For Batches 2018 & Onwards
Academic Autonomous Status vide letter No. F22-1/2014 (AC)

Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
3rd Semester (Second Year) -Curriculum

Total Contact Hours= 26

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTME-18309	Engineering & Solid Mechanics	3	1	0	40	60	100	4
2.	BTAC-18302	Chemistry-II	3	1	0	40	60	100	4
3.	BTCH-18303	Material & Energy Balance Computations	3	1	0	40	60	100	4
4.	BTBS-18305	Biology	3	0	0	40	60	100	3
5.	BTCH-18304	Thermodynamics-I	3	1	0	40	60	100	4
6.	BTCH-18305	Fluid Mechanics	3	1	0	40	60	100	4
7.	BTCH-18306	Chemical Engineering Lab-I	0	0	3	30	20	50	1
8.	CHMC-I	Environmental Sciences	-	-	-	-	-	-	-
	TOTAL		18	05	03	270	380	650	24

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Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
4th Semester (Second Year) -Curriculum

Total Contact Hours= 26

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTCH-18401	Heat Transfer	3	1	0	40	60	100	4
2.	BTCH-18402	Mass Transfer-I	3	1	0	40	60	100	4
3.	BTCH-18403	Thermodynamics-II	3	1	0	40	60	100	4
4.	BTCH-18404	Materials Science	3	0	0	40	60	100	3
5.	BTHS-18901	Fundamentals of Management for Engineers	3	0	0	40	60	100	3
6.	BTCH-18405	Numerical Methods in Chemical Engineering	3	0	0	40	60	100	3
7.	BTCH-18406	Numerical Methods in Chemical Engineering Lab	0	0	2	30	20	50	1
8.	BTCH-18407	Chemical Engineering Lab-II	0	0	3	30	20	50	1
Total=			**18**	**3**	**5**	**300**	**400**	**700**	**23**

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Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
5th Semester (Third Year) -Curriculum

Total Contact Hours= 23

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTCH-18501	Chemical Reaction Engineering-I	3	1	0	40	60	100	4
2.	BTCH-18502	Mass Transfer-II	3	1	0	40	60	100	4
3.	BTCH-18XXX	DE-I	3	0	0	40	60	100	3
4.	BTXX-18XXX	OE-I	3	0	0	40	60	100	3
5.	BT HS-18902	Entrepreneurship and Project Management	3	0	0	40	60	100	3
6.	BTCH-18506	Chemical Engineering Lab-III	0	0	3	30	20	50	1
7.	BTCH-18507	Particle & Fluid Particle Processing	3	0	0	40	60	100	3
8.	CHMC-II	Constitution of India/Essence of Indian Traditional Knowledge	-	-	-	-	-	-	-
Total=			**18**	**2**	**3**	**270**	**380**	**650**	**21**

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Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
6th Semester (Third Year) -Curriculum

Total Contact Hours= 23

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTCH-18601	Chemical Reaction Engineering-II	3	1	0	40	60	100	4
2.	BTCH-18602	Process Technology & Economics	3	0	0	40	60	100	3
3.	BTCH-18XXX	DE-II	3	0	0	40	60	100	3
4.	BTCH-18603	Process Control	3	1	0	40	60	100	4
5.	BTHS-18903	Human Resource Management	3	0	0	40	60	100	3
6.	BTCH-18604	Chemical Engineering Lab -IV	0	0	3	30	20	50	1
7.	BTXX-18XXX	OE-II	3	0	0	40	60	100	3
Total=			**18**	**2**	**3**	**270**	**380**	**650**	**21**

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Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
7th Semester (Fourth Year) -Curriculum

Total Contact Hours= 22

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTCH-18XXX	DE-III	3	0	0	40	60	100	3
2.	BTCH-18701	Design & Simulation Lab	0	0	3	30	20	50	1
3.	BTCH-18702	Instrumentation & Control Lab	0	0	3	30	20	50	1
4.	BTCH-18XXX	DE - IV	3	0	0	40	60	100	3
5.	BTXX-18XXX	OE-III	3	0	0	40	60	100	3
6.	BTXX-18XXX	OE-IV	3	0	0	40	60	100	3
7.	BTCH-18703	Process Plant Design	0	0	4	30	20	50	2
8.	BTCH-18704	Summer Internship	0	0	0	-	100	100	3
Total=			**12**	**0**	**10**	**250**	**400**	**650**	**19**

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Beant College of Engineering and Technology, Gurdaspur, Punjab
Department of Chemical Engineering
B.Tech. Chemical Engineering
Scheme of Syllabi (2018 Onwards)
8th Semester (Fourth Year) -Curriculum

Total Contact Hours= 00

Sr. No.	Course Code	Course Title	Hours per week			Marks Distribution		Total Marks	Credit
			L	T	P	Internal	External		
1.	BTCH-18801	Industrial Training	0	0	0	200	200	400	12
Total=			**0**	**0**	**0**	**200**	**200**	**400**	**12**

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BTME-18309 Engineering and Solid Mechanics

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

Course Objective:

The main objective of this course is to develop in the student the ability to analyze any engineering problem in a simple and logical manner with the help of free body diagrams and then to apply the basic principles of mechanics to solve the problem. The students should develop skills to apply equilibrium equations of statics to various problems to determine reactions and also could determine centre of gravity and moment of inertia of various bodies. Students would be introduced to the basic concepts of mechanics of deformable materials.

