List of Revised Courses

Department : Chemical Engineering

Programme Name : B.Tech. Chemical Engineering

Academic Year : 2023-24

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	AMUCTE1	Mathematics-III
02.	CHUCTT2	Chemical Engineering Thermodynamics
03.	CHUCTT3	Material & Energy Balances
04.	CHUCLT1	Basic Chemical Engineering Lab
05.	CHUDTT1	Particle and Fluid Particle Operations
06.	CHUDLT1	Particle and Fluid Particle Operations Lab
07.	CH407TPE53	Design and Development of Catalyst
08.	CH408TPE62	Optimization Techniques

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2022-23

School : *School of Engineering and Technology*

Department : *Chemical Engineering*

Date and Time : 15 December 2022, 11:00 AM

Venue : *HoD Room*

Minutes of Meeting

The scheduled meeting of members of Board of Studies (BoS) of Department of Chemical Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held today (June 28, 2023) in blended mode (online and offline). The agenda of the meeting was as follows:-

1. Approval of Scheme & Syllabus of B.Tech. Final Year (VII & VIII Semester) of Chemical Engineering (w.e.f. Session 2023-24).
2. Approval of Departmental Vision and Mission.
3. Review of COs of B.Tech. Chemical Engineering Subjects, as required.
4. Review of Scheme & Syllabus of M.Tech. (All Semester) of Chemical Engineering (w.e.f. Session 2023-24)

Following members were present in the meeting:

1. Dr. Raghwendra Singh Thakur, Chairman-BoS , Associate Prof. and Head, Dept. of Chemical Engg.
2. Prof. (Mrs) A B Soni, External Expert Member-BoS, Prof., Dept. of Chemical Engg., NIT Raipur
3. Er. Arvind Verma, External Industry Expert, Special Invitee-BoS, Senior Manager-Process, Nu-Vista (NUVOCO Cement), Baloda Bazar
4. Dr. Anil Kumar Chandrakar Member-BoS, Associate Prof., Dept. of Chemical Engg.
5. Dr. Saurabh Meshram, Member-BoS, Assistant Prof., Dept. of Chemical Engg.
6. Dr. Amit Jain, Invited Member, Associate Prof., Dept. of Chemical Engg.
7. Dr. Neeraj Chandraker, Invited Member, Assistant Prof., Dept. of Chemical Engg.
8. Dr. Anuradha N. Joshi, Invited Member, Assistant Prof., Dept. of Chemical Engg
9. Dr. Gautam Prasad Dewangan, Invited Member, Assistant Prof., Dept. of Chemical Engg.
10. Mr. Vishnu Prasad Yadav, Invited Member, Assistant Prof., Dept. of Chemical Engg.
11. Dr. Sandeep Dharmadhikari, Invited Member, Assistant Prof., Dept. of Chemical Engg.
12. Dr. Ghoshna Jyoti, Invited Member, Assistant Prof., Dept. of Chemical Engg.
13. Dr. Pankaj Kumar, Invited Member, Assistant Prof., Dept. of Chemical Engg.

Following decision has been made in the meeting.

1. The committee discussed the scheme and syllabi of B. Tech Fourth year (VII and VIII semesters) at length and after incorporating the changes, as identified by the BoS members, the final scheme and syllabi is to be sent to the external BoS members for their formal consent.

2. Two open elective courses, Waste To Energy (CH207TOE02) in B.Tech. VII Semester and Project Engineering Economics and Management (B.Tech. CH208TOE03) in B.Tech. VIII Semester, are to be offered by the department of chemical engineering.
3. Vision and Mission of the Department was finalized after discussion in the meeting.
4. Discussion was made on M. Tech. Scheme and Syllabus to modify and implement the changes in next BoS likely to be held in August 2023.

Dr. Raghwendra Singh Thakur

Prof. (Mrs) A B Soni

Er. Arvind Verma

Dr. Anil Kumar Chandrakar

Dr. Amt Jain

Dr. Saurabh Meshram,

Dr. Neeraj Chandraker

Dr. Anuradha N. Joshi

Dr. Gautam Prasad Dewanga

Mr. Vishnu Prasad Yadav

Dr. Sandeep Dharmadhikari

Dr. Ghoshna Jyoti

Dr. Pankaj Kumar

Academic Year : 2023-24

School : *School of Engineering and Technology*

Department : *Chemical Engineering*

Date and Time : 06 October 2023, 11:00 AM

Venue : *HoD Room*

Minutes of Meeting

The scheduled meeting of member of Board of Studies (BoS) of Department of Chemical Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur was held today (06/10/2023, Friday), through blended mode in Room no. G-14, to discuss the B.Tech. (Chemical Engineering) Second year (III and IV semesters) scheme and syllabi. Also to review the CO-PO mapping of M.Tech. program.

