



**List of Courses Focus on Employability/ Entrepreneurship/
Skill Development**

Department : Chemical Engineering

Programme Name : B.Tech.

Academic Year : 2016-17

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	MEBTES04	Engineering Thermodynamics
02.	MEBLES06	Workshop Practice
03.	CH3TES05	Fluid Mechanics
04.	CH3PES05	Fluid Mechanics Lab
05.	CH3TPC02	Chemical Engineering Calculation
06.	CH3TES06	Chemical Engineering Thermodynamics-I
07.	CH4TBS06	Numerical Analysis & Computer Applications
08.	CH4PBS03	Numerical Analysis & Computer Applications Lab
09.	CH4TPC02	Chemical Engineering Thermodynamics-II
10.	CH4TPC03	Inorganic Chemical Technology
11.	CH4TPC04	Mechanical Operations
12.	CH4PPC02	Mechanical Operations Lab
13.	CH4TPC05	Process Instrumentation
14.	CH4THS05	Business Communication And Presentation Skill
15.	CH3501	Heat Transfer
16.	CH3506	Heat Transfer Lab
17.	CH3502	Mass Transfer-I
18.	CH3507	Mass Transfer-I Lab
19.	CH3504	Chemical Reaction Engineering-I
20.	CH3503	Process Dynamics And Control
21.	CH3505	Organic Chemical Technology
22.	CH3508	Process Dynamics & Control Lab
23.	CH3608	Chemical Reaction Engineering Lab
24.	CH3601	Mass Transfer-II
25.	CH3603	Fuel Combustion & Energy Technology
26.	CH3602	Process Equipment Design-I



27.	CH3604	Chemical Reaction Engineering-II
28.	CH3606	Mass Transfer-II Lab
29.	CH3607	Fuel Combustion & Energy Technology Lab
30.	CH4702	Process Equipment Design-II
31.	CH4703	New Separation Processes
32.	CH4707	Computer Aided Design & Simulation
33.	CH4709	Minor Project
34.	CH4708	Vocational Training Viva Cum Seminar
35.	CH4701	Project Engineering, Economics And Management
36.	CH4803	Environmental Pollution Control Engineering
37.	CH4807	Major Project
38.	CH4705	Petroleum Refinery Engineering
39.	CH4806	Petrochemical Engineering
40.	CH4801	Optimization Techniques In Chemical Engineering
41.	CHPG1101	Advanced Heat Transfer
42.	CHPG1102	Chemical Reactor Design
43.	CHPG1103	Fluidization Engineering
44.	CHPG1105	Membrane Separation Processes
45.	CHPG1106	Chemical Engineering Computational Lab
46.	CHPG1201	Advanced Fluid Mechanics
47.	CHPG1202	Advanced Mass Transfer
48.	CHPG1203	Industrial Pollution Control Technologies
49.	CHPG1204	Design And Development Of Catalyst
50.	CHPG1206	Project
51.	CHPG1207	Seminar



Scheme and Syllabus

SCHEME OF EXAMINATION B.Tech – I Year (2nd Sem.), Common to All Branches, Course – B,
w.e.f. Session: 2015-2016

S. No	Subject Code	Subjects Theory	Periods /Week			Evaluation Scheme					Grand Total	Credits		
			L ¹	T ²	P ³	Internal Assessment				E.S.E				
						C.T. ⁴	M.S.E. ⁴	T.A. ⁷	L.A. ⁸				Total	
1	CHBTH502	Environmental Studies	3	0	0	10	20	10	-	40	60	30	3	
2	MEBTE504	Engineering Thermodynamics	3	1	0	10	20	10	-	40	60	30	4	
3	EEBTE505	Basic Electrical & Electronics Engineering	3	1	0	10	20	10	-	40	60	30	4	
4	PHBTE503	Engineering Physics	3	0	0	10	20	10	-	40	60	30	3	
5	EMBTB504	Engineering Mathematics – II	3	0	0	10	20	10	-	40	60	30	3	
Practical														
1	EEBLE505	Basic Electrical & Electronics Engg. Lab	0	0	3	-				30	30	20	50	2
2	PHBLE509	Engineering Physics Lab	0	0	3	-				30	30	20	50	2
3	MEBLE506	Workshop Practice	0	0	3	-				30	30	20	50	2
											Total Credits	23		

¹-Lecture Hours, ²-Tutorial Hours, ³- Practical Hours, ⁴- Mid Sem. Exam, ⁵-Class Tests/Assignments, ⁶-Lab Work Assessment, ⁷- Mandatory course



Syllabus		SEMESTER-II							
Subject code	MEBTES04	Credit: 3			SESSIONAL - TA				ESE
Subject	ENGINEERING THERMODYNAMICS	L	T	P	CT	MSE	TA	Total	
		3	1	0	10	20	10	40	60

UNIT-1: BASIC CONCEPTS AND DEFINITION: Thermodynamic System, Surrounding and Universe, Phase, Microscopic and Microscopic Point of View, Thermodynamic Equilibrium, Property, state, Path, Quasi-static Process, Reversible and Irreversible process. Heat and work- Forms of work during quasi-static or reversible process, work as a path function, Heat, various thermodynamic processes. Temperature and Zeroth law of thermodynamics, First law of thermodynamics- first law of thermodynamics undergoing cyclic process, first law of thermodynamics undergoing a process, Internal energy of a perfect gas, Application of first law to a closed system, First law of thermodynamics for flow process- flow processes and control volume, flow energy and flow work, first law of thermodynamics applied to open system, General study flow energy equation, application of study flow energy equation

UNIT-2: SECOND LAW OF THERMODYNAMICS: Limitation of first law and essence of second law, thermal reservoir, heat engine, thermal efficiency of heat engine, heat pump and co-efficient of performance, statement of second law, equivalence of Kelvin and clausius statement, types of Irreversibility, Carnot cycle, Corollary 1 & 2, Entropy -Clausius inequality, Entropy Principle, temperature and entropy diagram, application of entropy principle.

UNIT-3: PROPERTIES OF PURE SUBSTANCE: Properties of steam – types of steam, wet, saturated and superheated steam, phase transformation at constant pressure, T-s and h-s diagram, sensible heat, latent heat, superheat, internal energy, enthalpy, dryness fraction. Steam Processes – Constant volume, adiabatic, isothermal, polytropic, entropy of steam.

UNIT-4: Vapour Power cycle: Carnot vapour cycle, rankine cycle, effect of operating conditions on ranking efficiency, principle & method of increasing the thermal efficiency, deviation of actual cycle from theoretical cycle, thermal efficiencies and specific steam

Consumptions, requirement of an ideal working fluid, the reheat cycle, binary vapour cycle

UNIT-5: Gas power cycles & Boilers: Air Standard Cycle- Otto, Diesel and Dual, Comparison among cycles, Boilers, Types, Requirements of boiler, boiler efficiency, boiler mountings and accessories.

Recommend Text Books

1. Engineering Thermodynamics - P.K. Nag, TMH publisher.
2. Engineering Thermodynamics – C.P. Arora, TMH publisher.
3. Engineering Thermodynamics - Cengel, TMH, Publisher
4. Engineering Thermodynamics - Jones Dugan, PHI publisher
5. Fundamentals of Engg Thermodynamics - R. Yadav, C. P House publisher
6. Applied Thermodynamics – Onkar Singh, New Age Publishing Co.