1 Force and Force Equilibrium

Force, System of forces, Coplanar concurrent & non-concurrent force, Non-coplanar concurrent & non-concurrent force, Couples and resultant of force systems, Equilibrium of force system (two and many force system), Lami's theorem, General equations of equilibrium for rigid-body, Rigid body constraints, Concept of free-body diagrams, Resultant moment of forces, Varingnon's theorem and its applications, Numerical Problems. (6)

2 Friction

Types of friction, Limiting friction, Static and dynamic friction, Laws of dry friction, Determination of coefficient of sliding friction, Rolling resistance, Force of friction on a wheel when a force is applied & when acted upon by torque, Motion of bodies on inclined plane, wedge friction, screw jack. (5)

3 Centroid, Centre of Gravity and Moment of Inertia

Center of Gravity and Center of Mass for a Body, Centroid of simple figures from first principle, Centroid of composite sections, Area moment of inertia, Moment of inertia of plane sections from first principles, Parallel and perpendicular axes theorem of Moment of inertia, Moment of inertia of standard sections and composite sections, Mass moment of inertia of cylinder, cone and sphere. (7)

4 Review of Particle Dynamics

Rectilinear motion with uniform and variable acceleration, Displacement, velocity and acceleration of connected bodies, Equations of dynamic equilibrium, Analysis of motion of elevators and motion of pulleys. Plane curvilinear motion with components of motion as rectangular components, Normal & tangential components, Collision of elastic bodies; Direct central impact, Nature of impact and the coefficient of restitution. (7)

5 Introductions to Kinetics of Rigid Bodies

Basic terms, General principles in dynamics, Plane motion of a rigid body, Relation between the translatory and rotary motion of a body in plane motion, D'Alembert's Principle in plane motion, Instantaneous centre of rotation in plane motion and simple problems. (6)**6**

Mechanics of Solids : Concept and philosophy of stress and strain, Longitudinal and lateral strain, Normal stress (tensile and compressive), shear stress, Young's modulus of elasticity, Modulus of rigidity, Bulk modulus, Poisson's ratio, Relations among elastic constants. Stress strain curve for ductile and brittle material, Yield point, Elastic limit, Ductility, True stress and true strain. Elongation of uniform bar due to application of external load with and without self weight. Temperature stresses in composite bar. Strain energy and resilience, Modulus of resilience, (7)

Books Recommended:

- Engineering Mechanics – Irving H. Shames, PHI Publications
- Engineering Mechanics – U.C.Jindal, Galgotia Publications
- Tayal A.K. Engineering Mechanics,Umesh Publications
- Bansal R.K. A Text Book of Engineering Mechanics, Laxmi Publications
- Engineering Mechanics By R S Khurmi,S Chand Publications
- Andy Ruina and Rudra Partap, Introduction to Statics and Dynamics,Oxford University Press.
- Strength of Material by S S Rattan ,Tata McGraw Hill Education Private Limited
- Strength of Material by Sadhu Singh. Khanna Publishers.

BTAC-18302 Chemistry-II

L T P
3 1 0

Internal Marks: 40
External Marks: 60
Total Marks: 100

(i) Polymers

Types and mechanism of polymerization (free radical, cationic and anionic). Average molecular weights; Determination of molecular weight by number average method. Crystallinity, melting point and glass transition. Copolymerization. Elastomers-structure, applications. Conducting polymers and applications. Synthesis, properties and uses of PE, PVC, PMMA, formaldehyde resins, melamine-formaldehyde-urea resins. Adhesives, adhesive mechanism and applications. Composites: characteristics, types and applications. (10)

(ii) Surfactants and Lubricants

Methods of preparation, cleaning mechanism. Critical micelle concentration and its determination by surface tension. Hydrophobic and hydrophilic interactions. Micelles and reverse micelles. Detergents. Lubricants-physical and chemical properties,type sand mechanism of lubrication. Additives of lubricants and freezing points of lubricants. (8)

(iii) Corrosion

Thermodynamic overview of electrochemical processes. Reversible and irreversible cells. Chemical and electrochemical corrosion and mechanism of corrosion. Factors affecting corrosion. Protection of corrosion. (9)

(iv) Nanochemistry

Introduction; Materials self assembly; Molecular vs materials self assembly; Self assembly materials; Two dimensional assemblies; Mesoscale self assembly; Coercing colloids; Nanocrystals; Nanoscale materials. (8)