The following members were present in the meeting

1. Prof. A. B. Soni, External Expert Member-BoS (Prof., Dept. of Chemical Engg., NIT Raipur)
2. Dr. Raghwendra Singh Thakur, Chairman BOS & Head (I/c) (Associate Professor, Dept. of Chemical Engg.)
3. Prof. Anil Kumar Chandrakar, (Professor, Dept. of Chemical Engg.)
4. Dr. Saurabh Meshram, Member-BoS (Associate Professor, Dept. of Chemical Engg.)
5. Er. Arvind Verma, External Industry Expert Member-BoS (Senior Manager (Process), Nu-Vista (NUVOCO Cement), Baloda Bazar (Online)
6. Dr. Gautam Prasad Dewangan, Invited Member (Assistant Professor, Dept. of Chemical Engg.)
7. Dr. Neeraj Chandraker, Invited Member (Assistant Professor, Dept. of Chemical Engg.)
8. Dr. Anuradha N. Joshi, Invited Member (Associate Professor, Dept. of Chemical Engg.)
9. Dr. Amt Jain, Invited Member (Associate Professor, Dept of Chemical Engg.)
10. Mr. Vishnu Prasad Yadav, Invited Member (Assistant Professor, Dept, of Chemical Engg.)
11. Dr. Sandeep Dharmadhikari, Invited Member (Assistant Professor, Dept. of Chemical Engg.)
12. Dr. Ghoshna Jyoti, Invited Member (Assistant Professor, Dept. of Chemical Engg.)
13. Dr. Pankaj Kumar, Invited Member (Assistant Professor, Dept. of Chemical Engg.)

The following agenda was presented and approved.

1. The committee extensively discussed the scheme and syllabi of B. Tech Second year (III and IV semesters). After thorough discussions and incorporation of identified changes, the final scheme and syllabus with CO-PO mapping was approved.
2. The committee acknowledged that subject codes may be changed as per the University notification.
3. The CO-PO mapping of M.Tech. program was approved with some modification.

Prof. (Mrs) A B Soni
External Expert Member, BoS
Professor, Dept. of Chemical Engg.
NIT Raipur

Dr. Raghwendra Singh Thakur
Head (I/c) & Chairman-BoS
Associate Prof., Chemical Engg., GGV

Prof. Anil Kumar Chandrakar
Professor, Member-BoS,
Chemical Engg. GGV

Er. Arvind Verma
External Industry Expert Member, BoS
Senior Manager, NUVOCO Cement, Baloda Bazar

Dr. Saurabh Meshram
Member, BoS
Associate Prof.,Chemical Engg., GGV

Dr. Anuradha N. Joshi
Invited Member, BoS
Associate Prof., Chemical Engg., GGV

Dr. Gautam Prasad Dewangan
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Dr. Neeraj Chandraker
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Dr. Amt Jain
Invited Member, BoS
Associate Prof., Chemical Engg., GGV

.Mr. Vishnu Prasad Yadav
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Dr. Sandeep Dharmadhikari
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Dr. Ghoshna Jyoti
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Dr. Pankaj Kumar
Invited Member, BoS
Assistant Prof., Chemical Engg., GGV

Scheme and Syllabus

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Ordinance 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

B. TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

SECOND YEAR, THIRD SEMESTER (NEP)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	CIA	SEA	TOTAL	
01.	CHUCTT1	Fluid Mechanics	3	1	0	40	60	100	4
02.	CHUCTT2	Chemical Engineering Thermodynamics	3	1	0	40	60	100	4
03.	CHUCTT3	Material & Energy Balances	3	0	0	40	60	100	3
04.	CHUCTK1	Process Utilities & Safety	3	0	0	40	60	100	3
	CHUCTK2	Water Treatment and Management							
05.	AMUCTE1	Mathematics-III	3	0	0	40	60	100	3
06.	CHUCTO1	Engineering Materials	3	0	0	40	60	100	3
	CEUCTO1	Green Buildings							
	MEUCTO1	Introduction to Thermodynamics							
	IPUCTO1	I. C. Engine							
	CSUCTO1	Data Structure With C++							
	ITUCTO1	Computer Organization & Architecture							
	ECUCTO1	Data Communication							
	PRACTICAL								
01.	CHUCLT1	Basic Chemical Engineering Lab	0	0	2	25	25	50	1
02.	CHUCLT2	Fluid Mechanics Lab	0	0	2	25	25	50	1
		Total	18	2	4	290	410	700	22

