 Hrs)

Unit II: Dynamic behavior of first order system;

First order system and their transfer functions. Dynamic behavior of first order system, pure capacitive process, first order system with variable time constant and gains. Response of first order system in series; Interacting and non-interacting systems. Derivation of transport equations. (06 Hrs)

Unit III: Dynamic behavior of second order system :

Second order system and their transfer functions. Under damped and over damped and critically damped systems, transportation lag. Dynamic behavior of higher order system. Derivation of transport equations (06 Hrs).

Unit IV: Feedback control :

Introduction to feed back control, controllers and final control elements. Dynamic behavior of feed back control processes. Closed loop transfer function Control action, block diagram and application of control system for chemical reactors, distillation column, adsorption column , heat exchange equipment like DPHE, S&THE and evaporator. (08 Hrs).

Unit V: Controllers:

Proportionate, Proportionate Derivative, Proportionate Integral, and Proportionate Integral Derivative. Design of feedback controller: Performance criteria, selection of type of controller. Tuning of feedback controller. Stability analysis by Routh criteria and Root locus analysis. (08 Hrs)

Unit VI: Frequency response:

Frequency response analysis of linear processes; Bode's diagram, Nyquist plot. Design of feed back control system using frequency response techniques, Bode's stability diagram, criteria, gain and phase margin. Ziegler – Nichols technique. Nyquest stability criteria. Advance control strategies; Cascade control, feed forward control, ratio control, selective control, split range control, adaptive and inferential control. Introduction to analogue, digital computer and DCS. (08 Hrs)

Reference Books:

1. Chemical process control: An Introduction to theory and practice, George Stephanopoulous, Prentice-Hall of India.
2. Process System Analysis and Control, D. R. Coughnour,et al McGraw Hill Publication.
3. Process control, Peter Harriot, Tata McGraw Hill Publication.
4. Principle of Industrial Instrumention , D. Patranabis, Tata McGraw Hill Publication.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part: Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 402: Process Equipment Design and Drawing-II

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) Understand principle of equipment design.
2) Understanding of design of equipment for different process.
3) Knowing how to improve performance of given equipment

UNIT-I

Assembly drawing of chemical equipment with accessories. DPHE, S&THE, Evaporators, jacketted vessels, vessels with externals and internal coils.

UNIT-II

Mechanical design and drawing of chemical processes equipment like DPHE, S&THE, Evaporators, Crystallizer ,Distillation columns, Dryers, other mass transfer equipment , use of B.I.S.(I.S) Codes expected.

UNIT-III

Piping design and layout: Pipe sizing for gases and liquid , piping for high temperature, piping layout and its factors under consideration, design of buried pipeline and overhead pipeline.

Books Recommended:

1. Unfired pressure vessel code IS-2825,IS-4503 and TEMA standards hand book by Perry's
2. Machine Design by Mahadevan etal,
3. Process Equipment Design By Brownwell and Young
4. Pressure Heat Transfer By D.Q. Kern
5. Process Equipment Design By Dr .S.D. Dawande

Section A: Unit 1, 2
Section B: Unit 2, 3

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

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CHE 403: Transport Phenomena

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objective:

1) Understand physics and mathematics of momentum, heat and mass transfer in chemical engineering process.
2) Formulate and model the process of momentum, heat and mass transfer on a microscopic and macroscopic level considering a control volume in a medium.
3) Study steady state and unsteady state phenomena in momentum, heat and mass transfer.

Unit 1:

Viscosity & the mechanisms of momentum transport: Introduction of viscosity and mechanism of momentum transport. Newton's law of viscosity. Newtonian & non-Newtonian fluids. Pressure & temperature dependency of viscosity. Molecular theory of viscosity of gases & of liquids. (6 Hrs)

Unit 2:

Shell momentum balances and velocity distributions: Shell momentum balances & boundary conditions, flow of a falling film, flow through a circular tube and an annulus, flow of two adjacent immiscible fluids, creeping flow around a sphere. The equations of change for isothermal systems: The equation of (i) continuity, (ii) motion, (8 Hrs)

Unit 3:

Thermal conductivity and mechanism of energy transport: Fourier's law. Temperature & pressure dependence of heat conductivity. Thermal conductivity of – gases, liquids & solids. Effective thermal conductivity of composite solids. Convective transport of energy. (6 Hrs)

Unit 4:

Shell energy balances and temperature distributions in solids & laminar flow: Shell energy balances – boundary conditions. Heat conduction with heat sources like, electrical, nuclear, viscous, and chemical. Heat conduction through a composite wall, in a cooling fin. Analogy of interphase transport with momentum transport. (8 Hrs)

Unit 5:

Diffusivity and the mechanism of mass transport: Definitions of concentrations, velocities, mass flow. Fick's law. Temperature & pressure dependence of diffusivities. Diffusion in gases at low density, in binary liquids, & in colloidal suspensions. Mass & molar transport by convection. The Maxwell – Stefan equations. (6 Hrs)