(v) Environmental and green chemistry

Air, water and noise pollution. Optimum levels of pollution. Significance and determination of COD and BOD. Greenhouse effect and global warming. e-Waste. Concept of green chemistry; Twelve principles with emphasis on the concept of atom economy; the use of alternative feedstock; Use of innocuous reagents in natural processes; Alternative solvents; Design of safer chemicals; Designing alternating reaction methodology. Microwave and ultrasonic radiation in green synthesis- Minimizing energy consumption. (10)

Books

(1) Introduction to Nanoscience, by S. M. Lindsay
(2) A Textbook of Engineering Chemistry, by Shashi Chawla
(3) Engineering Chemistry, by P. C Jain and M. Jain
(4) Advanced Polymer Chemistry, by M. Chanda
(5) A Textbook of Environmental Chemistry, by O. D. Tyagi and M. Mehra

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BTCH-18303 MATERIAL AND ENERGY BALANCE COMPUTATIONS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

COURSE OBJECTIVES :

The objective of this course is to present to the students, an introduction to chemical engineering calculations, establish mathematical methodologies for the computation of material balances, energy balances and to present an overview of industrial chemical processes.This course will serve as a basis for all further chemical engineering courses that are part of the curriculum.

Contents :

Introduction to Chemical Engineering Calculations :Introductory concepts of units, physical quantities in chemical engineering, dimensionless groups, "basis" of calculations, Applications of Laws of Conservation of Mass & Energy. **(3L+1T)**

Material Balance: Introduction, solving material balance problems without chemical reaction. Material balance for unit operations like absorption, distillation, extraction, drying and evaporation. **(5L+2T)**

Concept of stoichiometry and mole concept and compositional relationship, Concept of limiting and excess reactants, percentage conversion, yield, selectivity etc. **(5L+2T)**

Material Balances with recycle, bypass and purge. **(3L+1T)**

Gases, Vapors and Liquids: Equations of state, Vapour pressure, Clausius-Clapeyron equation, Cox chart, Duhring's plot, Raoult's law. **(5L+1T)**

Energy balance: open and closed system, heat capacity, calculation of enthalpy changes. **(5L+1T)**

Energy balances with chemical reaction: Heat of reaction, Heat of combustion, Adiabatic reactions. **(5L+1T)** Crystallization, Dissolution, Humidity and Saturation, humid heat, humid volume, dew point, Psychrometric Operations, humidity chart and its use. **(5L+1T)**

COURSE OUTCOMES:

1. Ability to make material balances on unit operations and processes.
2. Develops the systematic problem solving skills.
3. Ability to perform simultaneous material and energy balances.
4. Develops the capability of application of laws to different proportions.

Suggested Text Books

1. Himmelblau, D. M., Riggs, J. B. "Basic Principles and Calculations in Chemical Engineering", Eighth Ed., Pearson India Education Services, 2015.

2. Bhatt, B. I., Vora, S. M., "Stoichiometry", Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2004.

3. "Stoichiometry and Process Calculations", K.V. Narayanan, B. Lakshmikutty, Prentice-Hall of India Pvt. Ltd., 2006.

Suggested References Books

1. Felder, R. M.; Rousseau, R. W., "Elementary Principles of Chemical Processes", Third Edition, John Wiley & Sons, 2000

2. Hougen, O. A., Watson, K. M., Ragatz, R. A., "Chemical Process Principles, Part-I Material & Energy Balances", Second Edition, CBS Publishers & Distributors, 2004

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BTBS-18305 Biology

Internal Marks: 40	
External Marks: 60	**L T P**
Total Marks: 100	**3 1 0**

Objective: Students will be introduced to the basics of biology such as cell structure and functions, inheritance & evolution, basic concepts of genetics, and an introduction to microbiology. So that they can use technology for the betterment of life on this planet.

Unit–I Introduction to living world: Diversity of life, major prokaryotes- monera, eubacteria and eukaryotic kingdoms- Protista, Fungi, Plantae, and Animalia. (6L + 1T)

Unit–II Biochemistry: Metabolism (Catabolism: oxidation reactions and Anabolism: reduction reactions), ATP, Bioenergetics: cellular respiration and photosynthesis. (12L + 3T)

Unit–III Genetics: Basic principles of Mendel, molecular genetics, structure and function of genes and chromosomes, Central dogma, Replication, Transcription and Translation, introduction to recombinant DNA technology and its applications including genetically modified foods and organisms. (12L + 3T)

Unit–IV Cell Biology: Macromolecules: carbohydrates, lipids, water, aminoacids, proteins, nucleic acids, cell membrane, organelles: mitochondria, ribosomes, golgi appratus, endoplasmic reticulum, cytoskeleton, cell-signaling, cell division: mitosis, meosis, differentiation, motility. (12L + 3T)

Unit–V Microbiology: Host-microbe interactions, physiology, ecology, diversity, and virology, microbial diseases and preventions, Antibiotics production with major examples, types of vaccines and important examples. (6L +2T)

Course Outcomes:

1. Get insight into basic biology as a science
2. Outlining the diversity and evolution
3. Organization and fundamental principles of living systems
4. Principle behind recombinant technology

Suggested Books:

1. Biology Fundamental Principles by Balaji S Thorat and Sumit M Raut
2. Lehlinger's Principles of Biochemistry
3. Microbiology by Prescott

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BTCH 18304 THERMODYNAMICS-I

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

COURSE OBJECTIVE: The objective of the course is to introduce to students about the thermodynamic laws and its application to chemical engineering problems. The student will learn about the concept of equations of state, Heat Effects, Thermodynamics properties of fluids , and Thermodynamics cycle.

