

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY**CIRCULAR NO.SU/Engg./B.E.IIIrd Yr./64/2018**

It is hereby informed to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faculty of Science & Technology the **Academic Council at its meeting held on 30 June & 02 July 2018 has accepted the following syllabi in accordance with Choice Based Credits & Grading System for all Branches Third Year Engineering & Second Year of Bachelor of Architecture** under the Faculty of Science & Technology as enclosed herewith:-

Sr.No.	Syllabi as per CBC & GS
[1]	Third Year B.E.[Civil Engineering],
[2]	Third Year B.E [Mechanical Engineering],
[3]	Third Year B.E [EE/EEE/Electrical, Electronics & Power,],
[4]	Third Year B.E [Chemical Engineering],
[5]	Third Year B.E [Instrumentation Engineering],
[6]	Third Year B.E [E&TC/E&C/IE/ECT],
[7]	Third Year B.E [CSE/IT].
[8]	Second Year of Bachelor of Architecture.

This is effective from the Academic Year 2018-2019 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.SU/2018/

Date:- 03-07-2018. / 14497-03

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6/7/18
Deputy Registrar,
Syllabus Section

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 this Circular on University Website.

Copy to :-

- 1] The Director, Board of Examinations & Evaluation,
- 2] **The Section Officer, [Engineering Unit] Examination Branch,**
- 3] The Section officer, [Eligibility Unit],
- 4] **The Programmer [Computer Unit-1] Examinations,**
- 5] **The Programmer [Computer Unit-2] Examinations,**
- 6] The In-charge, [E-Suvidha Kendra],
- 7] The Public Relation Officer,
- 8] The Record Keeper,

**DR. BABASAHEB AMBEDKAR
MARATHWADA UNIVERSITY,
AURANGABAD.**



Curriculum under Choice Based Credit & Grading System

Revised Syllabus of

Bachelor of Engineering

Third Year

Chemical Engineering

Under the Faculty of Science & Technology

[Effective from the Academic Year 2018-19 & onwards]

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad

Faculty of Science and Technology

Structure of Third Year (Chemical Engineering)

Sr.No.	Part	ContactHrs/Week				ExaminationScheme(Marks)						Duration of Theory Exam.
SubCode	Subject	L	T	P	Total	CT	TH	TW	PR	Total	Credits	
Part-I												
CHE301	Mass Transfer Operations-I	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 302	Industrial Pollution and Control	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 303	Chemical Reaction Engineering-I	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 304	Material Science and Technology	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 305	Chemical Engineering Thermodynamics	4	-	-	4	20	80	-	-	100	4	3hrs.
BSH 305	CommunicationSkill	2	-	-	2	-	-	50	-	50	2	2hrs
CHE 321	Lab-1-Mass Transfer Operations-I	-	-	2	2	-	-	-	50	50	1	
CHE 322	Lab-2-Industrial Pollution and Control	-	-	2	2	-	-	-	50	50	1	
CHE 323	Lab-3-Chemical Reaction Engineering-I	-	-	2	2	-	-	-	50	50	1	
CHE 324	Lab-4- Material Science and Technology	-	-	2	2	-	-	50	-	50	1	
TotalofPart-I		22		08	30	100	400	100	150	750	26	
Part-II												
CHE 351	Mass Transfer Operations-II	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 352	Process Equipment Design and Drawing-I	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 353	Chemical Reaction Engineering-II	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 354	Plant Design and Process Economics	4	-	-	4	20	80	-	-	100	4	3hrs.
CHE 355	Chemical Process Industries	4	-		4	20	80	-		100	4	3hrs.
CHE 371	Lab1-Mass Transfer Operations-II	-	-	2	2	-	-	-	50	50	1	
CHE 372	Lab2- Process Equipment Design and Drawing-I	-	-	2	2	-	-	-	50	50	1	
CHE373	Lab3- Chemical Reaction Engineering-II	-	-	2	2	-	-	-	50	50	1	
CHE374	Lab4-Plant Design and Process Economics	-	-	2	2	-	-	50	-	50	1	
CHE375	Seminar-I	-	-	4	4	-	-	50	-	50	2	
TotalofPart-II		20	-	12	32	100	400	100	150	750	26	
TotalofPart-I&II		42		20	62	200	800	200	300	1500	52	

Note:1.Minimumtwotestsshouldbeconductedforeachtheorysubjectandaverageofbesttwotestsshouldbeconsidered.

2.AllthestudentsshallundergoIn-plantTrainingofminimum fourweeksinconcernedIndustry,duringsummer vacation.TheyshouldsubmitareportandgivepresentationonthesameduringFinalYear (Semester-I).

L: Lecturehrs/week,T:Tutorial hrs/week,P: Practicalhrs/week,TH:UniversityTheoryExam, TW:TermWork,PR:PracticalorOralExam.