INSTITUTE OF TECHNOLOGY
 GURU GHASIDAS VISHWAVIDYALAYA, BHILAI-4 (C.G.)
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SCHEME FOR EXAMINATION
B.Tech. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING.
SECOND YEAR, THIRD SEMESTER

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme				Credits	
			L	T	P	Sessional Exam	Mid	Test	ESE		Self-Total
01	CH21051	Engineering Mathematics	3	0	0	30	20	40	50	100	3
02	CH21052	Fundamentals of Chemical Engineering	3	0	-	20	20	40	60	100	4
03	CH21053	Fluid Mechanics	3	1	-	20	20	40	60	100	4
04	CH21054	Engineering Mathematics-II	3	1	-	20	20	40	60	100	4
05	CH21055	Chemical Engineering Thermodynamics	3	0	-	20	20	40	60	100	4
06	CH21056	Chemical Engineering Calculations	3	0	-	20	20	40	60	100	4
PRACTICAL											
07	CH21057	Chemical Engineering Lab	-	-	3	30	-	20	20	50	2
08	CH21058	Fluid Mechanics Lab	-	-	3	30	-	20	20	50	2
TOTAL			18	2	6					700	24

(N) Internal Assessment

MSE - Mid Semester Examination

ESE - End Semester Examination

Total Periods - 76

Total Periods - 26

Total Credits - 14

Dr. Chandra Prasad
 Head, Department of
 Chemical Engineering
 Institute of Technology

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CHAPTERS: Fluid Mechanics (2+1)

Unit I: Fluid Statics & Applications: Hydrostatic equilibrium, Hydrostatic equilibrium in manometric liquids and its applications in chemical engineering like manometers, differential Fluid Flow Process: Velocity gradient and shear, Types of fluids, Concept of viscosity, Momentum transfer, Nature of flow: Laminar, turbulent, Reynolds number, boundary layer formation and separation.

Unit II: Basic Equations for Fluid Flow: Mass balance, momentum balance equations, Bernoulli's equation with and without corrections for solid boundaries, kinetic energy, Transducer, Pump work.

Unit III: Incompressible Fluids: Flow through pipes, Flow characteristics: shear stress, friction factor, Laminar flow for newtonian fluids, Hagen Poiseuille equation, Laminar flow for non-newtonian fluids, Turbulent flow through pipes and flow diameter and its characteristic number, Friction factor and its dependence on roughness, Reynolds number, friction factor for flow through channels of non-circular cross section - concept of equivalent diameter, Friction factor also for sudden change in velocity or direction in flow, Pipe entry, Construction, Effect of fittings, Flow through in flow pipes.

Unit IV: Transportation of Fluids: Pipe fitting like bends, elbows, flanges, tee and different types of valves, Tools for tracing pipes, Pumps, NPSH, Power requirements, Types of pumps - Centrifugal & positive displacement, Troubleshooting in operation - Friction & cavitation, Characteristic curves - flow / capacity / power / efficiency, Capacity head beyond load characteristics.

Measuring of Flow: Variable head system - Venturi meter & orifice meter, Variable area meter - Rotameter, Discharge meters - Pitot tube.

Unit V: Agitation and Mixing of Liquids: Various types of agitators, agitators, power, torque, paddle, Standard turbine design, Circulation velocities and power requirements in agitated process including power correlations, effects of baffles, blending and mixing, Dimensional analysis, Shell balance.

Books Recommended

1. Unit Operations of Chemical Engineering by McCabe Smith And Harriot, fifth edition, McGraw-Hill Inc.
2. Chemical Engineering by P.M. Coulson and Richardson vol. II
3. Unit Operations in Chemical Engineering by McCabe Smith, McGraw-Hill Inc.

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CEETES6 51: Chemical Engineering Thermodynamics-I (3+0)

Unit 1: Basic Concepts, Definitions & P-V-T Relations: Approaches of thermodynamic system & types, Types of processes: Work, Heat, Energy
 P-V-T relations of fluids: Graphical representation of P-V-T behavior, Mathematical derivation of P-V-T behavior (Ideal gas law, van der Waals, Redlich-Kwong, Benedict-Webb-Rubin, Redlich-Kwong, Peng-Robinson, Soave-Redlich-Kwong, compressibility factor correlations, Equations of state (Benedict-Webb-Rubin, Soave-Redlich-Kwong, Peng-Robinson, van-der-Waals, van der Waals-Redlich-Kwong))

Unit 2: First & Second Law of Thermodynamics: First & Second Laws, Calculation of internal energy, Enthalpy, Heat capacities, Application of first law for open and closed system, Throttling process, Joule-Thomson effect.
 Second law: Kelvin-Planck statement, Clausius statement, Carnot cycle, Carnot theorem, Carnot efficiency, Entropy and its calculation.

Unit 3: Third Law of Thermodynamics: Definition and applications, Statistical & Non-equilibrium Thermodynamics: Basic concepts and applications

Unit 4: Thermochemistry: Enthalpy, Heat of reaction at constant pressure and volume, Hess's Law of constant heat summation: Effect of temperature on heat of reaction at constant pressure (Kirchhoff's equation), Heat of dilution, Heat of ionization, Heat of formation, Heat of neutralization and heat of combustion.

Unit 5: Equation of State, VLE/LLE Equilibrium: Le Chatelier's Principle, Kinetic theory, Vapor-liquid equilibria in ideal solution, Liquid-liquid equilibrium diagrams, Equilibria of state of a gas, Principles of corresponding states.

Books Recommended:

1. Chemical Engineering Thermodynamics by Y.K. Saou, Butterworths, London, 1974
2. Engineering Thermodynamics by E. K. Ryd, Tata McGraw Hill
3. Principles of Physical Chemistry by Merzou, Ahmed H. Prasad, Carl F. Corson & Bill Johnson, Dr. P. Ltd New Delhi
4. Textbook of Physical Chemistry by Sangeet Ghoshal, Macmillan Co Ltd London
5. Chemical Engineering Thermodynamics by H.P. Dodge.

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CHETP-02: Chemical Engineering Calculations (30 cr)

Unit I: Review: Concepts of units & dimensions, Pressure, Temperature, Volume, Mass, Average molecular weight, Stoichiometry & composition relationships.

Unit II: Gaseous Processes: Boyle's law, Dalton's law, Amagat's law, Dalton's pressure and pure component volume. Different methods of solving problems related to gaseous mixtures and chemical reactions in gaseous phase.

Unit III: Vapor Pressure: Concepts of vapor pressure, Vapor pressure of condensed liquids, Antoine equation, Cox chart, Vapor pressure of solutions and problems based on Raoult's law.

Unit IV: Humidity & Saturation: Difference between saturation & humidity, Different methods of expressing saturation & humidity, Psychrometry & its problems.

Unit V: Material Balance: General equation and concept of law of conservation of mass, Problems on material balance with & without chemical reaction, Recycle, bypass & purge calculations, Specific type of industrial applications on above.

Unit VI: Energy Balance: General heat balance equation and concepts of law of conservation of energy, Combustion calculations, Reaction and flame temperature calculations, Heat balances for heating & non-heating processes. Specific type of industrial applications on above.

Books Recommended:

1. Chemical Process Engineering Calculations by P.M. Saha, Chapman & Hall, New Delhi.
2. Chemical Process Principles Part I by Rowden, Watson & Riggs, Vol. I, Asia Publishing House.
3. Basic Principles & Calculations in Chemical Engineering by R.M. Himmelblau, Prentice Hall.
4. Stoichiometry by G. I. Ghosh and S.K. Vora, Tata McGraw Hill, India.

Dr. Chandan K. Jha
Professor & Head
Chemical Engineering Dept.
Jadavpur University, Kolkata

2022/23 on 24th June 2023

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SCHEME FOR EXAMINATION
B.Tech. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING
SECOND YEAR, FOURTH SEMESTER

Sl. No.	Course No.	Subject	Periods			Examination Scheme				Sub Total	Credits
			T	P		Stations	Essay	ESE	Total		
THEORY											
01	CH21101	Process Communication and Instrumentation	2	0	-	10	20	40	60	100	3
02	CH21102	Statistical Process & Control Applications	1	1	-	10	20	40	60	100	3
03	CH21103	Process Dynamics & Thermodynamics II	1	1	-	10	20	40	60	100	3
04	CH21104	Environmental Chemical Technology	1	1	-	10	20	40	60	100	3
05	CH21105	Mass Transfer Operations	2	4	-	20	20	40	60	100	3
06	CH21106	Process Heat Transfer	1	0	-	20	20	40	60	100	3
PRACTICAL											
01	CH21107	Numerical Analysis & Computer Applications Lab	-	-	3	30	-	30	20	50	2
02	CH21108	Vis. Control System Lab	-	-	3	30	-	30	20	50	2
TOTAL			8	2	6					500	24

EE - Internal Assessment; MSE - Mid Semester Examination; ESE - End Semester Examination
 Total Marks - 500; Total Periods - 26; Total Credits - 14



B. Tech. IV Semester

BAETHS35: Business Communication and Presentation Skills (2016)

Unit 1: Business communication: Meaning, Value of communication in different types of business and importance of effective communication skills. Aspects for effective communication. Communication in a formal organization. Barriers to the process of communication.