Unit 6:

Concentration distribution in solids & in laminar flow: Shell mass balances. Boundary conditions, diffusion through a stagnant film, with a homogenous and a heterogeneous chemical reaction. Diffusion into a falling liquid film – gas absorption & solid distribution (diffusion & chemical reaction inside a porous catalyst). Analogy of interphase transport with momentum and energy transport. (6 Hrs)

Reference Books:

1. Transport Phenomena, R.B. Bird, W.E. Stewart, E.N. Lightfoot, John Wiley & Sons Inc.

2. Analysis of Transport Phenomena, W.M. Deen, Oxford University Press.

3. Momentum, Heat and Mass Transport, C.O. Benett, J.E. Mayers, McGraw Hill Publication.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

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CHE 404: Industrial Safety and Management

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objective:

1) To understand the importance of safety in an industry.
2) To able to work and make the surrounding safe and environmental friendly.
3) To understand the fundamentals of behavioral science applied in an industry
4) To understand process management through decisions on designing, rearranging and improvement.

Unit 1:

Safety and law :Principles & practices. need for safety, definitions. Types of accidents & damages. Role of safety considerations in chemical plant design & operations. The Factories Act 1948 & Factories Rule 1963. safety related provisions. ESI & Workmen Compensation Act and rules. Indian Boiler Act & regulations. Gas Cylinder Rules, SMPV Rules. MSIHC Rules. Citizen safety . (06 Hrs)

Unit 2:

Minimization of hazards. Personal Protective Equipment (PPE). Need for PPE, selection, standard, supply, use, care & maintenance of respiratory & non respiratory PPE. Fires and explosion. The fire triangle. Distinction between fire & explosion, factors contributing to fire & explosion. Concept of ignition, ignition energy, auto ignition, fire point and flammability limits etc. explosions – various types & conditions for their occurrence. (08 Hrs)

Unit 3:

Hazards identification. Process hazards checklists, hazards survey. Hazards and Operability Studies (HAZOP), HAZAN, Safety reviews etc. Risk assessment. Review of probability theory, revealed & unrevealed failure, probability of coincidence, event trees & fault trees. (06 Hrs)

Unit 4 :

Introduction to industrial management. Definition, concepts, objectives, procedure and methods of job evaluation and merit rating. Motivation and Behavior – Hawthorne's studies and its findings, Maslow theory, X and Y theory, Immaturity theory. Motivation Hygiene theory, Pretence of needs and satisfaction of needs, Goal oriented behavior, Integration of organizational goals and needs of employee. (8 Hrs)

Unit 5 :

Management and Behavioral Approach – Contribution of Elton Mayo and Skinner to behavior sciences. Skills of a manager at various levels in an organization and inter-related systems, understanding past behavior, predicting future behavior, directing, changing and controlling behavior. (6 Hrs)

Unit 6

Process Management - Definition of process management. Major process decisions – process choice, vertical integration, resource flexibility, customer involvement, capital intensity, relationship between decisions, service operation. Designing processes, rearranging and process improvement. (6 Hrs)

Reference Books:

1. Loss Prevention in Process Industries, Vol. 1 & 2, F. Lees, Butterworth.
2. Chemical Hazards and Safety, Dr. S.D. Dawande, Denett & Co.
3. Chem Tech – I, D. Venkateshwarlu, S.Chand & Co Ltd.
4. Factories Act 1948.
5. Handbook of Fire Technology, R.S. Gupta, Orient Longman.
6. Chemical Process Safety Fundamentals with Applications, D.Y. Crowl, J.F. Louvar, Prentice Hall .
7. Industrial Safety/Safety Management, K.G. Mistry
8. Industrial Hazards & Safety Handbook, R.W. King, J. Magid, Butterworth.
9. Explosion Hazards and Evaluation, W.E. Baker, Elsevier, Amsterdam.
10. Workman Compensation Act 1923.
11. Principles of Management, Koontz O'Donnel, McGraw Hill.
12. Essentials of Management, Koontz Weirich (7th Edi.), Tata McGraw Hill.
13. Management of Organisational Behavior, P. Hersey and H. Kenneth, Prentice Hall of India Pvt. Ltd.
14. Operations Management – Strategy and Analysis, L.J. Krajewski and L.P. Ritzman (5th Edi.), Addison Wiley.
15. Organizational Behavior, S.P. Robbins (9th Edi.), Pearson Education Publications.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

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4) 10 marks question will be compulsory

CHE 403: Elective-I (Biochemical Engineering)

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objective:

1) To develop understanding of Kinetics of Enzyme Catalyzed Reactions.
2) To have an understanding Immobilized Enzyme Technology.
3) Student will have proficiency to Design and Analysis of Biological Reactors

Unit 1:

Introduction to Biochemical Engineering: structure of cells Prokaryotic & Eukaryotic, types of RNA and DNA, Amino acids as building block for proteins, classification of amino acids, structural types of protein. (06Hrs)