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FACULTYOFSCIENCEANDTECHNOLOGY
THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE301–Mass Transfer Operations-I	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Analysis of different mass transfer separation techniques. 2. Understand principle of different processes. 3. Evaluate design of equipment for different process. 4. Enable to improve efficiency of mass transfer equipments	
Unit-1 Diffusion and Interface Mass Transfer: Fick's law of diffusion, Steady state molecular diffusion, equimolecular counter diffusion, diffusion in stationary gas, Maxwell's law of diffusion, theories of mass transfer, Knudsen diffusivity, Capillary flow. Inter phase mass transfer; diffusion between two phases, local and overall mass transfer coefficients, steady state co-current and counter current processes, stage wise and differential contacts. Concept of theoretical stages, stage efficiency, height of mass transfer units. Diffusion in solids.	14
Unit-2 Gas-Liquid Operations: Equipments for Gas – liquid operations; Sparged vessels (bubble columns), Tray Towers, Mechanically agitated vessels for single phase and gas liquid contact, liquid dispersed – scrubbers, venture scrubbers, wetted towers, packed towers. Operating characteristics of equipments.	04
Unit-3 Drying: Theory and mechanism of Drying, Determination of batch drying, direct and indirect driers, freeze drying, rate of drying curve, mechanism of batch drying, cross circulation drying, liquid and vapor diffusion, unsaturated surface drying. Drying equipments used in industries. Design and performance of batch and continuous driers.	04
Unit-4 Gas Absorption: Equilibrium solubility of gases in liquids. Two component systems, multicomponent systems, ideal liquid solutions, non-ideal liquid solutions, choice of solvent for absorption, one component transfer. Material Balances; counter current flow, minimum liquid-gas ratio for absorbers, co-current flow. Counter current multistage operation, one component transferred; dilute gas mixtures, absorption factor, non-isothermal operation, real trays and tray efficiency. Continuous contact equipment; height equivalent to an equilibrium stage (theoretical plate), absorption of one component, overall coefficients and transfer units, overall height of transfer units. Introduction to absorption with chemical reaction.	08
Unit-5 Adsorption: Types of adsorption, nature of adsorption, theories of adsorption, adsorption isotherms, adsorption equilibria, single gases and vapor adsorption, adsorption hysteresis, heat of adsorption, effect of temperature and pressure on adsorption, adsorption from dilute and concentrated solutions. Pressure swing and temperature swing adsorption operation. Application to Chromatography and molecular sieves. Adsorption operation equipment. The Freundlich equation, Single stage and multistage operations, Ion Exchange; Principles, Equilibria, rate calculations involved in ion exchange.	06

Unit-6 Humidification: Humidification / Dehumidification and cooling tower; Definitions, Temperature./ Humidity, Enthalpy Humidity Chart. Method of changing humidity and equipments, cooling tower design, mass and heat balances, performance evaluation of cooling towers.	04
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Reference Books:

1. Unit Operations of Chemical Engineering, W. L. McCabe & J.M. Smith, et al McGraw Hill Publication.
2. Chemical Engineering Vol.-I & II, J. F. Richardson J. M. Coulson, Pergamon Press Publication.
3. Introduction to Chemical Engineering, W. L. Badger and J. T. Banchero McGraw Hill Publication.
4. Mass Transfer operations R. E. Treybal, McGraw Hill Publication.
5. Chemical Engineers Hand book, R. H. Perry, McGraw Hill Publication.
6. Mass Transfer, T. K. Sherwood et al 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 papers shall be set having two sections A and B, as per weightage of units. Section A question shall be set on first part and section B on second part. Question papers 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.

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE302-Industrial Pollution and Control	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Understand importance and need of pollution control 2. Compare and study various methods of pollution control 3. Understand the methods of control of effluent treatment 4. Recognize the various pollutions due to noise, industrial and environmental wastes	
Unit-1 Introduction to Industrial Pollution: Types of Pollution, Pollution control aspects, Environmental legislation, Water (Prevention and Control of Pollution) Act, 1974 , Air (Prevention and Control of Pollution) Act, 1981, Industrial Waste Water Analysis, Industrial Gaseous Effluent Analysis, General Instruments for Gaseous Pollutants.	08
Unit-2 Air Pollution: Introduction, Sources, effects, Meteorological aspects of air pollutant dispersion, Temperature lapse rates and stability, wind velocity and turbulence, Plume behavior and estimation, Sampling methods, Characteristics of particulate,	04
Unit-3 Air Pollution control Methods and Equipments: Collection efficiency calculations of Gravity settling chamber, solid traps, cyclone separator, fiber fabric filter, liquid scrubbers, ESP, Numerical Examples based on settling chamber, cyclone separators, fibre filter, liquid scrubber and ESP.	10
Unit-4 Water Pollution : Introduction, sources and classification of water pollutants, Waste water sampling and analysis BOD, COD DO, TOC, TDS etc. Water quality standards.	04
Unit-5 Waste Water Treatments: Primary, Secondary(Biological) and Advanced Waste Water Treatments as Activated Sludge Process; Trickling/Biological Filters; Waste Stabilization Ponds, Anaerobic Treatmentetc, Numerical Examples based on removal of BOD.	10
Unit-6 Control Methods: Removal of chromium, Mercury, Ammonia /Urea, Phenol, lead etc. Case study of pollution control in various Chemical industrial units:	04

ReferenceBooks:

- Air pollution control -P. PratapMouli& N. VenkataSubbaya, DivyaJyotiPrakashan, Jodhpur .
2. Air Pollution, M.N. Rao, H.V.N. Rao, Tata McGraw – Hill Publishing Co.
 3. Fundamentals of air pollution control -Stern. Academic Press.
 4. Industrial Water Pollution Control, W.W.Eckenfelder,Jr., McGraw – Hill Book Co.
 5. Waste Water Treatment, M. N. Rao& A. K Datta, IBH Pub., New Delhi.
 6. Pollution control in Process Industries, S.P. Mahajan. Tata McGraw-Hill Pub. Co. Ltd, N.Delhi.
 7. Introduction to waste water treatment -R. S. Ramhalho, Academic Press, New York.
 8. Waste Water Engineering: Treatment Disposal Reuse, Metcalf & Eddy, Inc, Tata McGraw Hill.
 9. Environmental Pollution Control Engineering, C.S. rao, New Age International (P) Publishers.
 10. Sewage Disposal & Air pollution Engineering, S.K. Garg, R. Garg, KhannaPublishers,N.Delhi