Introduction : Importance of thermodynamics in chemical engineering, Dimensions and Units, Pressure ,Work, Energy, Heat. **(3L+1T)**

Energy conservation and first law of thermodynamics : State functions, types of systems, internal energy, heat and work reversible and irreversible processes. Phase Rule,1st law of thermodynamic and its engineering applications, i.e., constant volume processes, constant pressure processes, isothermal and adiabatic processes. Mass and Energy Balance for open systems. **(6L+3T)**

P-V-T behavior: Ideal gas law, Equation of state for real gases and their mixtures Van der Waals, Virial and Cubic equations of state ,Reduced Conditions, Principle of corresponding states and generalized compressibility factor . **(5L+2T)**

Heat Effects : Latent Heat, Sensible heat, Standard heat of reaction, standard heat of formation, standard heat of combustion. **(3L+1T)**

Statement of Second Law : Statement of Second Law, Heat Engines, Carnot's theorem , Thermodynamic temperature scale, Concept of Entropy, Entropy changes of an ideal gas, Mathematical statement of the second law , Calculation of Ideal work ,Lost work ,Third law of thermodynamics and its applications, **(6L+2T)**

Thermodynamic Property of Fluids: Maxwell Relations , Binary phase systems, graphs and tables of thermodynamics properties**. (5L+1T)**

Applications of Thermodynamics to flow processes: Construction and working of Pumps, Compressors and Turbines , Joule- Thomson coefficient. **(3L+1T)**

Thermodynamic Analysis of steam Power Plants: Rankine Cycle ;The carnot Refrigerator ;Vapor - compression Cycle ; Absorption refrigeration, Heat pump, Liquefaction processes**. (5L+1T)**

COURSE OUTCOMES:
1.Apply mass and energy balances to closed and open system.

2.Evaluate the properties of non-ideal gases.

3.Solve problems involving equation of states, Heat effects ,Thermodynamics Process.

BOOKS RECOMMENDED:

1. Smith J.M. and Van Ness, H.C, Introduction to Chemical Engineering Thermodynamics, 7th Ed., McGraw Hill Book Co., 2005
2. Dodge B.F., Chemical Engg. Thermodynamics, McGraw - Hill Book Company, Inc.
3.K.V.Narayan, A Text book of Chemical Engineering Thermodynamics, Prentice Hall of India Private Limited.,New Delhi.

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BTCH 18305 FLUID MECHANICS

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

Course Objectives: This course is designed for the undergraduate chemical engineering students to develop an understanding of the behaviour of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries.

Introduction : Introduction to fluids, Continuum hypothesis, Liquid & their properties, Viscosity, Newton's law of viscosity. **(3L+1T)**

Fluid Statics : Pascal's law, Absolute & Gauge pressure, Hydro static paradox, Manometry, Forces on horizontally submerged bodies. **(3L+1T)**

Kinematics of Fluid Flow: Introduction to various types of flows, path line, stream line, Stream function, Vorticity and Circulation, flow nets. **(3L+1T)**

System and Control Volume Approach: Euler's equation of motion, Bernoulli equation and applications, Head loss in pipe flow, Moody diagram. **(5L+2T)**

Flow Measurements : Transportation of fluids - pumps, selection and design of pumps **(3L+1T)**

Diffrential Analysis: Mass and momentum balances, Navier-Stokes equation, Unidirectional flow, Viscous flow, Stokes law, Skin drag and pressure drag. **(5L+2T)**

Potential Flow: Potential function, streamlined and bluff bodies. **(3L+1T)**

Boundry Layer Theory: Drag and lift force on immersed body, dimensional analysis of lift and drag. **(5L+2T)**

Dimentional and Similitude Analysis (3L+1T)

Introduction to Compressible Flows: Blowers and compressors. **(3L+1T)**

COURSE OUTCOMES:

1. This course will develop analytical abilities related to fluid flow.
2. It is expected that students will be able to have conceptual understanding of fluids and their properties.
3. It is expected that students will be able to apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively and do the prototype studies of different types of machines and phenomenon.