Unit 2:

Enzyme Catalysis and Kinetics: Examples of enzyme Catalyzed Reactions. The enzyme substrate complex and enzyme action, Michaelis Menten Kinetics, simple enzyme kinetics with one and two substrates modification e.g. Lineweaver burk plot, Edie Hoffstie equation/plot, determination of elementary step rate constants, substrate activation and substrate & Enzyme inhibition, multiple substrate modulation reactions, modulation and regulation of enzyme activity; feedback, consorted, product inhibition, effect of temperature and pH on enzyme activity, enzyme deactivation. (10Hrs)

Unit 3:

Enzyme purification and Enzyme Immobilization: Means and Various principles of enzyme purification such as precipitation, chromatography, electrophoresis.

Enzyme immobilization : purpose and methods of enzyme immobilization, immobilization of enzymes for industrial process, kinetics of immobilized enzyme. Formulation, applications & characterization of immobilized cell biocatalysts (10Hrs)

Unit 4:

Ideal Reactors for Kinetic Measurements, ideal batch reactor, ideal continuous flow stirred tank reactor, Monod growth kinetics, Growth cycle phase for batch cultivation. (04Hrs)

Unit 5:

Design and Analysis of Biological Reactors: Fermentor design and functioning, batch reactors, enzyme catalyzed reactions in CSTR, CSTR reactors with recycle and wall growth, the ideal plug flow tubular reactor. Sterilization of reactors (04Hrs)

Unit 6:

Fermentation Technology: Medium formulation/ & Optimization, alternate bioreactor configurations, and product recovery trends, examples of fermentation, commercial enzymes- Amylase, antibiotics; penicillin & streptomycin, Organic acid –Citric Acid, single cell protein (SCP) in fermentation industries. (06Hrs)

Reference Books:

1. Biochemical Engineering Fundamentals, J. F. Bailey and D. F. Ollis, McGraw-Hill Bk Co.
2. Biochemical Engineering. Shuichi Aiba, E.H.Arthur & F.M.Nancy, University of Tokyo Press.
3. Principles of Fermentation Technology P.F.Stnbury, A. Whitakar & S. J. Hall, Aditya books(P)Ltd, New Delhi.
4. Enzymes by Trevor Palmer
5. The Nature of Enzymology by R. L. Foster

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

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2) Five questions in each section.
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4) 10 marks question will be compulsory

CHE 405: Elective-I (Industrial Piping)

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objective:

1) To acquire the knowledge of selecting the proper fitting material, Joint and Valves.
2) Students will able to learn requirements related to materials Insulation for piping systems
3) A read, understand, and use std. symbols notations used in process industry

Unit 1:

Importance of piping in chemical industry, Pipes & Tubing, Classification of pipes, Pipe codes and specification. Pipe sizing, Schedule numbers, BWG, NPS. Desirable properties of piping materials, materials for low, normal & high temperature services, materials for corrosion resistance. Basic energy equation for flow, calculation of frictional losses, pressure drop for Newtonian & Non-Newtonian fluids. Calculation of pipe diameter, thickness, equivalent lengths, etc. single liquid lines, single gas & vapor lines, NPSH. (08Hrs)

Unit 2:

Pipe fittings their advantages & disadvantages. Criteria for selection of pipe joints, pipe joints for similar and dissimilar material, valves expansion effects and methods for reducing them. Safety valves & other pressure relieving devices. Calculation of frictional losses, pressure drop for Newtonian & Non-Newtonian fluids. (06 Hrs)

Unit 3:

Piping layout piping diagrams, standard symbols & notations, types & design of pipe support, erection and maintenance of supporting, restraining and bracing systems. Fundamental considerations in pipe vibrations, types of vibrations, their prevention and control. Protection of pipe system such as cathode protection, painting, etc. (06 Hrs)

Unit 4:

Pipeline design on fluid dynamics. Complex pipelines in series and parallel. Pipeline storage capacity. Piping design for two phase flow, dispersed flow. Slurry pipeline – design parameters, slurry rheology for homogeneous & heterogeneous slurries. Piping & components as gas expands – isothermal flow, adiabatic flow. (08 Hrs)

Unit 5:

Design of pipeline for transportation of crude oil & for natural gas. Design of pipes in sea water. Empirical correlations for flow of oil, gasoline, hydrocarbons. Piping for cryogenic materials. Piping arrangements and factors considered in heat exchanger piping, reactor piping, process & storage vessel piping, reboiler piping, piping for compressor & pumps, utility piping.(08 Hrs)

Unit 6:

Insulation for piping systems. Purpose of insulation. Insulation materials, their selection criteria, their important properties. Principles of heat transfer to the extent of application to heat loss/gain through bare pipe surfaces. Critical thickness of insulation, estimating thickness of insulation, optimum thickness of insulation. (06 Hrs)

Reference Books:

1. Piping Design for process plants by H. F. Rase, John Wiley.
2. Process piping systems, ed" D. J.Deutsch, Chemical Engineering Magazine, McGraw Hill.
3. Industrial Piping by Littleton C.T., McGraw Hill.
4. Process Design of Equipments, Dr. S.D. Dawande, Central Techno Publications.
5. Handbook of Piping Design, G.K. Sahu, New Age International Publisher.
6. Process Piping Design Vol. 1 and 2, R. Weaver, Gulf Publishing.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

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2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 405: Elective-I (Energy Engineering)

Teaching Scheme

Theory: 04 hours/week

Examination Duration: 03 hours

Examination Scheme

Class Test: 20 Marks

Theory Examination: 80 Marks

Objectives:-

1. To understand Energy resources of India and its current status
2. To understand the different forms of energy and its utilization.
3. To understand the Analysis of energy recovery systems.

Unit 1 :

Energy resources of India and its current status. Conventional Vs Non-Conventional (Renewable) energy sources. Availability and utilization of energy resources, viz firewood, coal, petroleum, gaseous fuels, hydel, nuclear fuel, solar etc. Concept of energy conversion. Energy conservation act of India (2001). Co-generation concept and scope. Strategy for energy development in India, problems and prospects of centralized and decentralized patterns. Environmental effects of energy use. Thermodynamic concepts : Energy efficiency indices. Bureau (06 Hrs)

Unit 2 :

Solar energy storage and utilization. Thermodynamic and heat transfer aspect of solar energy collection. Solar collectors & concentrators their heat transfer analysis and performance. Solar devices like water heaters, stills, dryers, stills, photo-voltaic cells, etc.

Wind energy & its historical importance. Wind energy for water pumping. Scope of wind power generation in India. Design of wind machines. (08 Hrs)

Unit 3 :

Biomass utilization & conversion. Scope of biogas as a large scale energy source. Socio- economic importance of biogas production & utilization. Principles of biogas production, biological mechanism, effect of temperature, gas composition, product purification. Storage and use if biogas. Residue composition & utilization. Design & construction of biogas plants. (04 Hrs)

Tidal & wave energy its scope. Tidal phenomenon & generation of power from the ocean. (02 Hrs)

Basics of Geothermal energy, Nuclear energy. Hydrogen power, Biodiesel, and other renewable sources of energy. (02 Hrs)

Unit 4 :

Analysis of energy recovery systems. Study of energy recovery systems like recuperator, regenerator, thermal wheels, heat pipes, heat pumps, heat exchangers, waste heat boilers, absorbers, coolers, etc.

Co-generation of energy. Advantages of co-generation. Different types of co-generation power plants. Co-generation in typical chemical industries like sugar, pulp & paper, etc. (06)

Unit 5 :

Efficient steam generation, fluidized bed boilers. Efficient use of steam condensate, steam & gas co-generation. Heat exchanger network synthesis. Process heat recovery. Energy performance assessment of heat exchanger, water pumps, etc. Energy conservation in energy intensive chemical & process industries like pulp & paper, sugar, cement, fertilizer, etc. (08 Hrs)

Unit 6 :

Introduction to energy audit. Definition, need, types of energy audit. Methodology & steps taken, energy performance. Matching energy use to requirement, target setting, reduction in losses, improvements in operations. Optimizing the input energy requirement. Energy efficient process technologies. Investments for resources development cost and efficiencies. Concept of comprehensive energy conservation and planning. (08 Hrs)

Reference Books :

1. Energy Conservation Handbook, P.L. Diwakar Rao, Utility Publications Ltd.
2. Energy Technology Handbook, C. Douglas, McGraw Hill Publication.
3. Solar Energy, S.P Sukhatme, Tata McGraw Hill Publication.
4. Wind energy Conservation Systems, L.L. Freris, Prentice Hall publication.
5. Wind Power, D M Simmons, Noyes Data Corporation
6. Solar Energy, Principles of Thermal Collection and Storage, S P Sukhatme, Tata McGraw Hill 7. Nuclear Power, J J Duderstadt
8.Water Power Plants, E Mosinye,

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

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For 80 Marks papers:

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6) Five questions in each section.
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8) 10 marks question will be compulsory

CHE421: Lab-I: Process Dynamics and Control

Practical: 2Hrs/week

Examination Scheme
Practical/Oral: 50 Marks
Term Work: 25 Marks

List of Experiments: (Any eight of the following)

1) To study the dynamics of thermocouple / thermometer and to determine its tune constant with and without a thermo well (first order system).
2) Dynamics of manometer (Second order system).
3) To study the dynamic of liquid level system with two tanks in series without interaction.
4) To study the dynamics of liquid level system with two tanks in series with interaction.
5) To study the dynamics of thermal system.
6) To study the dynamics of pneumatic system.
7) To study the characteristics of a pneumatic controller with proportional, PD, PID controls actions.
8) To study the dynamics of liquid level system with proportional controller.