SectionA:Unit1, 2,3

SectionB:Unit4, 5, 6

PATTERNOFQUESTIONPAPER

Sixunitsinthe syllabusshallbedividedintoequalparts,i.e.threeunitsineachpart.Question papersshallbesethavingtwosectionsAandB,asperweightageofunits.SectionAquestion shallbesetonfirstpartandsectionBon secondpart.Questionpapersshouldcoverentire syllabus.

For80Markspapers:

- 1)SectionA&SectionBshouldbeof40markseach.
- 2)Fivequestionsineachsection.
- 3)Outoffivefourquestionsaskedshouldbeof15Marks&onequestionaskedshouldbe10 Marks.
- 4)10marksquestionwillbecompulsory.

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FACULTYOFSCIENCEANDTECHNOLOGY
THIRDYEAR(CHEMICAL)ENGINEERING

Part - I		
CHE303-Chemical Reaction Engineering-I		
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks	
Objective: 1. Understand the concept and definitions of various rates of chemical reaction. 2. Analyse and relate terms such as temp with Arrhenius equations. 3. Compare and study different types of reactors. 4. Understand design of various reactors and effects of various parameters.		
Unit-1		
Introduction to Reaction Engineering: Classification of reactions, variable affecting rate of reaction, definition of reaction rate. Kinetics of homogeneous reactions, concentration dependant terms of rate equation, elementary and non-elementary reactions, kinetic view of equilibrium for elementary reactions.		08
Unit-2		
Chemical kinetics: Reaction Rates and Its Dependency (Kinetics of Homogeneous Reaction), Molecularity and order of reaction, representation of reaction rates, testing kinetics models, temperature dependency of rate, rate of reaction predicted by theories.		06
Unit-3		
Interpretations of Kinetic Data: Constant volume batch reactor, integral methods of analysis, autocatalytic reactions, first and second order reversible reactions, differentials method of analysis, variable volume batch reactor, temperature and reaction rate, and search for rate equation.		06
Unit-4		
Reactor design: Batch reactor, semi batch reactor, single ideal reactors, performance equations for batch, plug, mixed reactor.		06
Unit-5		
Reactor Design for simple and multiple reactions: Size comparison of single reactors, general graphical comparison, multiple reactor systems, mixed flow reactor of different type in series, reactors of different types in series, recycle reactor, autocatalytic reactions. Reaction in series and parallel, qualitative and quantitative treatment about product distribution, successive irreversible reactions of different orders, semi-parallel reactions, kinetics of series-parallel reactions.		10
Unit-6		
Temperature and Pressure effects: Single reaction and multiple reactions. Optimum temperature progression. Adiabatic and non-adiabatic operations.		04

ReferenceBooks:

1. Chemical Reaction Engineering, O. Levenspiel, Wiley Eastern Ltd
2. Elements of Chemical Reaction Engineering, H. S. Fogler, Prentice- Hall of India Pvt Ltd.
3. The Engineering of Chemical Reactions, L.D.Schmidt, Oxford University Press.
4. Chemical Engineering Kinetics, J.M. Smith, McGraw Hill Book Co.

SectionA:Unit1, 2,3

SectionB:Unit4, 5, 6

PATTERN OF QUESTION PAPER

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE304-Material Science and Technology	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Student will be able to understand various material in terms of structure 2. Understand behavior of material under various conditions 3. Relate properties of material to its different parameters 4. Able to select materials for various engineering applications	
Unit-1 Introduction to Materials, Atomic Structure and Chemical Bonding: Variation in bonding character and properties. Scope of materials science and technology and its importance in chemical course. Structure of the Atom, the quantum states. The periodic table, ionization potential, electron affinity and electro negativity. Wave nature of electron and Schrodinger wave equation. Chemical Bonding.: Bond energy, Bond type and bond length, ionic bonding Covalent bonding metallic bonding secondary bonding (dispersion bonding, dipole bonding and hydrogen bonding). Variation in bonding character and properties.	10
Unit-2 Crystal Structure and Determination: Geometry Crystals. the space lattices (a brief mention of the Bravais lattices). Basis, Cubic, and hexagonal crystal structure. Crystal directions (Willer indices and planes) Structure Determination by X-ray diffraction: The Bragg law of X-ray diffraction, the Bragg spectrometer the powder method and structure determination.	06
Unit-3 Structure of solids and Deformation of Materials: Ionically-bonded structures, properties of ionic solid, covalently- bonded structures, properties of covalent solids, metallically- bonded structures and their properties, molecularly- bonded structures and their properties. Elastic deformation, inelastic deformation plastic deformation of a single crystal.	06
Unit-4 Mechanical Properties: Fundamental properties: Fatigue:- Mechanism of fatigue failure, characteristics of fatigue failure. Factors affecting fatigue strength; Creep- types of creep. Creep curve. Design for creep affecting creep, mechanism of creep types of fractures, cleavage, brittle fracture and Griffith crack theory: Factors affecting mechanical properties. Changes in mechanical properties by heat treatment.	06