SUGGESTED BOOKS:

1. McCabe, Warren L., Smith, Julian C. and Harriot, P., Unit Operations of Chemical Engg., 7th Ed., McGraw Hill, 2005
2. Backhurst J.R., Harker J.H., Coulson J.F., Richardson J.M., Chemical Engineering - Volume 1, 6th Ed., Butterworth Heinemann, 1999.
3. Foust, A.S., Wenzel L.A., Clump C.W. Maus L., Anderson L. B., Principles of Unit Operations, 2nd Ed., John Wiley & Sons, 2008.
4. Raju K.S., Fluid Mechanics, Heat Transfer, and Mass Transfer: Chemical Engineering Practice, John Wiley and Sons, 2011
5. Badger, W.L. and Banchero, J.T, Introduction to Chemical Engg., McGraw Hill.
6. Philip J. Pritchard P. J., Fox and McDonald's Introduction to Fluid Mechanics, 8th Ed., John Wiley and Sons, 2011
7. Chattopadhyay, P., Unit Operations of Chemical Engg. Vol.1, 3rd Ed., Khanna Publishers

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BTCH-18306 CHEMICAL ENGINEERING LAB-I

Internal Marks: 30 **L T P**

External Marks: 20 **0 0 3**

Total Marks: 50

1. Characteristic curves of a centrifugal pump.

2. Determination of stability of a floating body.

3. Verification of Bernoulli's equation for flow process.

4. Measurement of flow by a venturimeter.

5. Measurement of flow by an orifice meter.

6. Measurement of flow by a Rotameters.

7. Measurement of flow by a V-notch in an open channel.

8. Measurement of losses in various fitting and valves.

9. Measurement of losses due to contraction and expansion.

10. Measurement of losses due to variation in cross section/ shapes.

11. Verification of laminar/ turbulent flow regime in a flow process

12. Study of valves and fittings.

BTCH-18401 HEAT TRANSFER

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

COURSE OBJECTIVES : The objective of the course is to introduce to students about basic of Heat transfer, its mechanisms in solids and fluids and their chemical process applications. At the conclusion of the course, the student should possess the ability to model steady and unsteady heat transfer in simple systems and design and rating of heat exchangers with and without phase change.

Heat Transfer Fundamental : Mode of Heat Transfer ,Conduction Fourier's law, Thermal diffusivity & Heat Transfer Coefficient. Differential Equations of Heat Transfer and Special forms .Thermal conductivity of materials. Unsteady State Heat Transfer . **(5L+1T)**

Conductive Heat Transfer : One Dimensional Problems (one dimensional heat conduction through plane and composite structures having plane wall, spherical & cylindrical geometry), Heat transfer from extended surfaces ,two and three dimensional problems ,Insulation**. (5L+2T)**

Convective Heat Transfer : Free and forced convection, Concept of thermal boundary layer, dimensional analysis, Analogies and Correlations. **(6L+3T)**

Introduction to Radiative Heat Transfer Rradiation: Definition of emissivity, concept of Black and Grey bodies, Planck's law of monochromatic radiation,Kirchhoff's law, Wien's displacement law, Stefan-Boltzmann law, definition of intensity of radiation. Radiation formula for radiation exchange between simple bodies, two parallel surfaces and between any source and receiver, radiation shields. **(3L+1T)**

Basic of Heat Transfer with phase change : Condensation and Boiling heat transfer: Introduction to boiling ,Introduction to condensation , Dropwise and Filmwise condensation of pure and mixed vapours, Convective, Nucleate & Film boiling. **(3L+1T)**

Design of Heat Transfer equipment: Heat exchangers -Construction and working of double pipe heat exchanger, plate type heat exchanger, Shell and Tube heat exchanger ,Concept of LMTD temperature correction factor for shell & tube exchangers, fouling factors, overall heat transfer coefficient . **(8L+3T)**

Evaporators: Various types of evaporators- Standard vertical tube evaporator, basket type vertical evaporator, forced circulation evaporator and horizontal tube evaporators. Single effect evaporators and multi-effect evaporators and its various types of feed arrangements, boiling point elevation, capacity and economy of evaporators. **(6L+1T)**

COURSE OUTCOMES:

This course is expected to acquaint the students:-

1. About Various Mode of Heat transfer ,Steady state and Unsteady heat Transfer.
2. Empirical Correlation for Free and Forced Convection ,Dimensional Numbers .
3. Thermal Boundary Layer ,Condensation and Boiling Phenomenon.
4. Various types of Heat exchange Equipments, Boilers, Condensors, Evaporator.
5. Industrial Application of Heat Exchange equipments.
6. Identify, formulate, and solve industrial engineering problems using different equations studied .

Suggested Books:

1. Holman, J.P., Heat Transfer, 10th Ed., McGraw Hill, 2010.
2. McAdams W.H., Heat Transmission, 3rd Ed., Kreiger Publishing Co, 1985
3. Backhurst J.R., Harker J.H., Coulson J.F., Richardson J.M., Chemical Engineering - Volume 1, 6th Ed., Butterworth Heinemann, 1999
4. McCabe, Warren L., Smith, Julian C. and Harriot, P., Unit Operations of Chemical Engg., 7th Ed., McGraw Hill, 2005
5. Kern D.Q., Process Heat Transfer, McGraw Hill.
6.Kreith F., Manglik R.M., Bohn M.S., Principles of Heat Transfer, 7th Ed., Brooks Cole Thomson Learning Publication, 2010.
7.Principle of Heat Transfer ,D.Srinivasan,New Age International Publishers.