Unit 2: Skills and requirements of technical communication: including: Listening, speaking, writing, reading and thinking skills. Organize, clarity, precision in defining, features of technical communication. Various types of business writing: Letters, reports, memos, minutes, Language and format of various types of business letters. Language and style of reports. Report writing structure. Analysis of a sample report.

Unit 3: Communication and personality development: meaning, Psychological aspects of communication, contribute as a part of communication: Emotional intelligence, Politeness and etiquette in communication. Cultural factors that influence communication. Motivation in the workplace in communication. Language and performance. Language and conflict resolution.

Unit 4: Language Laboratory emphasis on Listening and comprehension skills, Reading Skills, Social Structure of English and its relation to business.

Unit 5: Oral Presentation and professional speaking: covering, Styles of English pronunciation, Elements of effective presentation: Body Language and use of voice during presentation. Connecting with the audience during presentation. Projecting a positive image while speaking. Planning and preparing a good presentation. Organizing the presentation to suit the audience and content. Basics of public speaking. Preparing for a speech.

Text books:

1. Fred Luthans, Organizational Behavior, McGraw Hill
2. Lind et al. (2011), Report writing for business
3. M. Asher, Social Structure of English: Technical Communication, McGraw Hill
4. Wallace et al. (2008), Personal Development: Verbal and Written Communication

Reference books:

1. Parashar, L. M. Communication skills for Technical Students
2. Richard Moxham, John Woods, The Business letters Handbook
3. Henry A. Menck, Effective Business Communication
4. M. J. Handberg, The Writers of Research Papers

BUS 1011 on 24/11/2016

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CH4TNS06: Numerical Analysis & Computer Applications (310)

UNIT - I Approximations and Errors in Computations: Errors and their analysis, Types of errors: Curve fitting: Method of Least squares, fitting of a straight line, fitting of an exponential curve, polynomial fit, Non linear Regression (various degree parabola), Cubic spline Approximation, Method of moments.

UNIT - II Numerical Solution of Algebraic and Transcendental Equations: Graphical method, bisection Method, Secant Method, Regula Falsi Method, Newton-Raphson Method, Newton-Raphson Method Solution of a system of simultaneous linear equations, Lagrange's method, Gauss elimination Method, Gauss Jordan method, iterative methods: Jacobi, Gauss-Seidel Method, Gauss-Seidel iterative method.

UNIT - III The Solution of Finite Difference: Finite differences, Difference operators, operators and relation between adjacent linear operators, Interpolation with equal intervals: Newton's forward and backward interpolation formula, Central difference interpolation formula, Gauss's forward and backward interpolation formula, Stirling's formula, Bessel's formula, Laplace - Everett's formula, choice of interpolation formula, Interpolation with Unequal intervals: Lagrange's interpolation, Newton's difference formula, inverse interpolation.

UNIT - IV Numerical Differentiation and Integration: Numerical Differentiation: Newton's forward and backward difference interpolation formula, Minima and Maxima of a tabulated function, Numerical Integration: Newton's quadrature formula, Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Romberg's rule, wedge rule, Difference Equation: Definition, order and degree of a difference equation, linear difference equations, Difference equations reducible to linear form, simultaneous difference equations with constant coefficients.

UNIT - V Numerical solution of ordinary differential equations: Taylor series method, Picard's Method, Euler's method, Modified Euler method, Runge-Kutta method, Numerical solution of partial differential Equations: Classification of P.D.E. of 2d second order elliptic equations, solution of Laplace equation, solution of Poisson's equation, solution of elliptic equation by relaxation method, parabolic equations.

Books Recommended:

1. IAN S. EDWARDS: Numerical Methods for Scientific and Engineering Computers.
2. S.D.G.S. Numerical Analysis.
3. Numerical Methods in Engineering and Science.
4. D.S.R. Advanced Engineering Methods.
5. Kipriyanov: Elementary Numerical Methods.

BDS held on 24th June 2016.

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CH17PCHE117: Inorganic Chemical Technology (300)

Unit A: Water and Sulfur Chemistry: (a) (i), (ii) Sulfuric, SO₂, SO₃, SO₃H₂ processes, Sodium Chloride, etc. (b) (i).

Unit B: (Chemical Industries): Common salt, Chemicals from sea brines.

Unit C: Industrial Gases and Selective Inorganic Chemicals: Manufacture and use of H₂, CO, CO₂, NH₃, SO₂, Acetylene, Oxygen, Nitrogen and inert gases. Inorganic chemicals: Boron, Boron chemistry, Boric acid, Borax, etc.

Unit D: Fertilizers: (a) (i) (ii), (iii) and classification of fertilizers, Raw materials, Hydrocyan production, Formulation of fertilizers, Synthetic Ammonia based fertilizers, Phosphoric acid, Phosphoric acid and other fertilizers (DAP, TSP, MAP, DAP and calcium phosphate), Potash fertilizers, HPR, conversion of minerals to fertilizers, construction, Bio-fertilizers.

Unit E: Silica Acid: Manufacture, Special materials of construction, Storage and modified storage process, Environmental considerations, Corrosion problems and materials of construction.

Unit F: Alkali Industry: Electrochemistry of brine, electrolysis, Current efficiency, Energy efficiency, Diaphragm cells, Mercury cells, Mercury pollution and control, Caustic soda, Chlorine, Hydrochloric acid, Environmental problems and materials of construction.

Unit G: Cement, Glass and Refractory: Manufacture, Environmental considerations, Corrosion problems, Engineering problems and materials of construction.

Books Recommended:

1. Chemical Process Industries - H.F. Shreve B.T.A. (1986)
2. Inorg. Tech I, II, III, IV - I.T. Khanna
3. Inorganic Chemical Technology by Heyden (G. H. N. Rao and M. Srinivas)

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Department: _____
Institution: _____

SCS held on 18th June 2016

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GMPC03: Mechanical Operations (300)

Unit I - Solid Properties, Handling, Storing, Storage & Transportation - Characterisation of solid particles, Particle shape, Size, Size analysis, Number of particles, Masses, Surface areas, Fluidised beds, Size classification for fine particles, Storage of solids, Conveying systems - Mechanical and pneumatic (basic operations), **Flow of Solids** - Types of equipment (hoppers, bins, chutes, augers, mixers, etc.) and their design, Material flow, and mixer, pneumatic classifiers, cyclones, etc., Mixing rules.

Unit II - Size Reduction - Principles, Major equipment - Crushers, grinders, miller, crushers, cutting, crushing theory & power calculations for size reduction, Closed circuit and open circuit grinding.

Unit III - Settling & Flotation - Classification and sedimentation, Flow of solids through tanks, hoppers, etc., Free and hindered settling, Types of classifiers (static & continuous), Settling chambers, Cyclones & water cyclones and their design, Dust and slurry collectors, Electrostatic precipitators, Filter bags, Vestal separators.

Unit IV - Mechanical Separations - Industrial processes, their principle and efficiency, Filtration - Theory, hand and continuous filtration equipment and their functioning, Filtration, Clarifiers - Principles only, Centrifugal separation for liquid mixtures.

Unit V - Flotation - Flow of fluids through beds of particles, General flotation systems, Froth - Flotation, Column, Egger's method, Aggregate and particle size distribution, Minimum velocity, Density, Expansion of dispersed fluid, industrial applications.

Books Recommended:

1. The operations of chemical Engineering by McKee Smith and Throck, Fifth edition McGraw Hill Inc.
2. Chemical Engineering by I.M. Colson and Richardson Vol-II.
3. Unit Operations for Chemical Engineering by G.C. Brown & Associates.
4. Unit Operations in Chemical Eng. by P. Chaudhry, Krishna Prakashan.

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 Dr. Chandra Prakash
 Professor & Head
 Chemical Engineering Dept.
 Institute of Technology, Raigarh

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CE442PC03G: Process Instrumentation (3-0-0)

Unit-I: Process Variables : Introduction to process variables, Static and Dynamic characteristics, characterization and their general classification.

Unit-II: Measuring Systems : Elements of measuring system and their functions, Signal transmission, Transmitters, Receivers, pneumatic transmitters.