CIA – Continuous Internal Assessment
SEA – Semester End Assessment

Total Credits – 22
Total Marks – 700
Total Periods / Week - 24

CIA-Shall be two class test (CT) I &II each 15 marks, 05 marks for assignment, surprise test, quiz etc. and 05 marks attendance
CH-Chemical Engineering, CE-Civil Engineering, ME-Mechanical Engineering, IT-Information Technology
IP-Industrial and Mechanical Engineering, CSE-Computer Science & engineering,
EC-Electronics and Communication Engineering

BoS Held on 06-10-2023

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Ordinance 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

B. TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

SECOND YEAR, FOURTH SEMESTER (NEP)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	CIA	SEA	TOTAL	
01.	CHUDTT1	Particle and Fluid Particle Operations	3	0	0	40	60	100	3
02.	CHUDTT2	Inorganic Chemical Technology	3	0	0	40	60	100	3
03.	CHUDTT3	Numerical Methods in Chemical Engineering	3	0	0	40	60	100	3
04.	CHUDTK1	Process Instrumentation	3	0	0	40	60	100	3
	CHUDTK2	Fluidization Engineering							
05.	CHUDTO1	Energy and Environment	3	0	0	40	60	100	3
	CEUDTO1	Remote Sensing & GIS							
	MEUDTO1	Introduction to Fluid Mechanics							
	IPUDTO1	Automobile Engineering							
	CSUDTO1	Introduction to Information Science							
	ITUDTO1	Computer Network							
	ITUDTO2	Fundamentals of Python Programming							
	ECUDTO1	Introduction to Electronic Devices & Circuits							
	ESUDTO1	Effective Technical Communication							
	PRACTICAL								
01.	CHUDLT1	Particle and Fluid Particle Operations Lab	0	0	2	25	25	50	1
02.	CHUDLT2	Numerical Methods in Chemical Engineering Lab	0	0	2	25	25	50	1
03.	CHUDPV1	Mini Project	0	0	4	50	50	100	2
		Total	15	0	8	300	400	700	19

CIA – Continuous Internal Assessment SEA – Semester End Assessment	Total Credits – 19 Total Marks – 700	Total Periods / Week - 23

CIA-Shall be two class test (CT) I &II each 15 marks, 05 marks for assignment, surprise test, quiz etc. and 05 marks attendance
CH-Chemical Engineering, CE-Civil Engineering, ME-Mechanical Engineering, IT-Information Technology
IP-Industrial and Mechanical Engineering, CSE-Computer Science & engineering,
EC-Electronics and Communication Engineering

BoS Held on 06-10-2023

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A Central University Established by the Central University Act 2009, No. 3 of 2009)

SCHEME FOR EXAMINATION (Effective from Session 2023-24)

B.TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

FOURTH YEAR, SEVENTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH407TPC14	Process Equipment Design-II	3	0	0	30	70	100	3
02.	CH407TPC15	Transport Phenomena	3	0	0	30	70	100	3
03.	CH407TPE4X	Professional Elective-IV	3	0	0	30	70	100	3
04.	CH407TPE5X	Professional Elective-V	3	0	0	30	70	100	3
05.	XX207TOEXX	Open Elective-II	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH407PPC09	Vocational Training Viva cum Seminar	0	0	4	30	20	50	2
02.	CH407PPC10	Minor Project	0	0	6	30	20	50	3
		Total	15		10	210	390	600	20

IA – Internal Assessment
Total Marks – 600

ESE - End Semester Examination
Total Periods / Week – 25

Total Credits – 20

1

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
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SCHEME FOR EXAMINATION (Effective from Session 2023-24)

B.TECH. (FOUR YEAR) DEGREE COURSE, CHEMICAL ENGINEERING

FOURTH YEAR, EIGHTH SEMESTER (AICTE-NEW)

