SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Engineering Mathematics-I				Code: MBAB01001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	0	2	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To impart knowledge of complex numbers and its applications to solve Engineering problems.
- To provide an understanding of Principles of Vector Algebra, Single variable and Multivariable Calculus.

Outcomes:

After successful completion of this course, students will be able to:

- Execute the concepts of complex number, hyperbolic functions, Mean value theorems, partial derivatives of functions and vector products to solve Engineering problems.
- Express functions in series using Taylor's and Maclaurin's expansion, and evaluate limits of indeterminate forms using L'Hospital's Rule and gradient, directional derivative, curl and divergence.
- Find partial derivatives of functions and carry out the knowledge to error and approximations, maxima and minima.
- Applications to partial derivatives and vectors to solve real life problems.

Detailed Syllabus:

Unit	Description	Duration
1.	**Complex Numbers:** DeMoivre's theorem, Roots of complex numbers, Expansion of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$ and $\cos\theta$, Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sine or cosine of multiples of θ, Hyperbolic functions, Separation of Real and Imaginary Parts, Inverse hyperbolic functions, Logarithm of a complex number.	12
2.	**Mean value theorems, Series expansion and Indeterminate forms:** Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's formula, Maclaurin series. Indeterminate forms: $\frac{0}{0}, \frac{\infty}{\infty}, 0\times\infty, \infty-\infty, 0^0, \infty^0, 1^\infty$ L'Hospital's rule.	08
3.	**Partial Derivatives and its applications:** Partial Derivatives of two variable and three variable functions, Partial derivative of composite function, Homogeneous functions in two or three variables, Euler's theorem.	15

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	Applications: Errors and approximations, Maxima and minima in 2 variables, Constrained maxima minima- Lagrange's multiplier method with one or two constraints.	
4.	**Vectors:** Scalar and vector triple products, Product of four vectors, Curves in space, Differentiation of a vector function of a single scalar variable, Theorems on derivatives, concept of tangent vector, Scalar and Vector Point Functions, gradient, Directional derivative, Curl and Divergence. **Applications:** velocity of a moving particle, potential field, Irrotational and Solenoidal Fields.	10
	Total	**45**

Text Books:

1. Erwin Kreyszig (2010), Advanced Engineering Mathematics, *Wiley Eastern, 10th edition.*

Reference Books:

1. Andreescu Titu, Andrica Dorin (2014), Complex Numbers from A to ....Z, *Birkhauser Basel Publishers, 2nd edition.*
2. Thomas, Calculus (2014), *Pearson Education, 7th edition.*
3. Howard Anton (2012), "Calculus", *Wiley, 10th edition.*
4. B.V.Ramana (2010), "Higher Engineering Mathematics", *Tata McGraw Hill, 1st edition.*
5. Alan Jeffrey (2003), Handbook of Mathematical Formulas and Integrals, *Academic Press, 3 edition.*

Term Work:

As per institute norms.

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SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Engineering Chemistry				Code: MBAB01002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	2	0	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To familiarize with concepts on hardness of water, treatment of water for human consumption & industrial applications.
- To introduce the students to concepts of lubricant technology and important engineering materials like polymers, liquid crystals and nanomaterials.
- To acquaint importance and application of theories of corrosion science.
- To understand the various energy resources and its conservation.

Outcomes:

- Apply water technologies and corrosions combating to industrial problems.
- Identify energy resources and tackle e-waste.
- Solve numerical problems based on water treatment methods, analysis of fuels, and lubricant quality parameters.
- Utilize concepts of polymers, nanomaterials, liquid crystals in real engineering scenario.