Unit-III: Measuring Instruments : Principles, Construction and operation of instruments for the measurement, transmission, control and recording of various process variables such as temperature, pressure, flow, liquid level, humidity and composition.

Unit-IV: Electro-Pneumatic Transducer : Principle and construction of electro-pneumatic transducer, Pneumatic to electrical converter, Multiplexers, On/Off action and characteristics of final control elements such as pneumatic control valve, Stepper motor, Motorised valve, Principles and construction of pneumatic and electro-pneumatic control.

Unit-V: Data Acquisition & Analysis : introduction to data acquisition system and intelligent instruments, Process communication diagram and symbols- instrumentation of process equipment such as distillation column, heat exchanger etc.

Books

1. Ramadani, H. "Principles of Industrial Instrumentation" Tata McGraw-Hill Publishing Co. Ltd.
2. Doolittle, T.G., Marangoni, R.D. and Liebhart, J.H. "Mechanical Measurements", Addison-Wesley.
3. Jain, H.K. "Mechanical and Industrial Measurements", Krishna Publishers, New Delhi.
4. Johnson, C.D. "Process Control Instrumentation Technology", Pearson Education, Inc.

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Dr. Chandra Prasad
Head of the Dept.
Chemical Engineering
Jodhpur Institute of Technology

8/3/2016 at 2:07 hours 2016

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INSTITUTE OF TECHNOLOGY

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SCHEME FOR EXAMINATION

B.Tech. (FOUR YEAR DEGREE COURSE) - CHEMICAL ENGINEERING

THIRD YEAR, FIFTH SEMESTER

Paper Code	Subject	Periods			Evaluation Scheme		Total	Credits
		L	T	P	TA	ESE		
THEORY								
CH3501	Heat Transfer	3	1	-	40	60	100	4
CH3502	Mass Transfer - I	3	1	-	40	60	100	4
CH3503	Process Dynamics & Control	2	1	-	40	60	100	4
CH3504	Chemical Reaction Engineering - I	3	1	-	40	60	100	4
CH3505	Organic Chemical Technology	3	1	-	40	60	100	4
PRACTICAL								
CH3506	Heat Transfer	-	-	3	40	20	60	2
CH3507	Mass Transfer - I	-	-	3	40	20	60	2
CH3508	Process Dynamics & Control	-	-	3	40	20	60	2
Total							650	26

TA - Internal Assessment

ESE - End Semester Examination

BOM/Engd/02/06/17 July 2013

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SCHEME FOR EXAMINATION

B.Tech. (FOUR YEAR DEGREE COURSE) - CHEMICAL ENGINEERING

THIRD YEAR, SIXTH SEMESTER

Paper Code	Subject	Periods			Evaluation Scheme		Total	Credits
		L	T	P	IA	ESE		
THEORY								
CH3601	Mass Transfer - I	3	1	-	30	60	100	4
CH3602	Process Equipment Design - I	3	1	-	40	60	100	4
CH3603	Fuel Combustion & Energy Technology	3	1	-	40	60	100	4
CH3604	Chemical Reaction Engineering - II	3	1	-	40	60	100	4
CH3605	Engineering Materials	2	1	-	40	60	100	4
PRACTICAL								
CH3606	Mass Transfer - II	-	-	3	30	60	90	2
CH3607	Fuel Combustion & Energy Technology	-	-	3	30	60	90	2
CH3608	Chemical Reaction Engineering	-	-	3	30	60	90	2
Total							650	26

IA - Internal Assessment

ESE - End Semester Examination

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**SCHEME FOR EXAMINATION
B.Tech. (FOUR YEAR DEGREE COURSE) - CHEMICAL ENGINEERING**

FOURTH YEAR, SEVENTH SEMESTER

Paper Code	Subject	Periods			Evaluation Scheme		Total	Credits
		L	T	P	IA	ESE		
THEORY								
CH4704	Project Engineering, Economics & Management	4	1	-	20	80	100	4
CH4702	Process Equipment Design - II	3	1	-	30	70	100	4
CH4703	New Separation Processes	3	1	-	40	60	100	4
CH4705	Transport Phenomena	3	1	-	40	60	100	4
CH4705-06	Elective - I*	1	1	-	40	60	100	4
PRACTICAL								
CH4707	Computer Aided Design & Simulation	-	-	3	30	20	50	2
CH4708	Vocational Training Viva Cum Seminar	-	-	3	30	20	50	2
CH4709	Minor Project	-	-	3	30	20	50	2
Total							650	26

IA - Internal Assessment

ESE - End Semester Examination

- * CH4705 - Petroleum Refinery Engineering
CH4705 - Polymer Technology - I

105 total on 9th July 2023

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INSTITUTE OF TECHNOLOGY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A Central University Established by the Central Universities Ordinance 1994 No. 25 of 1994)

SCHEME FOR EXAMINATION

B.Tech. (FOUR YEAR DEGREE COURSE) - CHEMICAL ENGINEERING

FOURTH YEAR, EIGHTH SEMESTER

Paper Code	Subject	Periods			Evaluation Scheme		Total	Credits
		L	T	P	IA	ESE		
THEORY								
CH4001	Process Utilities and Safety	3	1	-	70	30	100	4
CH4002	Deterioration Techniques of Chemical Engineering	3	1	-	70	30	100	4
CH4003	Environmental Pollution Control Engineering	3	1	-	70	30	100	4
CH4004-05	Elective - II*	3	1	-	70	30	100	4
PRACTICAL								
CH4006	Environmental Pollution Control Engineering	-	-	3	20	20	50	2
CH4007	Major Project	-	-	12	30	60	150	6
CH4008	Comprehensive Viva	-	-	-	-	50	50	2
Total							650	24

IA - Internal Assessment

ESE - End Semester Examination

* CH3004 - Petrochemical Engineering

CH3005 - Polymer Technology- II

BOS held on 06th July 2013

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B.Tech - V Semester

GH3301: Heat Transfer (3 x 30)

Unit I - Conductive Heat Transfer: Heat transfer by conduction in solid, Fourier's law, Compound resistance in series, Heat flow through a cylinder, Unsteady state heat conduction with application.

Unit II - Convective Heat Transfer: Heat transfer by forced convection in laminar and turbulent flow, Natural convection, Counter current, parallel flow, cross flow, Thermal analysis of heat exchangers, Rate of heat transfer, Overall heat transfer coefficient, Individual heat transfer coefficient, Fouling factor.

Unit III - Radiative Heat Transfer: Electro-magnetic radiation, Radiation heat transfer, Wien's displacement law, Kirchhoff's law, Stefan-Boltzmann law, Radiation between surfaces, Combined heat transfer by conduction, convection and radiation.

Unit IV - Heat Transfer Equipments: Heat exchangers and general design of parallel, counter current, Shell & tube heat exchanger, extended surface equipment.

Unit V - Heat Transfer with phase change: Evaporation - Types of evaporators and needs of their applications, single and multiple effect evaporators, their design and operation, Vapor compression, Heat transfer from condensing vapours, Heat transfer to boiling liquids.

Books Recommended

1. Process Heat Transfer by D.Q.Kern.
2. Heat Transmission by Mc Adams.
3. Unit Operations of Chemical Engineering - McCabe Warren, L Smith, Julian C and Harrow Peter, Fifth edition McGraw Hill Inc.
4. Chemical Engineering - Coulson J. M, Richardson Vol.1

BOS held on 06th July 2013



CHE3502: Mass Transfer - I (2+10)

Unit I: Principle of Diffusion: Theory of diffusion, Fick's first and second law of diffusion in gases and liquids, Diffusion coefficients, Mass transfer coefficient for mass transfer through known areas.

Unit II: Phase Equilibria: Vapour-liquid equilibrium: p - x and p - y phase diagrams, Raoult's law, Henry's law, Solubility of gases, Fugacity-concentration diagrams, Equilibrium Stage Operations Principles, Determination of number of ideal stages for two component systems by graphical and absorption factor methods, Application of enthalpy-concentration diagrams, Multi-component systems.

Unit III: Distillation: Flash distillation, Design and operation characteristics of plate columns, Analysis of fractionating column by McCabe Thiele's method and enthalpy-concentration diagram method, Effect of reflux ratio, Design of sieve plate columns, Plate efficiency, Azeotropic distillation, Steam distillation.