CHE422: Lab-II: Process Equipment Design and Drawing-II

Practical: 2Hrs/week

Examination Scheme
Practical/Oral: 50 Marks
Term Work: 25 Marks

List of Experiments: (Any five of the following)

1) Design and drawing of shell and tube Heat exchanger
2) Design and drawing of double pipe Heat exchanger
3) Design and drawing of Evaporator
4) Design and drawing of reaction vessel.
5) Design and drawing pressure vessel (High pressure and high temperature)
6) Design and drawing jacketed vessel
7) Design and drawing packed column
8) Design and drawing tray column.

CHE 423: In-plant Training Seminar

Practical: --

Examination Scheme
Practical/Oral: ---
Term Work: 50 marks

The students are required to submit a typed report and present a seminar on the industrial in-plant training (duration 4 to 6 weeks), they have undertaken at the end of 2nd semester of third year in the presence of students and staff members. The term work will be assessed by two university approved internal examiners appointed by the Principal of the college.

CHE 424: Project Part – I.

Practical: 04 Hrs/week

Examination Scheme
Practical/Oral: —
Term Work: 50 marks

The project work is training in chemical engineering practice. The knowledge gained by studying various subjects separately is utilized for a single task. The project trains to co-ordinate the knowledge of chemical engineering principles assimilated over the period of course study and about forty subjects. This is an exercise in literature survey, report writing and team work. The project report reflects on the devotion of students towards work and single mindedness of approach.

A group of 2-3 students will have to work on a topic assigned to them. The topic could be on Plant Design, Design of specific equipment, Process Development etc related to chemical engineering. One staff member will supervise the work of the students. The project work may involve experimental/ theoretical/computational work.

A preliminary report is to be submitted containing the details of literature survey, data collected, outlines of design and drawing, equipments, fabrication, cost estimation & project feasibility.

The term work will be assessed by two internal examiners appointed by the Principal of the college and approved by the university, one of whom will be his guide & the other a staff member of the concerned branch.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
FACULTY OF ENGINEERING AND TECHNOLOGY
FORTH YEAR ENGINEERING
SEMESTER VIII (Part-II)

CHE 451: Process Modeling and Simulation

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) Understand chemical process simulation.
2) Develop skills in advanced mathematics with respect to chemical engineering.
3) Solve chemical engineering problems through developing a mathematical model of the process or equipment

Unit 1:

Introduction to Modeling & Simulation, Definitions, different types of models, applications of modeling, scope of coverage. Approaches to simulation, design problems Vs simulation problems, information flow diagram in modeling, CAD package in Chemical Engg – Thermodynamic & physical properties package, module library, numerical routines library, costing, etc. (04Hrs)

Unit 2:

Mathematical Models their classification (deterministic Vs stochastic, linear Vs nonlinear, lumped Vs distributed parameter, dynamic Vs steady state etc with examples): Model building and procedure for steady state & unsteady state models in mass transfer operations, heat transfer operations, fluid flow operations, reaction engineering. (06Hrs)

Unit 3:

Fundamental laws and their applications – Equation of continuity, equation of motion, equation of energy, equation of state, equation of transport, phase & chemical equilibrium, chemical kinetics, etc. (04Hrs)
Solutions to systems of non-linear algebraic equations, Newton's & successive substitution, Euler & Runge-Kutta method, Models of difference. Applications in chemical engg operations. (06Hrs)

Unit 4:

Modeling and simulation of heat transfer & other equipments like DPHE, S&THE, evaporators, agitated vessels, mixing processes, fluid-solid operations, pressure change equipments etc. (06Hrs)

Unit 5 :

Modeling and simulation of mass transfer equipments used in flash distillation, continuous binary distillation, tray & packed column, vaporizers, single & multi phase separation, drying, adsorption, absorption & stripping. (08Hrs)

Unit 6 :

Modeling and simulation of reaction equipments like batch reactor, mixed flow reactor, plug flow ,reactor, trickle bed reactor, bubble column reactor, packed column reactor, fluid bed reactor, bioreactor, etc. (06Hrs)

Introduction.to commercially available simulation package. Hysis, Hysis-Aspen, Simulink, Simusolve ect.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 452: Advanced Separation Processes

Teaching Scheme
Theory: 04 hours/week
Examination Duration: 03 hours

Examination Scheme
Class Test: 20 Marks
Theory Examination: 80 Marks

Objective:

1) Understand advanced chemical process phenomena.
2) Develop skills in advanced separation techniques with respect to chemical engineering.
3) Solve advanced chemical engineering separation problems.