BTCH-18402 MASS TRANSFER-I

Internal Marks: 40 **L T P**

External Marks: 60 **3 1 0**

Total Marks: 100

COURSE OBJECTIVES : The purpose of this course is to introduce the undergraduate students with the most important separation equipments in the process industry, and provide proper understanding of unit operations.

Introduction: Importance and classification of mass transfer operations in Chemical Engineering. **(4L)**

Diffusion: Mass balance in simple situations, diffusion through solids, liquids & gases, Constitutive laws of diffusion ,unsteady state diffusion. **(8L+3T)**

Interphase Mass Transfer : Theories of Mass transfer, Convective mass transfer, interphase mass transfer and mass transfer coefficients, mass transfer correlations , Equilibrium stages and transfer units: number and height of transfer units, stage efficiency. **(10L+4T)**

Gas Absorption: Gas absorption plate and packed column design; reactive absorption . **(6L+1T)**

Humidification Operations: humidification operations and water cooling operations. Dehumidification Equipments: water cooling towers & spray chambers, Rate of drying curves, through circulation drying, Continuous drying, Types of dryers. **(8L+2T)**

COURSE OUTCOMES :
1. Students will learn about the diffusional mass transfer
2. Operation of cooling tower will be clearly understood
3. Operation of Dryer will be understood
4. Student will understand the mechanism of crystallization and absorption

Suggested Text Books

1. Binay K.Dutta, Principles of Mass Transfer and Separation Processes,2nd edition, Prentice Hall of India,2007
2. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983.
3. E.D. Cussler, Diffusion - Mass Transfer in Fluid Systems, Cambridge
4. S. Foust, Principles of Unit Operations, 2nd Edition, Wiley, New York, 1980.

Suggested References Books

1. C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition, Prentice Hall, India, 1993.

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BTCH-18403 THERMODYNAMICS -II

Internal Marks: 40 **L T P**

External Marks: 60 **3 1 0**

Total Marks: 100

COURSE OBJECTIVES : To introduce the concepts of fugacity, activity coefficient, vapour-liquid equilibrium and reaction equilibrium. Introduction to molecular thermodynamics.

Introduction: Review of first and second law of thermodynamics . **(2L)**

Solution Thermodynamics: Fundamental property relationships,chemical potential as a criterion for phase equilibrium, partial properties, ideal gas solution, fugacity and fugacity coefficient for a pure species, fugacity and fugacity coefficient for species in a solution, excess properties, Lewis rendall rule. **(8L+3T)**

Solution thermodynamics application: liquid phase properties from VLE, activity and activity coefficient, dependence of activity and activity coefficient on temperature and pressure, models for Gibbs free energy, heat effects and property change on mixing. **(7L+2T)**

Vapour-liquid equilibrium: Phase rule duhem's theorem, gamma-Phi formulation of VLE, dew point and bubble point calculations, Raoult's law and modified raoult's law, VLE from K-value correlations, flash calculations. **(6L+3T)**

Liquid-Liquid Equilibria: Vapor-Liquid-Liquid Equilibria; Solid-Liquid Equilibria, Solid-Gas Equilibria. (**6L+2T)**

Chemical Reaction Equilibria: Reaction coordinate, application of equilibrium criteria to chemical reactions, standard gibbs free energy and the equilibrium constant relation, effect of temperature on equilibrium constant, evaluation of equilibrium constants, relation of equilibrium constant to composition for single phase reactions and liquid phase reactions, equilibrium conversions for single reactions, reactions in heterogenous system, phase rule and duhem's theorem for reacting systems. V**(7L+2T)**

COURSE OUTCOMES :

1. Learning thermodynamics cycles, making cycle calculations by using basic thermodynamics principles.
2. Learning how to apply laws of thermodynamics on ideal gas mixtures.
3. Analyzing varied humidified air processes like air conditioning by using basic formulas and diagrams.
4. 4. Having opinion about social and environmental effects of thermodynamic applications.

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.

Suggested References Books

1. S.Sandler, “Chemical, Biochemical and Engineering Thermodynamics”, 4th edition,Wiley,India.
2.Y.V.C.Rao, “Chemical Engineering Thermodynamics”, University Press, Hyderabad,1997.
3.K.V.Narayan, A Text book of Chemical Engineering Thermodynamics, Prentice Hall of India Private Limited.,New Delhi.

For Batches 2018 & Onwards
Academic Autonomous Status vide letter No. F22-1/2014 (AC)

BTCH-18404 MATERIAL SCIENCE

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

COURSE OBJECTIVES: The objective of the course will be to give the students a basic introduction to the different classes of materials relevant to engineering in general, and Chemical Engineering in particular. The intent of the course will be to relate the underlying molecular structure of the materials to their physical and chemical properties, and their processing and performance characteristics.