Unit IV: Gas Absorption: Design of packed towers, Principles of absorption, Rate of absorption, Two film theory, Overall coefficients, HTU method, Interrelation between heat transfer, momentum transfer and mass transfer.

Unit V: Adsorption: Types of adsorption, Commercial adsorbent and their application, Characteristics and properties of adsorbents, Adsorption equilibria, Specific surface area of an adsorbent, Selection of adsorbent, Single stage and multistage operation, Rate of adsorption and breakthrough curve, Elution, Ion-exchange.

Books Recommended

1. Mass Transfer by Robert E. Treyb, McGraw Hill Inc.
2. Unit Operations of Chemical Engineering by McCabe, Smith and Harriott, Peter Hill edition McGraw Hill Inc.
3. Introduction to Chemical Engineering by Sulger & Ramchara, TATA McGraw Hill Inc.

BCS held on 09th July 2013



CH3503 : Process Dynamics and Control (3+0)

Unit I : Process Control - Importance of process control in chemical plants and processes. Various types of Control systems viz. open loop and closed loop control, feedback and feed forward control, servo and regulator control; importance of dynamic behavior of processes in process control; Physical and block diagram representations of control system; Use of Laplace transformation in analysis of control systems.

Unit II : Simple System Analysis - Laplace transformation and transfer function, Block diagrams, Linearization, First and higher order systems, Interacting and non-interacting systems, Distributed and lumped parameters systems, Dead time.

Unit III : Linear Open Loop Systems : Response of first order, second order and higher order systems; Linearisation of non linear systems; Transportation lag.

Linear Closed Loop Systems : Study of various control system and their components viz: controllers, final control elements; Measuring instruments; Closed loop transfer functions; Transient response of simple control system; Stability criteria and analysis.

Unit IV : Root locus, Stability Criterion and Transient Response :

Transient response analysis from root locus, Application of root locus in control system, Routh stability criterion.

Unit V : Frequency Response Analysis : Design of control system by frequency response. Closed loop response by frequency response, Frequency response technique: Phase margin and gain margin, Bode stability criterion, Nyquist stability criterion.

Books Recommended:

1. Coubournie, D.H., Process Systems Analysis and Control, McGraw-Hill Inc.
2. Stephanopoulos, G., Chemical Process Control, Plentice-Hall.
3. Seider, D.E., Edgar, T. and Melikamp, D.S., Process Dynamics and Control, John Wiley and Sons, Inc.
4. Bequette, B.W., Process Control: Modeling, Design, and Simulation, Prentice-Hall, Inc.
5. Process Control by H. Aron, P. TMHeds.

BOS held on 06th July 2013



CH 3504: Chemical Reaction Engineering - I (3+0)

Unit I : Kinetics of Homogeneous Reactions : Kinetics and thermodynamics of chemical reactions, Kinetics of heterogeneous reactions rate theories, Analysis of rate orders.

Unit II : Interpretation of Batch Reactor Data : Irreversible reaction, Total pressure method of kinetic studies, Analysis of complex rate equations, Complex reactions, Chain reaction, Spontaneous reactions, Rate constants and equilibrium.

Unit III : Ideal Reactor for Single Reaction : Ideal batch reactors, Steady state mixed flow reactor, Steady state plug flow reactor, Size comparison of single reactor, Multiple-reactor system.

Unit IV : Design for Multiple Reaction : Introduction to multiple reaction, Quantitative treatment of product distribution and reactor size for parallel reactions, Reversible first order reactions in series, Possible contacting pattern for irreversible reactions in series (First order k followed by first order)

Unit V: Temperature and Pressure Effects : Single reaction, General graphical design procedure, Optimum temperature progression, Heat effects- adiabatic and non-adiabatic operations, van Heulem relationship, Multiple reaction: Temperature and vessel size for maximum production.

Books Recommended

1. Chemical Engineering Kinetics by J.M. Smith
2. Chemical Reaction Engineering by O. Levenspiel
3. Elements of Chemical reaction Engineering by H.S. Fogler
4. Reaction Kinetics for chemical Engineering by S. L. Vasilev

BOS held on 06th July 2013



CHE385: Organic Chemical Technology (3:1:0)

Unit I: Dye & Soda: Name and scope, Major dye, soda's production in India, Synthesis, Solvent extraction, Energy & solvent requirements, Mineral salts and other color fixing materials, Hydrogenation of dyes, Common problems and materials of construction of equipments.

Unit II: Soap & Detergents: Raw materials, Manufacture of detergents, Active detergent matter, Biodegradability, Bio-splinting, Purification of fatty acids, Soap manufacture, Total fatty matters (TFM), Glycerin manufacture, Materials of construction.

Unit III: Cane Sugar: Cane production & varieties, Manufacturing equipment & technology, Cane sugar refining, Bagasse utilization, Energy requirements and recovery, Environmental considerations, Khandsari technology, Molasses based industries, Materials of construction.

Unit IV: Polymers: Name and scope, Applications, Classification of processes, Degree and modes of polymerization, Molecular weight and its distribution, Selected industrial polymerization including plastics, Synthetic rubber and polymeric foams, Synthetic fibers, Penicillin: Manufacturing process, scope and applications.

Unit V: Regenerated Cellulose: Growth of industry, Raw materials, Pretreatment, Pulping, Manufacture of paper, Recovery of chemicals, Environmental considerations, viscose rayon.

Varnishes and Paints: (scope and applications, Types of coatings, General manufacturing procedure, Environmental considerations.

Book Recommended:

1. Chemical Process Industries-R.S. Shrivastava & I.A. Brink
2. Chemistry I, II, III, IV-IT Madras
3. Outline of Chemical Technology by Bryden, Co. M.G. Dan and M. Siring
4. Handbook of Oil & Colour, Chemical Association (CCA).

BOB held on 06th July 2013



B.Tech.VI Semester

CE3601: Mass Transfer – II (2+1+0)

Unit I: Humidification Operations: Definitions, Humidity chart and its use in measurement of humidity and calculation of humidification operations, Air-water humidification.

Unit II: Leaching: Qualitative Principles of leaching, Calculation of number of ideal stages, Stage efficiency.

Unit III: Liquid-Liquid Extraction: Equipment, Principles of extraction, Ponchon-Sorel method, Co-current extraction using reflux-application of McCabe method, Extraction in packed and spray columns.

Unit IV: Crystallization: Principles, yield of crystals, Super-satubility curve, Crystal growth, Equipment and application of principles to design.

Unit V: Drying: Equipment, Principles, Mechanism and theory of drying, Calculation of drying time.

Books Recommended

1. Mass Transfer by Robert E. Treyb, McGraw Hill Inc.
2. Unit Operations of Chemical Engineering, Mc Cabe Warren, L. Smith, Julian C and Harriott, Peter H.H. ed. McGraw Hill Inc.
3. Introduction to Chemical Engineering, by Balcor & Bonduetto, TATA McGraw Hill Inc.



CH3602: Process Equipment Design-I (1.1.3)

Pressure and Storage Vessels: Design of pressure and storage vessels and their supports. End closures, Flange Joints, Bolted Joints, Reinforcement, Dimensional and material code.

Heat Transfer Equipment: Double Pipe heat exchangers, Shell and tube heat exchangers, Vertical & Horizontal coils, reboilers and evaporators.

Books Recommended

1. Hand book of Chemical Engineering S.H.Perry
2. Tubular Heat Exchangers: Manufacturers Association Manual
3. IS Codes
4. Introduction to Chemical Equipment Design (Mechanical Aspects) by R.C. Bhattacharya
Chemical Engineering Education Development Center
5. Process Equipment Design by Kenneth E Young
6. Process Equipment Design by M.L. Joshi
7. Process Heat Transfer by Dabke
8. Heat Transmission by McAdams
9. Unit Operations of Chemical Engineering by McCabe Warren, L. Smith Julian C. and Harriot Peter Fifth edition McGraw-Hill Int.
10. Chemical Engineering by Coulson J.M., Richardson Vol-1

BCES hold on 16th July 2013



GE3603: Fuel Combustion & Energy Technology [3 | 0]

Unit I: Solid Fuel: Origin, Composition and classification, Properties & characteristics, Coal storage & usage of coal, carbonization of coal, Various classification systems of coal, Briquetting, Carbonisation, Gasification of coal, Bituminous coal, charcoal, gasification, woodchar, fuel.