S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme			Credits
						Sessional			
	THEORY		L	T	P	IA	ESE	TOTAL	
01.	CH408TPC16	Process Equipment Design-III	3	1	0	30	70	100	4
02.	CH408TPE6X	Professional Elective-VI	3	0	0	30	70	100	3
03.	XX208TOEXX	Open Elective-III	3	0	0	30	70	100	3
	PRACTICAL								
01.	CH408PPC11	Major Project	0	0	12	120	80	200	6
		Total	9	1	12	210	290	500	16

IA – Internal Assessment
Total Marks – 500

ESE - End Semester Examination
Total Periods / Week - 22

Total Credits – 16

2

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
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DEPARTMENT OF CHEMICAL ENGINEERING

List of Professional Elective Courses (Seventh and Eighth Semester)

S.No.	Semester	Course No.	Subjects
01.	VII	CH407TPE41	New Separation Processes
02.		CH407TPE42	Water Conservation and Management
03.		CH407TPE43	Process Modeling and Simulation
01.	VII	CH407TPE51	Petroleum Refinery Engineering
02.		CH407TPE52	Process Utilities and Safety
03.		CH407TPE53	Design and Development of Catalyst
01.	VIII	CH408TPE61	Environmental Engineering
02.		CH408TPE62	Optimization Techniques
03.		CH408TPE63	Petrochemical Technology

CHUDTT1 Particle and Fluid Particle-Operations [L:3, T:0, P:0]

Objectives 20%

Objective of this course is to introduce students to the numerous industrial operations dealing with the particulate solids, their handling in various unit operations, and those in which particle fluid interactions are important.

Contents: 20

Unit I : Solids Properties: Solid particle characterization: Particle size, shape and their distribution, Screen analysis, standard screens; Relationship among shape factors and particle dimensions; Specific surface area; Measurement of surface area.

Unit II : Storage and Transportation, Size reduction : Types of storage equipment, Bin, Silo, Hoper, etc. Transport of fluid solid systems: mechanical conveying, pneumatic and hydraulic conveying. Major equipment's- Crushers, grinders, ultrafine grinders, laws of communition, Close circuit and open circuit grinding.

Unit III : Fluid-Solid Separation: Sedimentation: Elutraition, Classification and sedimentation, Free Settling, hindered settling, flow of solids through fluid, Stoke's law, Richardson-Zaki equation, design of settling tanks, Centrifugal separation, design of cyclones and hydrocyclones, filter bags, venture scrubber, electrostatic Precipitator.

Unit IV : Mechanical separation and Filtration: Industrial screen; their capacity and effectiveness. Types of filtration, principle of filtration, plate and frame filter, leaf filter, rotary drum filter, etc.

Unit V : Agitation and Mixing: Application of agitation, Agitation equipment, Types of impellers – Propellers, Paddles and Turbines, Flow patterns in agitated vessels, Prevention of swirling, Standard turbine design, Power correlation and power calculation, Mixing of solids, Types of mixers –, Muller mixers, Mixing index, Ribbon blender, Internal screw mixer.

Suggested Text Books

1. W. McCabe, J. Smith, & P. Harriott. Unit Operations of Chemical Engineering, 6th edition, McGraw Hill.

2. Coulson and Richardson's Chemical Engineering, Vol. 2, Butterworth-Heinemann, 5th edition 2002.

Suggested References Books

1. M. J. Rhodes, "Introduction to Particle Technology", 2nd edition, John Wiley, Chichester; New York.

2. T. Allen, "Powder Sampling and Particle Size Determination", Elsevier.

CHUDLT1 Particle and Fluid Particle Operations Lab [L:0, T:0, P:3]

2%

Objectives:

1. To understand the working and importance of various mechanical operations used in process industry.
2. To apply principles of basic sciences and chemical engineering for designing various size reduction, size separation and filtration equipment.

List of Experiments

1. To verify different laws of crushing for size reduction solid particles by Jaw crusher, roll crusher, and ball mill.
2. To find out the Effectiveness of Triple deck Vibrating Screen.
3. To determine the average diameter of a mixture of solid particles of using sieve analysis.
4. To determine the collection efficiency of cyclone separator for separating dust particles from air.
5. To determine the filter medium resistance and specific cake resistance of plate and frame filter press.
6. To determine the efficiency of elutriator for separating the particles in different size fractions.