Unit 1:

Characteristics of separation processes. General principles involved. Temperature swing adsorption (TSA), pressure swing adsorption (PSA). Liquid chromatography process – basic concepts, phenomena and their characterization. Chromatography options, separation systems. Characteristics of solids and their selection for various applications. Column design & filling. Applications of chromatography. (08 Hrs)

Unit 2 :

Membrane separation processes. Principle, classification, types of membranes, their characteristic and properties. Concentration polarization and fouling. Membrane transport models. Membrane processes like reverse osmosis, ultra-filtration, micro-filtration, dialysis, electro-dialysis etc. Applications of membrane processes. (08 Hrs)

Unit 3 :

Reactive separations. Separation based on reversible chemical complex formation. Ion exchange. Reactive distillation, reactive extraction, reactive crystallization. (06 Hrs)

Unit 4 :

Bubble and foam separation. Foam formation, collapse and drainage. Adsorption properties of foams, modes of operation of foam. Equipments for foam separation. Principle of froth floatation, properties of foam related to floatation operation. Design and development of floatation equipment. Applications of foam separation process. (08 Hrs)

Unit 5 :

Zone electrophoresis. Zone refining. Molecular sieves. Adductive crystallization. Applications of these processes. (06 Hrs)

Unit 6 :

Ultra centrifugation. Electric field and magnetic field separations. Recoil methods. Exchange reactions. Nanotechnology for separations. Applications of these processes. (06 Hrs)

Reference Books :

1. Separation Processes, C.J. King, Tata –McGraw Hill Publishing Co.
2. Separation Techniques for Chemical Engineers, Schweitzer, McGraw Hill Publishing Co.
3. Reverse Osmosis, S. Souri Rajan, Logos Press Ltd.
4. Membrane Hand Book, K. Sirkar, H.O. Winston, Van Nostrand Reinhold.
5. Separation Methods, M.N. Sasteri, Himalaya Publishing House.
6. Mass Transfer Operations, R.E.Treybal, McGraw Hill Publishing Co.
7. Chemical Engineers Hand Book, R.H. Perry, C.H. Chilton, McGraw Hill Publishing Co.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 453: Petrochemical Engineering

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) To impart the knowledge of reserves and deposits of petroleum products worldwide.
2) To provide students characteristics of various crudes available worldwide.
3) To provide students knowledge of basic raw materials for petrochemical synthesis

Unit 1:

Origin, formation, and composition of petroleum & natural gas. Reserves & deposits of the world and in India. Types of crude & Indian crude types. Introduction to petrochemicals & petrochemical industry in India. Basic raw material for petrochemical synthesis and their sources. Preparation of feedstock for petrochemical production, main building blocks of petrochemical industry. (06 Hrs)

Unit 2:

Characteristics of petrochemical manufacture & techniques involved. Naphtha cracking, alkylation's, isomerisation and polymerization to produce petrochemicals. Petrochemicals and their applications. Classification of petrochemicals according to source : Ethylene derivatives, Propylene derivatives, Derivatives of C4 hydrocarbons, Derivatives of higher paraffin's, Polymers of Olefins & Plastics, Petroleum aromatics. Economic aspects of petrochemical industry in India. (06 Hrs)

Unit 3:

Chemicals from methanol & synthesis gas like formaldehyde, carbon-di-sulfide, hydrogen cyanide, etc. Chemicals from ethane, ethylene& acetylene like synthetic ethanol, glycols, acids, acetates,ketones, amines, etc. Chemicals from propane & propylene like isopropanol, acetone, glycerol, glycols, etc. Chemicals from butanes, pentanes like butadiene, butanol amines, butyl acetate, methyl ethyl ketone, etc. (08 Hrs)

Unit 4:

Chemicals from aromatics like mono-chloro & di-chloro benzene, BHC, nitrobenzene, nitrotoulene, pthalic anhydride, terepthalic acid & dimethyl teraphthalate, adipic acid, hexamethylene diamine, maleic anhydride, etc. (08 Hrs)

Unit 5:

Polymers : Different types of polymerization techniques like bulk, emulsion, suspension, engineering and special types of polymers etc. At l east two different types of polymeric products & their manufacture from each of the different types of polymerization techniques. (06 Hrs)

Unit 6:

Future of petrochemicals. Natural gas as a petrochemical feed stock, Integrated petrochemical complex, with power generation, pollution control – norms and methods of elimination, brief description on safety considerations. Energy crisisand petrochemical industry. Trends in petrochemical industry. (06 Hrs)

Reference Books :

1. Petroleum Refining Engineering, W. L. Nelson, McGraw Hill Book Co.
2. Petroleum Refining and Petrochemicals, N.K. Sinha, Umesh Publications, Delhi.
3. The Petroleum Chemicals Industry, R. F. Goldstein. (E & FN London, 1967).
4. Chemical Technology of Petroleum, W. S. Gruseand Dr. Stevens, McGraw Hill, 1960.
5. Chemicals From Petroleum, A. I. Waddams, Chemical Publishing Co.
6. Petroleum Processing Hand Book, W. F. Bland and R. L. Davidson.
7. Petroleum Processing Part-2, A. Chauvee and G.Lefebure, Gulf Publishing Company, 1986.
8. Modern Petroleum Refining Processes, B. K. Bhaskara Rao, Khanna Publishers, N. Delhi.
9. A Text on Petrochemicals, B. K. Bhaskara Rao,Khanna Publishers, New Delhi.
10. Dryden's Outlines of Chemical Technology, M. Gopal Rao, M. Sittig, East-West Press Pvt.Ltd.
11. Shreve's chemical Process Industries, G.T. Austin, McGraw Hill Bok Co