Liquid Fuel: Origin, Composition and classification, Properties & characteristics of liquid fuel from petroleum, gasohol and bio-diesel.

Gaseous Fuel: Classification of gaseous fuel, Natural gas, LFG, Biogas, syngas, Proximate gas, Water gas, Breeze.

Unit II: Combustion Process: General principles of combustion of solid, liquid and gaseous fuels, flame and flame temperatures, Stought, limits of inflammability, Types of combustion, Preheating, Submerged, Pulsating, Flame combustion.

Unit III: Fuel Combustion Calculation: Stoichiometric air requirements and heating values, Combustion calculations with numerical examples.

Unit IV: Non - Conventional Energy Sources: General principles with applications and technology of solar energy, Geothermal energy, Wind energy, Nuclear energy, Hydroelectric energy system, Hydrogen as source of energy, Fuel cells.

Unit V: Energy Audit and Conservation: Energy consumption pattern in various sectors, Various ways of energy conservation in various process industries, Energy efficient conversion devices.

Books Recommended

1. Fuel combustion Energy Technology by R.N. Saha : Dhanpat Rai Publication Co. Pvt. Ltd. New Delhi.



CH3604 : Chemical Reaction Engineering - III (3 : 10)

Unit-I : Basics of Non-Ideal Flow: Age distribution over time, the RTD, The system for non-ideal flow reactors, Models for non-ideal flow: dispersion model, Chemical reaction and dispersion, Tank in series model.

Unit-II : Mixing of Fluids: Self mixing of single fluid, degree of segregation, Early and late mixing, Mixing of two miscible fluids.

Unit-III : Fluid Particle Reactions: Decreased area model, Diffusion through gas film and ash layer control, Chemical reaction control, Rate of reaction for shrinking spherical particles, Deactivation of rate controlling step.

Unit-IV : Fluid - Fluid Reactions: Kinetic regimes for mass transfer and reaction, Rate equations for various regimes, Film coefficient parameters, Applications to design, Reactive and extensive reactions.

Unit V : Catalysis : Heterogeneous catalysts, General characteristics, Adsorption on solid surface, Physical properties of catalysts, Preparation of catalyst, Steps in catalytic reactions, Synthesizing the rate law.

Books Recommended

1. Chemical Engineering Kinetics J.M. Smith
2. Chemical Reaction Engineering Octave Levenspiel
3. Chemical Reaction Engineering H. Scott Fogler
4. Principles of Reaction Engineering, Central Techno Publications, Solihull, U.K.
5. Chemical Engineering, Volume IV, Coulson and Richardson



B. Tech. VII Semester

CH4701: Project Engineering, Economics & Management (3+1+0)

Unit I: Project Engineering: Introduction to project engineering, Difference between project & process engineering, Role of a project leader, factorial design considerations, First layout and site selection, Flow diagram- qualitative & quantitative, Concept of drafting, Concept of technical economic feasibility report.

Unit II: Project Finance & Accounts: Elementary knowledge of books of accounts-Journal, Ledger, Balance sheet, P/L a/c, Cost and asset accounting methods, Cost estimation, Cash flow statements, Production cost, Capital investment, Cost indices- Inflation and overhead cost, Interest and taxes.

Unit III: Profitability & Alternative Investment: Depreciation and IIR calculation methods, Scrap value, Salvage value, Book value, Market value, Methods of calculating profitability, Alternative Investments, Replacement of assets, Rate of return, Payback period, Discounted cash flow, Break Even Analysis: Break even analysis, Break even chart & its importance.

Unit IV: Project Scheduling: Importance of project and required scheduling and steps, Network techniques, CPM, PERT, Gantt Chart.

Unit V: HR Personnel & Administration: Importance & role of this management function, Recruitment process, Training & Development, Job evaluation- Job analysis, Performance appraisal, Wages & salary Administration, Wage policy, Wage survey, Negotiation, Rewards, Motivation, Job engagement & job enrichment, Brief concepts of public relations, Brief introduction to Indian Factory Act.

Books Recommended

1. Plant layout & location for chemical engineers by M.S. Peters & K. D. Timmerhaus.
2. Engineering Economics by Tarechand

IOS held on 06th July 2013



CH4702 : Process Equipment Design (I (1.1.3))

Mass Transfer Equipment - Absorbers, tower, Distillation tower, Tower and Column trays.

Books Recommended

1. Hand Book of Chemical Engineering J. H. Perry
2. Coulson & Richardson Vol. VI
3. Mass Transfer by R. Treybal
4. ISI Codes

Candidates have to bring their own copies of ISI Code book, if it is not supplied by the university or the examination centers.

8045 held on 08th July 2013



CH4703 - New Separation Processes (1.1.1)

Unit I: Overview of Separation Processes: Basic concept of separation processes; Physico-chemical properties and other factors controlling separation; Limitations of Conventional separation processes and new separation processes; Equilibrium and rate governed separation processes.

Unit II: Membrane Separation Processes: Principle of membrane separations process; Advantages and disadvantages; Classification; membrane materials; general methods of preparation and characterization of membranes; Membrane modules; Transport equations and concentration polarization.

Unit III: Porous Membrane Based Processes: Reverse osmosis, Ultra-filtration, Micro-filtration, Nano-filtration, Dialysis, Ion-selective membranes and electrodialysis; Industrial applications of porous membrane based processes.

Unit IV: Non-porous Membrane Based Processes: Gas separation; Permeation; Gas separation; Supported and un-supported liquid membranes and their industrial applications; Carrier facilitated transport.

Medical applications of membranes; Miscellaneous membrane processes: diahem, medicine distillation, membrane reactors.

Unit V: Other Non-conventional Separation Processes: Foam and bubble emulsification; Principle, classification, separation techniques, column operations; Adsorption and Extractive Separation- Pressure and temperature swing adsorption, Cyclic adsorption, Super-critical fluid extraction; Parametric pumping; Batch, continuous and semi-continuous pumping; Thermal, pH and heat sensitive gravimetric pumping.

Books:

1. Seader, J.D. and Holey E.J., "Separation Process Principles", John Wiley & Sons Inc.
2. King C.J., "Separation Processes", McGraw-Hill, Inc.
3. Mada, K., Membrane Separation Processes, PHI, New Delhi (2008)
4. Baker, R.W. Membrane Technology and Applications, John Wiley and Sons, Ltd, UK (2009)

8245 held on 10th July 2013



CH4705 : Petroleum Refinery Engineering (3-1-6)

Unit I : Petroleum Grade and Refining : Structure of petroleum grade, Origin & occurrence, composition, Classification & physical properties of petroleum grade. Conversion of organic matter into petroleum grade, Different sources of petroleum oil, Refining of petroleum grade, Type of refineries, Planning for operation of oil refinery.

Unit II : Physical Properties and Testing Methods of Petroleum Products : Physical-chemical properties of various petroleum products as per API / ASTM / IS specifications.

Unit III : Crude Processing : Treatment of crude, atmospheric and vacuum distillation, cruda, Distillation & equilibrium, Degree of separation, Type of trays of distillation column & re-florents, Types of distillates in a petroleum industries.

Unit IV : Cracking & Reforming Operation : Cracking, Type of cracking, Thermal cracking, catalytic, Dimer process & tube still process of thermal cracking, Visbreaking, delayed coking & fluidized coking, Catalytic cracking, Fixed & moving bed catalytic cracking, Thermal reforming, Catalytic reforming processes.

Unit V : Chemical Treatment & Refining Operation : Chemical treatment of petroleum products, Caustic soda treatment, Treatment with H_2SO_4 & Hg , Stergum removal & oxidation process, Sulphur removal from petroleum products - Docton's treatment, hydro-de-sulphurization, dewaxing and refining of lubricating oils.

Books Recommended :

1. Petroleum Refinery Engineering by W.L. Sabara
2. Petroleum Refining by Gary and Handwerk, Marcel Dekker
3. Petroleum Refining & Petrochemicals by N.K. Saha, French Publications New Delhi.

IOS held on 06th July 2013



CH44022: Optimization Techniques in Chemical Engineering (3 E.C)

Unit I : System Analysis and Modelling : Introduction to systems analysis and modeling with reference to chemical engineering processes. Differential method for solving one and two variable problems with and without constraints. Case studies. Application of Lagrangian multiplier method.