Introduction to Materials: Bonding between atoms: metallic bonding, ionic bonding, covalent bonding, Vander Waals bond, thermal expansion, elastic modulus and melting point of materials, Role of materials selection in design, structure-property-processing-performance relationships. **(3L)**

Structure of Materials: Miller indices of directions and planes, packing of atoms inside solids, close-packed structures, structure of ceramics, ionic solids, glass and polymers, density of various materials. **(3L)**

Imperfections in Solids : Vacancies, equilibrium concentration of vacancies, interstitial and substitutional impurities in solids, dislocations, types and characteristics of dislocations, interfacial defects, stacking faults. **(3L)**

Strength of Materials : Yield strength, tensile strength and ductility of materials: stress strain behavior of metals, ceramics and polymers, tensile test, plastic deformation, necking, creep behavior and fatigue. **(4L)**

Semi-crystalline Materials : Classification, structure and configuration of ceramics, polymers, copolymers, liquid crystals and amphiphiles. **(7L)**

Non-Crystalline/Amorphous Materials: Silicates, glass transition temperature, viscoelasticity. **(4L)**

Polymer Nano-composite Materials: Nanocomposites, role of reinforcement-matrix interface strength on composite behavior, Corrosion, Degradation and Recycling **(7L)**

Biomaterials: Material related to catalyst such as zeolites, silica etc. and other selected materials . **(2L)**

Introduction to Experimental Techniques: XRD, NMR, PSA, etc. for material characterization highlighting links between molecular structure and macroscopic properties. **(3L)**

COURSE OUTCOMES

1.Students will have a fair understanding of hard and soft materials, including polymers and composites.

2. All materials characterization, properties and use in engineering applications.

Suggested Books

1. V. Raghavan Materials Science and Engineering: A First Course, 5th Edition Prentice Hall India, 2004.
2. S. Upadhyaya and A. Upadhyaya, Material Science and Engineering, Anshan Publications, 2007.

Suggested Reference Books

1. R. A. L Jones, Soft Condensed Matter, Oxford University Press, 2002.
2. William D. Callister, David G. Rethwisch Materials Science and Engineering: An Introduction, Wiley Publisher.
3. B. S. Mitchell An Introduction to Materials Engineering and Science for Chemical and Materials Engineers, John Wiley & Sons, 2004.

For Batches 2018 & Onwards
Academic Autonomous Status vide letter No. F22-1/2014 (AC)

BTHS-18901 Fundamentals of Management for Engineers

Credit: 3

Internal Marks: 40
External Marks: 60 **L T P**
Total Marks: 100 **3 0 0**

Unit 1. Definition, functions, and significance of Management. Levels of management, Douglas Mc Gregor Theory X and Theory Y. Difference between management and Administration.

Unit 2. Evolution of Management, thought, approaches of management. principles of Henry Fayol and F.W Taylor.

Unit3. Planning and organization nature, objectives and significance of planning, types and steps of planning. Span of control. Methods and types of training, Various organizational structures. Formal and informal organizations.

Unit 4. Concept of motivation, theories of motivation - Maslow need hierarchy theory & Herzberg two factor theory, Concepts of leadership and styles. Steps of Controlling .

Books Recommended:-

1. General Management - C.B. Gupta Sultan Chand

2. Principal and Practice of management- L.M. Prasad Sultan Chand

3. Essential of Management -Koontz & O, Donnel Tata Mc Graw

4. Essential Of Management – Koontz and Weihrich Tata Mc Graw 5. Management : James Stoner, R Edward Freeman, Daniel R. Gilbert, Jr. Prentice Hall of India

BTCH- 18405 NUMERICAL METHODS IN CHEMICAL ENGINEERING

Internal Marks: 40 **L T P**
External Marks: 60 **3 0 0**
Total Marks: 100

COURSE OBJECTIVES: This course is aimed at providing the students with knowledge about the numerical solutions to various mathematical expressions that they may come across in Chemical Engineering Practice, those are not easily solvable by conventional techniques. These techniques are very useful for the students for experimental data analysis, integration and differentiation of involved functions, solutions of certain implicit equations.

Introduction: Approximation and Concept of Error & Error Analysis **(3 L)**

Linear Algebraic Equations: Methods like Gauss elimination, LU decomposition and matrix inversion, Gauss-Siedel method, Chemical engineering problems involving solution of linear algebraic equations **(5 L)**

Root finding methods for solution on non-linear algebraic equations: Bisection, Newton- Raphson and Secant methods, Chemical engineering problems involving solution of non-linear equations **(5 L)**

Interpolation and Approximation: Newton's polynomials and Lagrange polynomials, spline interpolation, linear regression, polynomial regression, least square regression **(5 L)**

Numerical integration: Trapezoidal rule, Simpson's rule, integration with unequal segments, quadrature methods, Chemical engineering problems involving numerical differentiation and integration. **(7 L)**

Ordinary Differential Equations: Euler method, Runge-Kutta method, Adaptive Runge-Kutta method, Initial and boundary value problems, Chemical engineering problems involving single, and a system of ODEs. **(11 L)**

COURSE OUTCOMES:

1. To learn the application of Numerical methods and its application in chemical industry
2. To understand the concept of errors and their significance in numerical methods.
3. To learn different numerical methods used for solution of linear and non linear equations
4. To learn how different type of Chemical Engg. problems can be solved by using different methods (ODE/Integration).