Unit-5 Electrical and magnetic Properties of Materials: Introduction to Magnetism and Magnetic Properties. (Definitions and brief explanations) Magnetization and Classification of magnetic materials, hysteresis. Introduction to Superconductivity: Definition and brief explanation, Critical transition temperature. Type I and type II superconductors. Applications.	04
Unit-6 Selection of Materials of Construction for Chemical Process Industries: Factors determining choice of materials, General factors, Corrosion: Definition, units of measurement Eight forms of corrosion sub types, mechanisms and examples) prevention of corrosion. Engineering Materials Metals and alloys and their applications (ferrous and nonferrous) Non-metallic materials: Polymeric materials and applications, Ceramics (Clays, Refractories and Glasses), Others (e.g. Graphite)	08
Reference Books: 1. V. Raghavan, Physical Metallurgy: Principles and Practice, Prentice Hall of India, New Delhi, 1983 2. V. Raghavan Materials Science and Engineering, Addison Wesley New York, 1989 3. M.G.Fontana, Corrosion Engineering, Tata Mcgraw Hill, 1985 4. J.F. Schackelford, Introduction to Material Science for Engineers, 2nd ED, McMillan New York, 1990 5. L.H.Vlac, Elements of Material Science and Engineering: A first Course, 4th ED, Prentice Hall of India , New Delhi 1997 6. W.D. Callister, Jr.Materials Science and Engineering, John Wiley New York, 1997 7. Z.D. Jastrzebski, The Nature and properties of Engineering Materials, John Wiley 1987 8. R. Perry and D.W.Green, Perrys Chemical Engineers Handbook, 7th Ed, 2001	
SectionA:Unit1, 2,3 SectionB:Unit4, 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 papers shall be set having two sections A and B, as per weightage of units. Section A question shall be set on first part and section B on second part. Question papers should cover entire syllabus. For 80 Mark 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.	

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE305 - Chemical Engineering Thermodynamic	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Understandproperty relationship between different thermodynamic properties. 2. Able to relate different thermodynamic properties. 3. Deduce criteria for any Chemical process regarding Phase and Chemical Equilibrium. 4. Able to evaluate values of different state functions of thermodynamic system.	
Unit-1 Thermodynamic Properties of Homogeneous system: Non-ideal behavior: Thermodynamic energy properties, Fugacity and fugacity coefficient, calculation of fugacity for pure substances, fugacity in ideal solutions, standard states, property changes of mixing, the excess Gibbs free energy, activity coefficients for Homogeneous system.	08
Unit-2 Partial Thermodynamic Properties: Relations among partial properties for constant composition solutions, Ideal solutions, fundamental residual property relation, Excess property relations, Evaluation of partial properties, Property changes of mixing, heat effect of mixing process, Equilibrium and stability, system of limited Liquid phase miscibility	08
Unit-3 Thermodynamic Analysis of processes: Second law for steady state flow process, calculation of ideal work, lost work, thermodynamic analysis of steady state flow processes.	04
Unit-4 Phase Equilibrium:Nature and criteria of equilibrium, the Phase Rule, vapor -liquid equilibrium, Roults law, phase diagrams for miscible systems, VLE calculations for miscible systems for low to moderate pressures, activity coefficients from experimental data, Gibbs Duhem equation. Prediction and correlation of activity coefficients, group contribution methods for activity coefficients (ASOG, UNIFAC, UNIQUAC).	08
Unit-5 Vapour Liquid Equilibrium: Properties of fluid from Virial equation of states, Properties of fluid from cubic equation of states, vapour/ liquid equilibriumfrom cubic equation of states.	04

Unit-6 Chemical Reaction Equilibria: The reaction coordinate, application of the criteria for equilibrium to chemical reactions. Standard Gibbs free energy change & equilibrium constant, effect of temperature on equilibrium constant evaluation of equilibrium constant and composition. Equilibrium conversions for single reactions (single phase and heterogonous reactions). The phase rule for reacting systems. Introduction to multi reaction equilibria.	08
ReferenceBooks: 1. Chemical Process Principles Part - II O. A. Hougen et al John Wiley Publication. 2. Chemical Engineering Thermodynamics, T. E. Daubert McGraw Hill Publication. 3. Chemical Engineering Kinetics, J. M. Smith, McGraw Hill Publication. 4. Introduction to Chemical Engineering Thermodynamics by G.N. Pandev& J.C. Chaudhary. 5. Chemical Engineering Thermodynamics Dodge. 6. Introduction to Chemical Engineering Thermodynamics J.M. Smith & H. C. Van Ness McGraw Hill Publication.	
SectionA:Unit1, 2,3 SectionB:Unit4,5,6 PATTERN OF QUESTION PAPER Six units in the syllabus shall be divided into equal parts i.e. three units in each part. Question papers shall be set having two sections A and B, as per weightage of units. Section A question shall be set on first part and section B on second part. Question papers should cover entire syllabus. For 80 Mark 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.	