Unit II : Linear Programming : Modeling, Graphical method, Single phase, simplex method, Two phase simplex method, Duality, Sensitivity analysis.

Unit III : Geometric Programming : An account to chemical engineering problems with degree of difficulty equal to zero and one. With and without constraints.

Unit IV : Search Methods : Sequential search methods - Golden section method, Exclusionary search method, Intersect halving method, Fibonacci method.

Unit V : Dynamic Programming : Introduction to dynamic programming as applied to discrete multistage problems like cascade of CSTR, Train of heat exchanger etc., Computer programming techniques applied to optimization.

Book Recommended:

1. Optimization Theory and Practice by Bevanidge and Schechter
2. Optimization Techniques for Chemical Engineers by Aggarwal Hussain
3. Optimization by G.S. Rao
4. Linear Programming by Hadley

BOS held on 10th Feb 2023






CE84003 - Environmental Pollution Control Engineering (2 + 0)

Unit I - Environmental Pollution and its Effect : Environment and its components, Sources and type of pollutants, General effect on man, animal, vegetation and property.

Unit II - Air Pollution : Air quality criteria and standards; Ambient air sampling and analysis; Stack emission standards; Stack sampling and analysis; Meteorology and dispersion of air pollutants; Atmosphere: lapse rate and stability; Photo chemical; Control of gaseous and particulate pollutants (from mobile and stationary sources).

Unit III - Water Pollution : Water quality criteria and effluent discharge standards; Domestic and industrial sources of waste water; Waste water sampling and analysis methods as per BIS specifications; Physico-chemical and biological methods of waste water treatment; Recovery of material from process effluents.

Unit IV - Pollution free to Hazardous Industrial Waste : Nature of hazardous waste materials from various chemical and allied industries; Methods of disposal, destruction and reuse; Hazardous wastes and their management; Solid waste from commercial, domestic and industrial sectors-composition and characterization, recycle, resource recovery and disposal.

Unit V - Environmental Pollution Management : Case studies of air and water pollution control in chemical industries.

Books Recommended:-

1. Environmental Pollution Control Engineering by C. S. Ron, New Age International Ltd.
2. Environmental Engineering by R.N Hazak, Tata McGraw Hill Pub. Co. Ltd.
3. Essentials of Environmental Studies by K. Joshi and B. Nagarkar, Patriot Education (Singapore) Pvt. Ltd.

4035 Inhdvsa 001 July 2013



CH4804: Petrochemical Technology (1.1.3)

Unit I: Survey of Petrochemical Industries - Petrochemical industries in India: Plastics and synthetic fibre industries. Product of petroleum industries. Feed stocks in petrochemical production. Fractionation and separation of feed stocks.

Unit II: C₁ and C₂ Hydrocarbons - Chemicals from methane, ethane, ethylene and acetylene, synthesis gas as a feed stock for chemical industries. Nicholas cracking and reforming. Hydrogen from reforming of hydrocarbons.

Unit III: Chemicals from C₃, C₄ and Higher Fractions - Carbon compound, Dehydrogenation of hydrocarbon and higher paraffins, Greases and lubricants, Polymer and their properties. Polymers from olefins: polyethylene (HDPE, LDPE), Polypropylene, Vinyl polymers.

Unit IV: Aromatic Hydrocarbons - Production of BTX, Benzene derivatives, Products from toluene, Oxidation products of toluene, Synthetic fibres and their production, Synthetic rubber and its production.

Unit V: Plastics - Classifications of plastics, Different types of resin and their production, ABS plastic, Poly carbonate (PC), Poly urethanes, Polyimides, Polystyrene, Synthetic detergents and their production.

Books Recommended:

1. Modern Petroleum Technology by G.D. Hobson and W.Pow
2. A Textbook on Petrochemical Technology by Bhaskara Rao.

BOS held on 05th July 2013



INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by Central University Ordinance 2009, No 3 of 2009)

SCHEME FOR EXAMINATIONS

M.Tech. (TWO YEARS POST GRADUATE COURSE), CHEMICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER

S. No.	Course No.	Subject	Periods /week	Evaluation Scheme			Credits
	Theory			IA	ESE	Sub. Total	
01.	CHPG1101	Advanced Heat Transfer	3	40	60	100	3
02.	CHPG1102	Chemical Reactor Design	3	40	60	100	3
03.	CHPG1103	Fluidization Engineering	3	40	60	100	3
04.	CHPG1104	Process Optimization	3	40	60	100	3
05.	CHPG1105	Elective - I	3	40	60	100	3
Practical							
06.	CHPG1106	Chemical Engineering Computational Lab	3	50	--	50	2
Total						550	17

IA- Internal Assessment

Total Marks - 550

ESE- End Semester Examination

Total Credits - 17

BOS held on 06th July 2013



INSTITUTE OF TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by Central University Ordinance 2009, No 3 of 2009)

SCHEME FOR EXAMINATIONS

M.Tech. (TWO YEARS POST GRADUATE COURSE), CHEMICAL ENGINEERING

FIRST YEAR

SECOND SEMESTER

S. No.	Course No.	Subject	Periods /week	Evaluation Scheme			Credits
	Theory			IA	ESE	Sub. Total	
01.	CHPG1201	Advanced Fluid Mechanics	3	40	60	100	3
02.	CHPG1202	Advanced Mass Transfer	3	40	60	100	3
03.	CHPG1203	Industrial Pollution Control Technologies	3	40	60	100	3
04.	CHPG1204	Design and Development of Catalyst	3	40	60	100	3
05.	CHPG1205	Elective - II	3	40	60	100	3
Practical							
06.	CHPG1206	Project	3	50	--	50	2
07.	CHPG1207	General Seminar	2	50	--	50	1
Total						600	18

IA- Internal Assessment

Total Marks - 600

ESE- End Semester Examination

Total Credits - 18

BOS held on 06th July 2013



Elective - I (CHPG1105)

1. Operations Research & Management
2. Advanced Wastewater Treatment Technology
3. Numerical Methods for Chemical Engineering
4. Chemical Process Modeling
5. Membrane Separation Processes

Elective - II (CHPG1205)

1. Safety Hazards & Risk Analysis
2. Advanced Process Control
3. Steady State Process Simulation
4. Process Intensification

BOS held on 06th July 2013.



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M. Tech. (Chemical Engineering)

CHPG1101: Advanced Heat Transfer

General equation of heat conduction, Transient heat Conduction numerical and analytical methods for the solution of transient heat conduction problems. Critical radius and optimum thickness of insulation. Free convective heat transfer under different situation and application of dimensional analysis to estimate the convective heat transfer coefficients. Heat transfer factor Reynolds No. Plot. Analogy equation for heat momentum transfer. Boiling heat transfer with particular reference to Nucleate and film boiling and estimation of boiling heat transfer coefficient. Heat transfer from condensing vapors. Nusselt equation for film type condensation of vapors over vertical surfaces and inclined tubes. View factors and emissivity factors for different situation. Radiation shield and radiation error in pyrometry. Combined conduction, convection and radiation heat transfer.

Texts/References

- Hallman J. P., Heat Transfer Operation, McGRAW-Hill
- R.C.Sachdeva, Fundamentals of Engineering Heat & Mass Transfer.
- Bird, R. B, Steward, W.E and Lightfoot E. N., Transport Phenomena, Second edition, John Wiley and sons.
- Deen W. M., Analysis of Transport phenomena, Oxford University Press, 1998.
- Slattery J. C., Momentum Heat and Mass Transfer, Krieger Publishing, 1981

BCS held on 05th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M.Tech. (Chemical Engineering)

CHPG1102 : Chemical Reactor Design

Review of Design of ideal isothermal homogeneous reactor for single and multiple reactions. RTD of ideal reactor. Interpretation of RTD data. Flow models for non ideal reactors: dispersion model, N tanks in series, multi parameter model, diagnosing the ills of reactor. Influence of RTD and micro mixing on conversion. Adiabatic and non adiabatic operations in batch and flow reactors. optimal temperature in progression. Hot spot in tubular reactor auto thermal operation and steady state multiple steady state Introduction to bifurcation theory Catalytic reactors, effectiveness factor, selectivity, catalyst deactivation, Design of heterogeneous catalytic reactors.