Outcomes:

At the end of the laboratory course students will be able

1. To apply the principles of unit operations through experimentation.
2. To demonstrate the ability to understand the various mechanical operation equipments used in chemical and allied process industry.

CO-PO Mapping															
CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1		1			1				2	2	
CO2	1	2	1	1		1			1				2	2	
1-Weak, 2- Moderate, 3-Strong															

BoS Held on 06-10-2023

Basic Chemical Engineering Lab [L:0, T:0, P:2]

5%

Course objective:

The course covers the hands on experience of basic principle of viscosity, adsorption, solid handling, gravity settling, drag coefficient etc.

1. Determine the adsorption coefficient of coal and sawdust samples.
2. Determine the Bulk density and angle of repose at different moisture of given sample.
3. To determine the bed void fraction of given sample.
4. Determine the relative humidity using wet and dry bulb temperature.
5. Determine the percentage of heavy and light particle of given sample.
6. Determine the drag coefficient of given sample.
7. Determine the flash point and cloud point of given sample.
8. Determine the viscosity of given sample using redwood viscometer.

Outcomes: At the end of the laboratory course students will be able

1. To understand the factors affecting to flow in industrial point of view.
2. To understand how the conveyer belt shifting the materials from one place to another place in industry.
3. To understand how gravity settling, adsorption are implemented in industry.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										2	1	
CO2	3	2	1										2	1	
CO3	3	2	1										2	1	

Weightage 3weak-01, moderate-02, strong-03

BoS Held on 06-10-2023

CTT2 **Chemical Engineering Thermodynamics** **[L:3, T:1, P:0]**

20%

Objectives

Principles and application of law of thermodynamics, phase equilibria, introduce the concepts of multicomponent mixture, properties of solutions and reaction equilibria.

Contents:

Unit-I: Basic concepts and definitions of work, heat, energy, system & its types, types of processes. P-V-T relations of fluids: graphical representation of P-V-T behavior, mathematical representation of P-V-T behavior (Ideal gas law, van der Waals, Beattie-Bridgeman, Benedict-Webb-Rubin, Redlich-Kwong, Virial equation of state), Generalized compressibility factor correlation, equations of state (Redlich-Kwong, Soave-Redlich-Kwong, Peng-Robinson, Lee-Kesler, Virial coefficient correlation)

Unit-II: Basic concepts of laws of Thermodynamics: Zeroth law, First & Second laws, Calculation of internal energy, enthalpy, heat capacities, application of first law for open and closed systems, throttling process. Heat engine, heat pump, refrigerator, Kelvin and Clausious statement, criteria of irreversibility, Carnot theorem, Carnot cycle, Clausious inequality, Entropy and its principle.

Unit-III: Thermodynamic Potentials : Postulates, Intensive properties, criteria of equilibrium, free energy functions and their significances in phase and chemical equilibria, Euler relation, Gibbs-Helmholtz equation, Gibbs free energy minimum principle. Maxwell relations, various TdS equations, Cp and Cv relations. Clausisus – Clapeyron equations and estimation of thermodynamic properties by using equations, graphs and tables.

Unit-IV: Multicomponent Mixtures : Partial molar properties, partial molar Gibbs free energy, Chemical potential and its dependence on temperature and pressure, fugacity and its calculation, dependence of fugacity on temperature & pressure, Gibbs phase rule and its significance.

Unit-V: Properties of Solutions : Ideal solutions (Lewis Randall Rule) phase equilibrium, excess properties, Gibbs-Duhem relation, activity & activity coefficient, dependence of activity coefficient on temperature and composition, excess Gibbs free energy models : UNIQUAC and UNIFAC methods, Margules, Van laar, Wilson and NRTL equations, Herny's Law.
Chemical Reaction Equilibrium: Equilibrium constants in terms of measurable properties, Variation of equilibrium constants with temperature and pressure, adiabatic reactions, equilibrium in homogeneous & heterogeneous reactions.

Suggested Text Books :

1. J. M. Smith, H.C. Van Ness and M.M. Abbott, "Introduction to Chemical Engineering Thermodynamics", 7th edition, McGraw-Hill International Edition, 2005.
2. Y. V. C. Rao, "Chemical Engineering Thermodynamics", University Press, Hyderabad, 1997.
3. K V Narayanan, "A Textbook of Chemical Engineering Thermodynamics", Prentice Hall Of India, New Delhi 2011

Reference Book:

1. R.C. Srivastava, "Thermodynamics a core course", 3rd edition, PHI publication, India, 2007.
2. Engineering Thermodynamics by P. K. Nag, Tata McGraw Hill.