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THIRDIYEAR(CHEMICAL)ENGINEERING

Part-I	
BSH 305–Communication Skill	
TeachingScheme:2Hrs/week Credits: 02	ExaminationScheme Term Work:50Marks
Prerequisite: 1. Basic Knowledge of Soft Skills 2. Good understanding of English Objectives: 1. To imbibe leadership skills 2. To develop interpersonal Skills 3. To introduce corporate etiquettes 4. To imbibe team skills	
Unit-1 Understanding self and Goal Setting - Self-Assessment: Understanding Self Core Competency (SWOT/SWOC) - Long term and short-term Goal Setting - Execution Skills	05
Unit-2 Interpersonal Skills - Interpersonal Communication - Conflict Management - Problem Solving - Decision Making - Persuasion and Influence	06
Unit-3 Group Dynamics and Team Building - Group Vs Team - Team Building - Team Work - Developing Leadership Skills	04
Unit-4 Corporate Etiquette - Clothing Etiquette, Personal hygiene and grooming - Time Management - Influencing Skills (Impression) - Balancing personal and professional Life Ethics, Values and Laws	05

Text Book:

The Ace of Soft Skills (Gopalaswamy Ramesh) Pearson Publication

Reference Books:

1. **Execution;** :Ram Charan

(Publisher: Crown Business; 1 edition (June 15, 2002)

Language: English ISBN-10: 0609610570 ISBN-13: 978-0609610572)

2. **Laws of Teamwork** : John C Maxwell

3. **Master of Business Etiquette:** Cyrus Gonda

(Author: Cyrus Gonda, Publisher EMBASSY BOOKS, 2017, ISBN 9385492721, 9789385492723)

4. **Goals** :

(Author: Brain Tracy ISBN: 1-57675-235-6 Published by Berrett-Koehler Publishers, Inc)

5. **Interpersonal Skills at work :**

(Author: John Hayes Second Edition: Routledge)

6. **People Smart** :

(Author: Freda Hansburg by Berrett-Koehler Publishers, Inc)

Term Work Assessment (50 marks):

The term work shall consist of internal online examination of 50 Marks, conducted at institute level.

The marks of the examination shall be forwarded to the University.

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE321:Lab-I:Mass Transfer Operation-I	
Practical:2Hrs/week Credits: 01	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(Anyeightofthefollowing) 1. Mass transfer coefficient 2. Diffusion co-efficient of liquid 3. Tray dryer 4. Batch drying 5. HTU/NTU. 6. Humidification (Cooling tower) 7. Adsorption. 8. Ion exchange. 9. Dehumidification 10. Gas absorption with reaction. 11. Wetted wall column. 12. Fixed bed absorber 13. Vapor Liquid equilibria	

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Part-I	
CHE322:Lab-II:Industrial Pollution and Control	
Practical:2Hrs/week Credits: 01	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(Anyeightofthefollowing) 1. Measurement of pH 2. Volatile matter 3. Total solids 4. Hardness. 5. Alkalinity. 6. Dissolved oxygen. 7. BOD 8. COD 9. Chlorides 10. Turbidity.	

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE323:Lab-III:Chemical Reaction Engineering-I	
Practical:4Hrs/week Credits: 02	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(Anyeightofthefollowing) 1. Interpretation of batch reactor data. 2. To study the kinetics of liquid phase irreversible reaction in a batch reactor. 3. To study the kinetics of liquid phase reversible reaction in batch reactor. 4. Conversion in CSTR. 5. Conversion in PFR. 6. Conversion in multiple reactors: CSTR followed by PFR. 7. Conversion in multiple reactors: PFR followed by CSTR 8. Effect of mixing in a Batch reactor. 9. To carry out second order reaction in CSTR and to find the value of rate constant. 10. To determine the pseudo first order rate constant. 11. To study the kinetics of liquid phase reaction by dilatometer method.	

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
CHE324:Lab-IV:Material Science and Technology	
Practical:2Hrs/week Credits: 01	ExaminationScheme TermWork: 50Marks
ListofExperiments / Assignments :(Anyeightofthefollowing) Term work should consist of at least one assignment (detailed note on a topic or numerical problems where applicable) on each of topics through above. In addition, at least two chemical process industries as case studies for materials of construction in various equipments.	

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-I	
BSH331:Lab-5 Communicationskills-II	
TeachingScheme Practical:2Hrs/week Credits: 01	ExaminationScheme TermWork: 50Marks
Session-I 1. Fastcalculationtechniques,Numbersystem,ratio,proportion, variationsaverages, 2. Simpleinterest,compoundinterest, profit, loss 3. Workandtimespeedanddistance 4. SettheoryandVannndiagram, permutationandcombination 5. Probability,alphanumericseries,logicaldeduction,reasoning,codinganddecoding andbloodrelation 6. Datainterpretation	
Session-II 1. Thekeycomponentsofnon-verbalcommunicationi.e.eyeccontacts, body language, vocaltoneandvolume. 2. Teamworkandteambuilding, thebasicsofteamintelligence, diversity awareness, genderissues 3. Groupdiscussion ,unstructuredgroupdiscussionsandactualgroupdiscussions 4. Presentationskills,self-confidenceanddecisionmaking	
Session-III 1. Adaptingtocorporatelifelife 2. Phoneetiquettes,Emailietiquettes,clothingetiquettes, dinningtableetiquettes 3. Gettingreadyforaninterviews,corporatedressing, writingreportsand proposals,minuteswriting,	
Referencebooks 1. GopalSwamyRamesh,MahadevanRamesh,"TheAceofsoftskills"Pearson publication 2. BansalHarison,"SpokenEnglish" 3. Orientblackswan,"EnglishforEngineersandTechnologist" 4. Jerry Wiessman,"PresentingtoWin"PretniceHallpublications 5. WilliamsanbornPfeiffer,T.V.S,Padamaja,"TechnicalCommunication" 6. M.Tyra,"Magicalbookon Quikermaths"BSCpublishingco.pvt.ltd.	