Text/References

- James J Carberry: Chemical and catalytic reaction engineering McGraw Hill
- J M Smith " Chemical Engineering Kinetics", McHill
- O. Levenspiel " Chemical Reaction Engineering", Wiley Eastern, 2nd ed. 1972
- Froment G. F, Bischoff K. B: " Chemical Reactor Analyzer and design" John Wiley & Sons
- H. S. Fogler: Elements of Chemical Reaction Engineering

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M.Tech. (Chemical Engineering)

CHPG1103: Fluidization Engineering

Phenomena of Fluidization, Industrial applications of fluidized beds, Gross behavior of fluidized beds-Minimum fluidizing velocity and pressure drop; Voidage, Transport disengaging height; Bubbles in dense beds-Davidson Model, stream of bubbles, Bubbling bed models, Emulsion phase, Turn-over rate of solids, Residence Time Distribution of Solids, Diffusion model of solids movement, Interchange coefficient of solid into and out of wake; Flow Pattern of Gas through fluidized beds, diffusion model for gas flow; two region models, evaluation of interchange coefficients, Mass and heat transfer between fluids and solid- from bubbling bed models; Catalytic conversion from bubbling bed model; contacting efficiency; application to successive reactions; Theories and bed wall heat transfer; comparison of theories; Entrainment and elutriation, Circulation rates of solids, flow of high and low bulk density mixtures; Design for catalytic reactors; Design for non catalytic gas-solid reactors.

Text/References

- D Kunin and O Levenspiel, Fluidization Engineering, John Wiley, 1969
- J. F. Davidson and D. Harrison, Fluidization, Academic Press 1971.
- F.A. Zenz and D. F. Othmer, Fluidization and Fluid Particles Systems, Reinhold Publishing, 1960

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M. Tech. (Chemical Engineering)

CHPG1201: Advanced Fluid Mechanics

The Physical Properties of Fluids. Newtonian and Non Newtonian and non viscous fluid. Kinematics of the Flow Field: Specification of the flow field. Continuity Equation in Cartesian, Cylindrical and Spherical coordinates, Derivation of general momentum equation for Newtonian fluid in Cartesian coordinates, Euler's Equations principles of rotational and irrotational flow, velocity potential, Bernoulli's Equation, Laplace equations, stream function, vorticity, Cauchy Riemann Equation, Analytical solution for simple two dimensional irrotational fluid flows: flow along to inclined plates, Stokes law of viscosity, Navier-Stokes equation, creeping flow around a solid sphere, expression for total drag, turbulent flow: transition to turbulence, Prandtl's mixing length, turbulence models. Boundary layer on immersed bodies, two dimensional boundary layer equation, laminar boundary layer on flat plate (Blasius Exact solution), Von-Karman's Integral momentum equation, boundary layer separation flow and pressure drag, flow of compressible fluids, thermodynamic considerations, continuity and momentum equation for one dimensional compressible flow.

Text/References

- Bird, R. B., Stewart, W.E. and Lightfoot E N., Transport Phenomena, Second edition.
- R. W. Fox, A.T. McDonald, P.J. Pritchard: Introduction to Fluid Mechanics, John Welly 6th Edition.
- J.G. Krudusan, D.L. Katz: Fluid Dynamics & Heat Transfer, McGraw Hills

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M.Tech. (Chemical Engineering)

CHPG1202 : Advanced Mass Transfer

Qualitative behavior of the vapour-liquid equilibria (VLE). Simple models for vapour-liquid equilibria: Raoult's and Henry's laws. Dew point and bubble point calculations. VLE by modified Raoult's law and K-value correlations. Flash calculations.

Ternary and multicomponent system, fractionation. Theories and design. No. of plates. Lewis Sorel's method, minimum reflux ratio. Underwood's equation. Colburn's equation.

Unsteady state mass transfer, multicomponent Gas-Phase systems, effective diffusivity, Maxwell's law, Regular and Random surface renewal, Harriot Model, Danckwerts model.

Mass Transfer across a phase boundary - the film-penetration theory, other theories of mass transfer. Interfacial turbulence, Mass Transfer coefficient. Applications of theories of interphase transfer. Mass Transfer and chemical reaction - steady state and unsteady state

Momentum, heat and mass transfer, molecular diffusion, Eddy diffusion, mixing length and eddy kinematics viscosity, overview of all separation processes including adsorption

Universal velocity profile - The laminar sub-layer, the buffer layer, Reynolds analogy, Taylor - Prandtl Modifications.

Text / References :

- J.D. Seader, Ernest J. Henley : Chemical Engineering Principles.
- J.M. Coulson & J.F. Richardson: Chemical Engineering.

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M.Tech. (Chemical Engineering)

CHPG1203: Industrial Pollution Control Technologies

Brief review of industrial, municipal and natural Pollution sources, dynamics of pollutants from point, non-point, line and area sources; Generation, transport and decay of air pollutants; Sampling and monitoring methods;

Strategies and methods for removal of gaseous pollutants and particulates from process exhaust streams; Air pollution abatement technology; Detail design of particulates and gaseous emission control equipment; Air pollution indices; Air pollution survey; Costs of air pollution control, Air Pollution legislation and regulations.

Case studies of a few industrial pollution control system

Waste water characteristics, Wastewater treatment objectives, methods and implementation considerations liquid hazardous waste treatment such as chemical, biological, and thermal oxidation, carbon adsorption, ion exchange.

Design of facilities for physical and chemical treatment; Design of facilities for treatment and disposal of sludge; Effluent disposal

Water pollution legislation and regulation

Text / References:

- K B Schuele & C. A. Brown, Air Pollution Control Technology Handbook, CRC Press
- H. S. Peavy, Donald R Rowe & George Tchobanoglous, Environment engineering, McGraw-Hill
- R. K. Trivedy & P K Goel, An Introduction to Air Pollution, Technoscience Pub.
- Dharmendra S. Sengar; Environmental Law, PHI
- De B. C. Arun Ku. Jain, Ashok Ku. Jain; Waste Water Engineering.

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M.Tech. (Chemical Engineering)

CHPG1204: Design and Development of Catalysts

Structure of solid surfaces: Chemisorption and physisorption: Thermodynamics and kinetics of surface processes: Principles of heterogeneous catalysis: Preparation, characterization and classification; Structure and activity; Lattice imperfection; Geometric and electronic factors: Preparation and characterization of catalysts.

Kinetics of heterogeneous reactions.

Physical **Chemical and mathematical description** of catalyst deactivation:

Deactivation by fouling, poisoning and sintering.

Deactivation and regeneration of catalyst pellets.

Deactivation and regeneration of fixed beds.

Dynamics of polyfunctional catalysts.

Electrocatalysis and photocatalysis.

Mechanism and kinetics of some typical heterogeneous catalytic reactions.

Applications in fertilizer, petroleum, petrochemical **industries and pollution control.**

Text / References:

- G. Poncelet, J. Martens, B. Delmon: Preparation of Catalyst VI : Scientific bases for the preparation of Heterogeneous Catalysts: Elsevier
- John Regalbuto: Catalyst Preparation : Science and Engineering: CRC Press

BOS held on 06th July 2013



Institute of Technology,
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

M. Tech. (Chemical Engineering)

Membrane Separation Processes

Principles, characteristic and classification of membrane separation processes;
Membrane materials, structures, and preparation techniques; Membrane modules;
Plant configurations.

Membrane characterization: Pore size and pore distribution; Bubble point test;
Challenge test: Factors affecting retentivity, concentration polarization, gel
polarization, fouling, cleaning and regeneration of membranes.

**Mechanisms of separation: Porous membranes, dense membranes, and liquid
membranes.**

**Membrane separation models: Irreversible thermodynamics; Capillary flow theory;
Solution diffusion model; Science and technology** of microfiltration, reverse osmosis,
ultrafiltration, nanofiltration, dialysis and electrodialysis, pervaporation, liquid
membrane permeation, gas permeation.

Membrane reactors: Polymeric, ceramic, metal and bio-membrane.

Tests/References

- J. D. Seader, Ernest J. Henley; Separation Process Principles.
- Phillip C. Wankat; Separation Process Engineering; PHI

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