Course Outcome:

BoS Held on 06-10-2023

CTT3 Material and Energy Balance ~~Calculations~~ [L:3, T:0, P:0]

5%

course will serve as a basis for all further chemical engineering courses that are part of curriculum.

Contents:

Unit-I: Unit and its conversion, physical quantities in chemical engineering, Dimensionless groups, Stoichiometric principles and compositions, "basis" of calculations, Gas laws, Partial pressure and pure component volume, Mole concept and mole fraction, Weight fraction, Concentration, Molarity, Molality and Normality.

Unit-II: Humidity and Saturation, humid heat, humid volume, dew point, humidity chart and its use.

Unit-III: Material Balances: Without chemical reaction with recycle, bypass and purge, unsteady state material balance.

Unit-IV: Material Balance: With chemical reaction with recycle, bypass and purge.

Unit-V: Energy balance: heat capacity, calculation of enthalpy changes, Hess's Law of constant heat summation, Heat of dilution, Heat of formation, Heat of neutralization and heat of combustion, Energy balance with and without chemical reaction, adiabatic flame temperature.

Suggested Text Books :

1. Hougen, O. A., Watson, K. M., Ragatz, R. A., "Chemical Process Principles, Part I Material & Energy Balances", Second Edition, CBS Publishers& Distributors, 2004
2. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.
3. K.V. Narayanan and B. Lakshmikutty "Stoichiometry & process calculations, Prentice hall of India

Suggested Reference Books :

1. S. N. Saha, "Chemical Process Engineering Calculation", DhanpatRai Publication Co. (Pvt.) Ltd., New Delhi
2. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.
3. Venkataramani, V., Anantharaman, N., Begum, K. M. Meera Sheriffa, "Process Calculations", Second Edit ion, Prentice Hall of India.

Course Outcome:

Students would be able to

1. Develop mastery over units and dimensions and compositions relevant to chemical engineering.
2. Be able to explain the basics of Humidity and Saturation and solve problems related to humidification.

BoS Held on 06-10-2023

70%

Mathematics-III

[L:3, T:0,P:0]

Course Objective: Basic concepts of statistics, curve fittings, Laplace transform and Fourier transform.

Unit I : Introduction to statistics, mathematical statistics, frequency distribution, exclusive and inclusive class intervals, type of series, graphical representation: histogram, frequency polygon, measure of central tendency, various types of averages, skewness and kurtosis.

Unit II : Curve fittings by method of least square- straight line parabola correlation-scatter cliagrem's Karl Pearson's coefficient of correlation. Limits for correlation coefficient, rank correction. Regression linear regression, equation to the line of regression. Regression coefficient, angle between two lines of regression.

Unit III : Laplace Transforms: Transforms of elementary functions and periodic functions, transforms of derivatives and integrals, evaluation of integrals by Laplace transforms, inverse Laplace transforms, convolution theorem, application to differential equations, unit step and unit impulse function.

Unit IV: Fourier Transforms: Fourier integrals and Fourier transforms, finite Fourier sine and cosine functions, F- transforms, convolution theorem of F-transforms.

Unit V: Relation between Fourier and Laplace transforms, application of transforms to boundary value problems

Suggested Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. M. Ray, H. S. Sharma & C. C. Chaudhary, "Mathematical Statistics", Ram Prasad Publications.
3. H K. Das, Higher Engineering Mathematics, S Chand 2014.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Analyze and apply measures of location and measures of dispersion grouped and ungrouped series.
2. Apply discrete and continuous probability distributions to various business problems.
3. Apply the Laplac transformation in various chemical engineering problems.
4. Apply the Fourier transformation in various chemical engineering problems.

CO-PO Mapping

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	3											
CO2	2	2	1	3	1								1		
CO3	2	2	1	3	1								1		
CO4	1	1	1	3									1		

1-Weak, 2- Moderate, 3-Strong

BoS Held on 06-10-2023

2%

B.Tech. VIII Semester

CH407TPE53 **Design and Development of Catalyst** [L:3, T:0, P:0]

Objectives

To gain the knowledge of catalyst preparation methods, characteristics, mechanism of catalytic reactions, and design of catalytic reactors.