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THIRDYEAR(CHEMICAL)ENGINEERING

Part-II		
CHE351–Mass Transfer Operations-II		
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks	
Objective: 1. Evaluate various separation processes. 2. Understand principle of mass transfer processes. 3. Evaluate design of equipment for different mass transfer processes. 4. Recognize how to improve efficiency of mass transfer equipment		
Unit-1		
Distillation: Vapor liquid equilibrium for ideal and non-ideal binary system T- x-y and P-x-y diagrams, Thermodynamically estimation of VLE using vapor pressure data and relative volatility, Azeotropes .Vapor liquid equilibrium for multi-component mixture differential simple distillation, equilibrium distillation.		08
Unit-2		
Rectification: Minimum and optimum reflux ratio, McCabe Thiele, PonchanSavarit and Fenskey’s method, calculation of number of theoretical plates, plate efficiency, design of plate tower and packed tower, steam distillation, azeotropic and extractive distillation, molecular distillation ,introduction to multi components ,distillation introduction to reactive distillation ,design and opting characteristic of multistage distillation column and accessories		08
Unit-3		
Crystallization: Principles and theory of Crystallization, crystal formation and crystal growth calculation of yield of crystals, crystallization equipment, concept of MSMPR, design calculation.		04
Unit-4		
Liquid-Liquid Extraction: Solvent extraction, choice of solvent, ternary liquid equilibria, coordinate systems, staged calculation for single stage, multistage cross current, multistage counter current extraction, multistage counter current extraction with reflux.		08
Unit-5		
Extractors Design: spray column, packed and plate column, multistage extraction columns, mixer settlers, analysis on solvent free basis, performance evaluation of extractors, concept of HTU and HETP.		08
Unit-6		
Leaching: Principles, steady state operation, unsteady state operation, single and multistage operations, leaching calculation.		04

Reference Books:

1. Chemical Engineering Vol. 2-Richardson and Coulson.
2. Mass Transfer Operation- Treybal, McGraw Hill
3. Absorption and extraction- Sherwood and Pigford
4. Elements of Fractional Distillation-Robinson and Gilliland
5. Unit operations of Chemical Engineering by W.L. McCabe and J.C. Smith, McGraw Hill

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 papers shall be set having two sections A and B, as per weightage of units. Section A question shall be set on first part and section B on second part. Question papers should cover entire syllabus.

For 80 Mark papers:

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

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Part-II	
CHE352–Process Equipment Design and Drawing-I	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Understand the basic of design and drawing. 2. Evaluate principles of equipment design. 3. Understand design of equipment for different process. 4. Analyze how to improve performance of given equipment	
Unit-1	
Design preliminaries: Theories of failure of materials, corrosion, material of construction and selection criteria. Lining and coating of vessels, testing procedures.	06
Unit-2	
Pressure Vessel: Classification of Pressure Vessel, Codes and Standards for the Pressure Vessels. Design of vessels subjected to internal pressure, external pressure and combined loading, closures for vessels, selection of economic head. Estimation of equipment weight. Vessels subjected to high pressure, their fabrication techniques. Optimal proportions of vessels etc.	08
Unit-3	
Accessories: Classification of flanges, procedure for classification, gasket design flange rating, types of nozzles, reinforcement of nozzles, jackets for vessels, coils for heating, cooling.	06
Unit-4	
Supports: Classification of supports for vessels, design procedure for skirt support, bracket support, skirt-bearing plate, anchor bolts, bolt chair. Design of tall vertical vessels.	06
Unit-5	
Equipment Design: Mechanical Design of Agitators, Cyclone, Internal coil vessels and accessories. Design of Coupling, Stuffing Box and Gland. Process Hazards and Safety Measures in Equipment design.	06
Unit-6	
Storage Tank: Optimal proportions of storage tank, loss mechanism in storage tank, estimation of volume of storage tank, mechanical design of storage tank, wind girders, roof of storage tank, roof curb angles, ovalizations of storage tanks, estimations of nozzles, diameter of drain, storage tank dike.	08

ReferenceBooks:

1. Equipment Design, L. E. Brownell & E. H. Young Wiley Eastern Ltd. Publications.
2. Process Equipment Design, M. V. Joshi & V. V. Mahajani Macmillan India Ltd. Publication.
3. Process Design of Equipments, S.D. Dawande, Central Techno Publication.
4. Introduction to Chemical Equipment Design, B. C. Bhattacharyya, CBS Publishers & Distributors.
5. Machine Drawing, N. D. Bhatt, Charotar Publishing House.
6. Machine Drawing, N. Siddheshwar et al Tata McGraw Hill Publishing Co.
7. Chemical Engineering and Design, R C Volume 6