Suggested Books:

1.Gupta, S. K., "Numerical Methods for Engineers, New Academic Science.
2.S.C. Chapra & R.P. Canale, "Numerical Methods for Engineers with Personal Computer Applications", McGraw Hill Book Company.
3.R.L. Burden & J. D. Faires, "Numerical Analysis", 7th Ed., Brooks Coles.
4. Atkinson, K. E., "An Introduction to Numerical Analysis", John Wiley & Sons.
5. Press, W. H. et al., "Numerical Recipes in C: The Art of Scientific Computing, 3rd Edition, Cambridge University Press.

BTCH-18406 NUMERICAL METHODS IN CHEMICAL ENGINEERING (P)

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

PRACTICAL DESCRIPTION [No. of turns (2 hrs)]

1.Introduction to use of computers for numerical calculations (1 practical turn)

2.Solution of linear algebraic equations using Gauss elimination, Gauss-Siedel etc. (2 practical turns)

3.Solution of a non-linear equations using bracketing and Newton-Raphson method. (2 practical turns)

4.Interpolation and Approximation(2 practical turns)

5.Numerical integration(2 practical turns)

6.Euler method (1 practical turn)

7.Runge-Kutta methods for ODEs (2 practical turns)

8.Solution of system of ODEs using simple methods (1 practical turn)

9.Solution of simple PDEs (2 practical turns)

Total :15 practical turns

For Batches 2018 & Onwards
Academic Autonomous Status vide letter No. F22-1/2014 (AC)

BTCH-18407 CHEMICAL ENGINEERING LAB-II

Internal Marks: 30 **L T P**

External Marks: 20 **0 0 3**

Total Marks: 50

Objective:

The objective of this course is to calculate heat transfer coefficient for different types of heat transfer equipments along with heat losses for various devices like vertical cylinder by natural convection, to determine thermal conductivity of different materials .Student will learn about double pipe heat exchanger and perform calculation for heat exchanger. Student will perform experiments based on conduction , convection and radiation principles.

PRACTICAL DESCRIPTION

1. To determine the thermal conductivity of insulating powder.
2. To determine the heat transfer resistance and thermal conductivity through composite wall .
3. To determine the thermal conductivity of Metal Bar (Brass).
4. To find the heat transfer coefficient of heat loss by vertical cylinder by natural convection.
5. To find heat transfer coefficient loosing heat by forced convection to air flowing through it for different air flow rates & heat flow rates.
6. To find heat transfer coefficient for parallel flow and counter flow for double pipe heat exchanger.
7. To study and determine the heat transfer through lagged pipe.
8. To determine the Steafan Boltzman's constant with Stefan Boltzman apparatus.
9. To study the emissivity of a test plate with the help of emissivity measurement apparatus.
10. To study the temperature distribution and determine the heat transfer rate for an unsteady state system.
11. To determine the super thermal conductivity of heat and to compare its working with best conductor i.e., Cu pipe and SS pipe.

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Department of Chemical Engineering

B.Tech. Chemical Engineering

Scheme of Syllabi (2018 Onwards)

DEPARTMENTAL ELECTIVES (DE)		
Serial No.	**Course Code**	**Course Title**
1.	BTXX-18XXX	Water Conservation and Management
2.	BTXX-18XXX	Sustainability Engineering
3.	BTXX-18XXX	Interfacial Engineering
4.	BTXX-18XXX	Nanoscience and Nanotechnology
5.	BTXX-18XXX	Advanced Separation Processes
6.	BTXX-18XXX	Polymer Science and Engineering
7.	BTXX-18XXX	Environmental Pollution and Control
8.	BTXX-18XXX	Renewable Energy
9.	BTXX-18XXX	Transport Phenomena
10.	BTXX-18XXX	Petrochemical Technology
11.	BTXX-18XXX	Plant Utilities
12.	BTXX-18XXX	Petroleum Refining Engineering
13.	BTXX-18XXX	Optimization Methods

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Scheme of Syllabi (2018 Onwards)

Departmental Open Electives (OE)		
Serial No.	**Course Code**	**Course Title**
1.	BTCH-18970	Corrosion Engineering
2.	BTCH-18971	New & Renewable Energy Sources
3.	BTCH-18972	Environment Impact Assessment
4.	BTCH-18973	Hydrocarbon Engineering
5.	BTCH-18974	Bio-Chemical Engineering
6.	BTCH-18975	Polymer Reactor Design
7.	BTCH-18976	Plant Utilities
8.	BTCH-18977	Petro-Chemical Technology