Contents

Structure of Solid Surfaces, Chemisorption and Physisorption, Thermodynamics and Kinetics of Surface Processes, Principles of Heterogeneous Catalysis, Preparation, Characterization and Classification, 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, Electro catalysis and Photocatalysis, Mechanism and Kinetics of Some Typical Heterogeneous Catalytic Reactions, Applications in Fertilizer, Petroleum, Petrochemical Industries and Pollution Control. Modern characterization techniques such XRD, SEM FTIR etc.

Suggested Text Books

1. Preparation of Catalyst VI: Scientific bases for the preparation of Haterogeneous Catalysts by G. Poncelet,J. Martens, B. Delmon, Elseveir
2. Catalyst Preparation: Science and Engineering by John Regalbuto, CRC Press

Course Outcomes

Upon completion of this course, the students will be able to understand the:

1. Application of catalyst in various industries
2. Development of various type of catalyst and catalytic reaction mechanisms.
3. Effects of external heat and mass transfer in heterogeneous catalysis
4. Design of different types of reactors for catalytic reactions
5. Understand the various characterization techniques.

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	2	2						3	2	
CO2	3	3	3	3	2	2	1						3	2	
CO3	3	2	3	2	1	2	1						3	2	
CO4	3	3	3	2	1	2	1						3	2	
CO5	3	3	3	2	3	3	1						3	2	

25/5/22

CH408TPE62

B.Tech. VIII Semester
Optimization Techniques

[L:3, T:0, P:0]

30%

Course Objectives

(1) Understanding the concept of optimization methods
(2) Formulate the optimization problem with and without constraint
(3) Introduction to software tools of optimization
(4) Identify and apply the optimization techniques to optimize the process.

Contents

Unit-I: Introduction: Introduction to systems analysis and modelling with reference to chemical engineering problems, Process optimization, Formulation of various process optimization problems and their classification, Basic concepts of optimization-convex and concave functions, Necessary and sufficient conditions for stationary points Differential method for solving one and two variable problems with and without constraints. Lagrangian multiplier method, Karush-Kuhn-Tucker (KKT) conditions,

Unit-II: Optimization of One-Dimensional Functions: Sequential search methods - Golden section method, dichotomous search method, Interval halving method, Fibonacci method; Newton-Raphson method, Quasi-newton's method, Secant method, root finding using optimization techniques.

Unit-III: Multi-Variable Optimization: Multivariable optimization methods without constraints, such as steepest descent, Newton's method and unidirectional search method. Solving two-variable optimization problems using above methods.

Unit-IV: Linear Programming: Modelling, graphical method, single phase simplex method, two phase simplex method, duality.

Unit-V: Special Optimization Techniques: Introduction to dynamic programming as applied to discrete multistage problems like cascade of CSTR, Train of heat exchanger etc. Non-Traditional Optimization Techniques: Genetic Algorithm, Simulated Annealing

Soft tools MS Excel Solver and MATLAB applied to optimization.

Course Outcomes: Upon Completion of the course the students will be able to

(1) Formulate the optimization problems.
(2) Solve single and multivariable optimization problem
(3) Use different optimization techniques for problem solving.
(4) Use non-traditional optimization Techniques for problem solving
(5) Solve optimization problem using software tools

Suggested Text Books:

1. Edgar, T. F., Himmelblau, D. M. and Lasdon, L.S. Optimization of Chemical Processes, McGraw-Hill (2001).
2. S. S. Rao, Engineering Optimization Theory & Practice, Foruth Edition, John Wiley & Sons Inc (2009).
3. Prem Kumar Gupta and D.S.Hira, Problems in Operations Research (Principles and Solutions), S.Chand and company Ltd. New Delhi, India

Reference Books:

1. Kalyanmoy Deb "Optimization for Engineering Design", Prentice Hall, India,2005.
2. Ravindran. A., and Ragsdell, K.M., Reklaitis, G.V., "Engineering Optimization-Methods and Applications", 2nd Edition, Wiley, New York, 2006
3. Babu, B.V., Process Plant Simulation, Oxford University Press (2004).

CO-PO Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO2	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO3	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO4	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2
CO5	3	3	2	2	-	2	1	1	1	1	2	--	2	1	2