SectionA:Unit1, 2,3

SectionB:Unit4, 5, 6

PATTERN OF QUESTION PAPER

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Part-II	
CHE353-Chemical Reaction Engineering-II	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Compare ideal and non-ideal reaction flow patterns for given reactions. 2. Understand effect of RTD, Temperature and Pressure on reactions. 3. Able to relate different reaction schemes i.e. fluid-fluid, fluid-particle etc. 4. Select proper catalysts for given reactions.	
Unit-1 Non-ideal flow and mixing : Concept of RTD, different curves, Models for non-ideal flow and applications to reactor design. Mixing of fluids : Self mixing of a single fluid and mixing of two miscible fluids.	10
Unit-2 Non-catalyzed Fluid-Particle Reaction: Contacting Pattern for Two-Phase Systems, Fluid Particle Reactions. Progressive Conversion Model, Unreacted Core Model for Spherical Particle of Unchanging Size, Rate of Reaction for Shrinking Spherical Particles, Determination of Rate Controlling Steps, Mathematics of Progressive Conversion Model Reactors for Fluid-Particle non catalytic reactions.	06
Unit-3 Fluid-Fluid Reaction(without catalyst): Rate Equation for Instantaneous, Fast, Intermediate, Slow, Reaction and Infinitely Slow Reaction, Film Conversion Parameter, Slurry Reaction Kinetics. Applications to design - Tower for Fast and 'slow Reaction, Mass Transfer with Chemical Reaction.	06
Unit-4 Catalysts: Introduction, Classification, Characteristics, Preparation and Deactivation of Catalyst. Promoters and Inhibitors. Determination of surface Area, Pore Volume etc of Catalyst. Selection & preparation catalysts for industrial reactions like NH_3, H_2SO_4, Water gas shift reaction, etc. Adsorption Process and its classifications. Types of Adsorption Isotherm.	06
Unit-5 Kinetics of Catalyzed Reactions: The Rate equation, Various resistances in catalyst pellets. Effectiveness Factor. Heat effects during reaction, Resistances for isothermal particles.	06
Unit-6 Heterogeneous Catalytic Reactors: Design, Mechanism, Construction and applications of : Moving Bed Reactors like Slurry Bed Reactors, Trickle Bed Reactors. Isothermal and Adiabatic Fixed Bed Reactors.	06

ReferenceBooks:

1. Chemical Reaction Engineering, O. Levenspiel, Wiley Eastern Ltd
2. Elements of Chemical Reaction Engineering, H. S. Fogler, Prentice- Hall of India Pvt Ltd.
3. The Engineering of Chemical Reactions, L.D.Schmidt, Oxford University Press.
4. Chemical Engineering Kinetics, J.M. Smith, McGraw Hill Book Co.
5. Principles of Reaction Engineering, S.D. Dawande, Central Techno Publications.

SectionA:Unit1, 2,3

SectionB:Unit4, 5, 6

PATTERN OF QUESTION PAPER

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Part-II	
CHE354–Plant Design and Process Economics	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1 Understand the factors affecting plant design. 2 Evaluate the basis of sizing of equipments and costing. 3 Study the principle of depreciation. 4 Understand PERT and CPM	
Unit-1 Process Design and Development: Design Project procedure, literature survey, study and comparison of different process, development of a project from laboratory and pilot plant data, scale up methods, principles of similarity criteria and scale equations for important equipment, regime concent.	06
Unit-2 Plant Design: Plant layout, plant location, site selection & preparation, Design report, ,Process auxiliaries, selection of utilities like refrigerant, chilled water, air etc. Cooling water, steam, hot water, dowerm, molten salt baths. Sizing and costing of major equipments like reactors, H.E., multiple effects evaporator, distillation equipment.	08
Unit-3 Techno-economic Feasibility reports: Cost and asset accounting procedure ,Cost estimation, Cash flow, factor affecting cost and investment, Capital investment, cost index, cost factor, types of insurance, Total product cost, taxes and insurance,. Interest and investment cost.	08
Unit-4 Depreciation: Types of depreciation, service life, salvage value, present value and methods of determining depreciation, single unit and group depreciation. Causes of Obsolescence and Inadequacy.	05
Unit-5 Optimum Design: Procedure with one variable, break even chart, Optimum economic diameter optimum reflux ratio in distillation and Heat transfer, optimization, direct search, linear programming, dynamic programming, project organization, project scheduling,	05
Unit-6 PERT & CPM techniques: Project management, Element and Development of Network, Time estimate and Time computations, Network analysis, Cost Model (Reference to Indian conditions should be made wherever required)	08

ReferenceBooks:

1. Chemical Engineering, Plant Design by Vilbrandt F. O. and Dryden .E. E., McGraw Hill,
2. Plant Design and Economics for Chemical engineers by Peters M. S. and Timmerhaus K. D., McGraw Hill.

Chemical Process Economics: Happel& Jordon D.G.

The Chemical Economy Reaben B.G. Burstall ML. Longman.

SectionA:Unit1, 2,3

SectionB:Unit4, 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 papers shall be set having two sections A and B, as per weightage of units. Section A question shall be set on first part and section B on second part. Question papers should cover entire syllabus.

For 80 Mark papers:

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- 2) Five questions in each section.
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Part-II	
CHE355: Chemical Process Industries	
TeachingScheme:4Hrs/week Theory Exam: 03 hrs Credits: 04	ExaminationScheme TheoryExamination:80Marks ClassTest:20Marks
Objective: 1. Understand process flow-sheet in details for chemicals. 2. Analyze the properties of raw materials used in manufacture of products. 3. Recognize unit operations involved sequentially in manufacturing process. 4. Analyse engineering problems associated with the manufacturing process	
Unit-1 Introduction to Process Industries: Development and salient features of Chemical process Industries in India. Material Resources and shortcomings. Challenge faced by Chemical Industries in India and Future Trends and role of Chemical Engineer.	04
Unit-2 Inorganic Chemical Industries: Nitrogen Industries- Ammonia , Ammonium Nitrates, Ammonium sulphate, Urea, Nitric Acid.Phosphorus Industries-Phosphorous, Phosphoric Acid, Super Phosphate.Chlor- Alkali Industries- Caustic Soda, Chlorine, Hydrochloric Acid.	08
Unit-3 Manufacture Processes: Soda Ash, Bleaching Powder, Sodium Bicarbonate, Sulfuric Acid. Electrolytic Industries: Manufacture of Sodium, Sodium Chlorate and perchlorates. Industrial Gases: Manufacture of Oxygen, Nitrogen, Fuels and Fuel gases, Fuel Cells, Natural Gases, Water Gas, Producer Gas.	08
Unit-4 Organic chem. Industries:Overview of present day organic processing in India including perspectives of agro and other raw material resources as starting materials for industries such as vegetable oils and fats, sugar industries- starch, paper. Manufacturing industries: phenol, purified terephthaline acid, acetaldehyde, acetic acid, caprolactum, vinyl chloride, chlorobenzene, nitrobenzene.	08
Unit-5 Manufacturing industries-Ethylene, propylene, butanes, butadiene, benzene, toluene, xylene, Styrene, cumene. Synthesis of polymers: Poly ethylene, LDPE, HDPE, Polyester fiber, Nylon, PVC,Other Products: Paints, Varnishes, Soap and Detergents.	08

Unit-6 Fermentation Industries: Absolute Alcohol, Beer, Wine, Vinegars, Citric Acid. Rubber Industries: Natural Rubber, Synthetic Rubber (SBR, Polymeric Oils, Rubber Based on Silicon)	04
ReferenceBooks: 1. Shreve's Chemical Process Industries, G. T. Austin., McGraw Hill Publication. 2. Dryden's Outlines of Chemical Technology, Edited by M. GopalRao Affiliated East West Press Pvt. Ltd. 3. A Text Book of Chemical Technology, S. D. Shukla& G. N. Pandey, Vikas Publishing House	
SectionA:Unit1, 2,3 SectionB:Unit4,5,6 PATTERNOFQUESTIONPAPER Sixunitsinthe syllabusshallbedividedintoequalpartsie.threeunitsineachpart. Question papershallbesethavingtwosectionsAandB,asperweightageofunits.SectionAquestion ShallbesetonfirstpartandsectionBonsecondpart.Questionpapershouldcoverentire syllabus. For80Markspapers: 1)SectionA&SectionBshouldbeof40markseach. 2)Fivequestionsineachsection. 3)Outoffivefourquestionsaskedshouldbeof15Marks&onequestionaskedshouldbe10 Marks.	

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Part-II	
CHE371:Lab-I:Mass Transfer Operation-II	
Practical:2Hrs/week Credits: 01	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(Anyeightofthefollowing) - Flash/Equilibrium distillation - Batch distillation - Steam distillation - Tie line extraction - Kunni extraction column - Packed extraction column(Liquid –Liquid) - Spray extraction column - Solid-Liquid extraction - Ternary Phase Diagram - HETP - Packed Bed Distillation column - Batch crystallizer	

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Part-II	
CHE372:Lab-II: Process Equipment Design and Drawing-I	
Practical:2Hrs/week Credits: 01	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(AnyFiveofthefollowing) 1. Pressure Vessels 2. Heads and Closures. 3. Vessel supports 4. Vacuum Producing Devices, Steam Traps, Pressure Relief Devices. 5. Process Flow Diagrams. 6. Reaction Vessel with all internals. 7. Agitators 8. Tall vessels with internals e.g. Packed/ plate column.	

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Part-II	
CHE373:Lab-III:Chemical Reaction Engineering-II	
Practical:2Hrs/week Credits: 01	ExaminationScheme Practical/Oral:-50Marks
ListofExperiments:(Anyeightofthefollowing) 1. The kinetics of liquid phase reversible reaction with homogenous catalyst in a batch reactor. 2. The temperature dependency of liquid phase irreversible reaction. 3. Mass transfer with chemical reaction. 4. RTD in CSTR. 5. RTD in PFR. 6. RTD in packed bed reactor. 7. Characterization of catalysts. 8. CSTRs in series. 9. Heterogeneous catalytic reaction. 10. Catalyst Preparation 11. Neutralization Reaction	

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Part-II	
CHE374:Lab-IV:Plant Design and Process Economics	
Practical:2Hrs/week Credits: 01	ExaminationScheme TermWork: 50Marks
ListofExperiments / Assignments :(Anyeightofthefollowing) Term work should consist of assignments (detailed note on a topic or numerical problems where applicable) on each of topics mentioned in CHE 354 previously. In addition, at least two chemical process industries as case studies for materials of construction in various equipments.	

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Part-II	
CHE375-Seminar-I	
TeachingScheme: Guidance by Faculty:4Hrs/week Credits: 02	ExaminationScheme: TermWork: 50Marks
Topics & Contents The student shall study special topic beyond the scope of the syllabus under the subjects of Chemical Engineering or interdisciplinary branch from current literature, by referring the latest technical journal under the guidance of the faculty. The student shall prepare his report together with design, computation, process flow-sheet etc.,if any, and deliver presentation on the topic to students of his class in the presence of his guide and faculty. ---- The term work for this head will consists of the report written in a technical reporting manner and presentation on the subject and will be assessed by minimum two internal examiners appointed by the Principal/HOD of concern department of the institution. One of the examiners will be student's guide and the other can be from the concerned branch.	