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 454: Elective- II (Food Technology)

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) To understand recent technologies in processing of food.
2) To learn different preservation techniques and its applications.
3) To develop understanding of various unit operations used in in food industry

Unit 1 :

Introduction & general aspects of food industry, World food needs and Indian situation: Current status of various food products like food grains, cereals, dairy, edible oil, fruits, vegetables and beverages. Current status of the Indian agriculture, food and food processing industry. Market opportunities for the Indian processed food industry. Food constituents, quality and deteriorative factors. Constituents of foods, quality and nutritive aspects, food additives; standards, deteriorative factors and their Control. Physical, chemical, biological, nutritional, sensory characteristics of food. (08 Hrs)

Unit 2 :

Post harvesting operations and storage. Storage of solid foods. Cleaning (wet & dry), sorting by shape, size, color, weight, grading and peeling. Equipment for storage of solid foods. Controlled atmospheric storage of food grains, vegetables and fruits. (06 Hrs)

Unit 3 :

Processing of food products/grains like cereal grains, pulses, vegetables, fruits, spices, fats & oils, bakery, confectionary, & chocolate products. Theory of size reduction equipments & effect of size reduction on foods. Evaporation, extrusion, hot air dehydration, baking, roasting and hot oil frying. Theory, equipments, applications and effects on food materials for freezing, freeze drying and freeze concentration. (08 Hrs)

Unit 4 :

Processing of fruits for manufacture of jams, jellies, pickles, squashes, etc. Processing of soft & alcoholic beverages, dairy products, meat, poultry and fish products. Preservatives used in food processing. (06 Hrs)

Unit 5 :

Food Preservation methods. Conversion and preservation operations. Preservation by heat and cold, dehydration, concentration, frying, irradiation, microwave heating, sterilization & pasteurization, fermentation & pickling. (06 Hrs)

Unit 6 :

Post processing operations. Coating & enrobing operations, equipments and applications. Packing methods. Theory of food packaging, types of packing materials. Packaging operations, filing & sealing of rigid and semi-rigid containers. Materials for handling food items. Pollution and it's control in food industries. (06 Hrs)

Reference Books:

1. Fundamentals of Food Processing Operations, J. L. Hied and M. A. Joslyn. AVI Publishing Co.
2. Food Science, N.N. Potter, J.H. Hotchkiss, CBS Publishers & Distributors, N. Delhi.
3. Food Processing Engineering, D R. Heldman, AVI Publishing Co.
4. The Fundamentals of Food Engineering, S. E. Charm, AVI Publishing Co.
5. K. Sharma, et al, Food Process Engineering, Theory and Laboratory Experiments, John Wiley & Sons.
6. G. Subbulaxmi & S.A Udipi, food Processing & Preservation, New Age International Pvt.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 454: Elective- II (Polymer Technology)

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) To understand the basic concept of polymer chemistry and mechanism.
2) To understand the properties of the polymerization.
3) To understand the processing of the polymerization.

Unit 1:

Introduction to polymers. Basic concepts of polymer chemistry and mechanism of polymer formation. Classification of polymers. Functionality, chemical bonding in polymers, types of polymerization, structure of polymers. Linear, branch, and cross linked polymers. Thermosets & thermoplastics. Stereoisomerisms. (06 Hrs)

Unit 2:

Properties of Polymers, molecular weight, weight average, number average, etc. Polydispersity index, methods of determination. Factors influencing polymer properties. Effect of molecular weight on engineering properties of polymers. Crystallinity in polymers, transition in polymers, rheology in polymers, analysis & testing of polymers, polymer solubility parameter, polymer degradation. (08 Hrs)

Unit 3:

Mechanism of polymerization. Addition & condensation. Free radical . Homogenous. Ionic and coordination. Copolymerisation. Bulk, Solution, Suspension, Emulsion, Interfacial types of polymerization their design criteria & comparison. (06 Hrs)

Unit 4:

Kinetics of free radical polymerization. Chain transfer agents. Kinetics of step growth polymerization. Kinetics of copolymersation & coordination polymerization. Polymer reactions. (06 Hrs)

Unit 5:

Processing of polymers. Different molding methods - Injection molding, Blow molding, Compression molding, Extrusion molding, Slush molding. Casting, Spinning, Coating and Compounding. (08 Hrs)

Unit 6:

Brief description of individual polymers, their manufacture & production processes. Polyethylene, Polypropylene, Vinyls, Nylons, ABC polymers, Acrylics and Fluoro carbon polymers, Polyethers, Polyamides, Aldehydes. Condensation polymers, Polymers based on isocyanate reactions and Silicones. Thermoset polymers. (08 Hrs)

Reference Books:

1. Text Book of Polymer Science, F.W. Billmeyer Jr, John Wiley & Sons.

2. Principles of Polymer System, F. Rodrigues, Tata McGraw Hill Publishing Co. Ltd.

3. Fundamental Principles of Polymers Materials, S.L. Rosen, Wiley Interscience Publications.

4. Polymer Science, V.R. Gowarikar, N.V. Visvanathan, J. Sridhar New Age International (P) Ltd.

5. Introduction to Polymer Science and Technology, Dr. S.D. Dawande, Denett & Co.

6. Polymer Science & Technology, J.R. Fried, Prentice Hall of India.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE 454: Elective- II (Computer Aided Design and Optimization)

Teaching Scheme	Examination Scheme
Theory: 04 hours/week	Class Test: 20 Marks
Examination Duration: 03 hours	Theory Examination: 80 Marks

Objective:

1) To understand the computer aided design of the chemical process units.
2) To understand the basic concept of the process parameter optimization.
3) Find out the best suitable operating condition.

Unit 1:

Introduction and basics of computer aided design (CAD). Physical properties of compounds. Thermodynamic properties of gases and binary mixtures. Viscosity, vapor pressure, latent heat, bubble point and dew point calculations. Phase equilibria, vapor liquid equilibria. (6Hrs)

Unit 2:

Computer aided design of reactors, evaporators, absorption columns, distillation columns, heat exchangers, furnaces and other chemical engineering equipments. (6 hrs)

Unit 3:

Process flow sheet simulation. Process and information matrix. Recycle calculation sequence. Material and energy balance computation using modular approach. Process analysis. Process variables their selection. Equipment selection. (8Hrs)

Unit 4

The nature and organization of optimization problems; formulation of objective functions. (6Hrs)

Unit 5

Basic concepts of optimization; optimization of unconstrained and constrained functions; single and multivariable optimization; linear programming and applications. (6Hrs)

Unit 6

Optimization of staged and discrete processes: -

Dynamic programming. Applications of optimizations in areas like heat transfer, separation processes, fluid flow systems, Reactor design and operation (8Hrs).

Reference Books:

1. Computer Aided Design and Manufacturing, M.P. Groover, E.W. Timmers, Prentice Hall of India Ltd.
2. Material and Energy Balance Computations, E.J. Henley, F.M. Rusen, John Wiley.
3. Fundamentals and Modeling of Separation Processes, C.D. Holland, Prentice Hall.
4. Design of Equilibrium Stage Processes, B.D. Smith, McGraw Hill Book Co.
5. Process Flow Sheeting, A.W Wester Berg, Cambridge University Press.
6. Chemical Process Simulation, A. Chussain, Wiley Eastern.\
7. Optimization theory and practice, G. S. G. Beveridge and R. S. Schechter, McGraw Hill, 1970.

Section A: Unit 1, 2, 3
Section B: Unit 4, 5, 6

PATTERN OF QUESTION PAPER

Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question paper shall be set having two sections A and B, as per weight age of units. Section A question shall be set on first part and section B on second part. Question paper should cover entire syllabus.

For 80 Marks papers:

1) Section A & Section B should be of 40 marks each.
2) Five questions in each section.
3) Out of five four questions asked should be of 15 Marks & one question asked should be 10 Marks.
4) 10 marks question will be compulsory

CHE471: Lab-I: Process Modeling and Simulation

Practical: 2Hrs/week

Examination Scheme
Practical/Oral: 50 Marks
Term Work: 25 Marks

The practical work shall consist of at least 08 modeling / simulation / optimization problems based on the syllabus.

The practical examination shall consist of a viva-voce based on the syllabus and the term work.

CHE472: Lab-II: Advanced Separation Processes

Practical: 2 hrs/week

Examination Scheme
Practical/Oral: 50 Marks
Term Work: 25 Marks

List of Experiments: (Any eight of the following)

1) Mass transfer flux calculation in RO system
2) Separation by Ion exchange
3) Azotropic distillation
4) Reactive distillation
5) Reactive extraction
6) Mass transfer flux calculation in ultra filtration system
7) Electrophoresis
8) Reactive crystallization
9) Chromatographic separation
10) Adsorption

CHE 473: Project – II.

Practical: 04 hrs/week

Examination Scheme
Practical/Oral: 100 marks
Term Work: 100 marks

A group of 2-3 students who have been assigned a topic in Project -I will complete the details of the calculations, design & drawing of equipments, fabrication details, cost estimation & project feasibility etc.

The group will have to submit a detailed typed & bound report of the work done, in Project -I and Project II, combined together.

The Practical examination shall consist of a viva-voce based on the project work completed in Part-I and Part-II by the candidate.