Detailed Syllabus

Unit	Description	Duration
1.	**Water Technology:** Hardness of water. Determination of hardness of water by EDTA titration. Numerical based on hardness of water and EDTA method. **Softening Methods:** Hot and Cold Lime-Soda Method, Zeolite Method and Ion-Exchange Method. Numerical based on lime-soda and Zeolite method. **Drinking water purification:** Removal of microorganisms, by adding bleaching powder, chlorination (no breakpoint chlorination), Ozonization, Desalination by Reserve Osmosis, Ultrafiltration.	08
2.	**Polymers:** Introduction and definition of important terms - monomer, polymer, polymerization, degree of polymerization, tacticity, and melting-glass transition temperature. **Plastics**: Thermosetting & Thermoplastics, Compounding of plastics, Preparation, properties and applications of commercial plastics (PF, PMMA) **Elastomers:** Natural rubber, drawbacks of natural rubber,	07

	Vulcanization of rubber. Preparation, properties and applications of commercial elastomers (Buna-S, Isocyanate rubber) **Speciality polymers:** Conductive polymers, Self-healing plastics. Applications of specialty polymers.	
3.	**Important Engineering Materials:** i) **Nanomaterials:** Structure, properties, applications of CNTs, Fullerenes, Graphite. ii) **Liquid Crystals:** Definition, Classification, properties with applications.	02
4.	**Corrosion:** Dry or Chemical corrosion, Wet or Electro chemical corrosion. Types of corrosion: concentration cell corrosion, galvanic corrosion, waterline corrosion, pitting corrosion, intergranular corrosion, stress corrosion. Factors influencing rate of corrosion. (with respect to nature of the metal and the environment of the metal) **Corrosion control:** i) Cathodic protection techniques ii) Protective coatings: (a) Metallic coatings-(Electroplating, galvanizing, tinning, metal cladding) (b) Organic coatings – (Paints, Varnishes-constituents and their functions)	08
5.	**Fuels and Combustion:** Definition, Classification, characteristics. Calorific value - Theoretical & Experimental (Bomb calorimeter). **Solid Fuel:** Coal, proximate and ultimate analysis, Numerical based on analysis of coal. (Dulong formula) and bomb calorimetry. **Liquid fuels:** Mining of Petroleum, Cracking, Reforming, Knocking in IC engines, anti-knocking agents (TEL and MTBE), octane number of petrol, cetane number of diesel. **Gaseous fuel:** (LPG, CNG) Composition, properties and application. Numerical problems based on Combustion of fuels (Calculation of air/oxygen requirement (solid/gaseous fuels and flue gases)	09
6.	**Environmental Aspects of Chemistry:** i) **Green Chemistry:** Principles of green chemistry with examples, (Numerical Problems, based on Atom economy) ii) **E-Waste: Definition,** Classification and Management of e-waste.	04
7.	**Lubricants**: Definition, Mechanism of lubrication, Properties-Viscosity, viscosity index, flash & fire, cloud & pour points, oiliness, saponification and acid value (Numericals based on saponification & acid value.	07

	Total	45

Text Books:

1. Jain.P.C (2014), Jain M, Engineering Chemistry, D*hanpat Rai & Co (Pvt.) Ltd, New Delhi, 16th ed,*.
2. Palanna.O.G. (2009), Engineering Chemistry, T*ata McGraw Hill Education. Pvt. Ltd, 1st Edition.*
3. Mallick Abhijit (2012), Chemistry for engineers; *1st ed, Viva Books.*
4. Joshi Payal (2016), Experiments in Engineering Chemistry, *1st ed, I.K.International Publishing.*

Reference Books:

1. O.V.Roussak, H.D.Gesser (2013), Applied Chemistry: A Textbook of Engineers and Technologists, *2nd ed, Springer Science.*
2. Beran J. A. (2014), Laboratory Manual for Principle of General Chemistry *10th ed, John Wiley.*

Term work consists of the following:

1. 2 Tests and at least 10 experiments.

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Basic Electrical Engineering				Code: MBAB01003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit Hours per week	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	2	0	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- Understand and solve simple ac and dc electrical and magnetic circuits using different theorems and laws.
- To get a basic understanding of the working principle and applications of motors.
- To impart hands-on experience in assembling and testing circuits.
- Get exposed to inter disciplinary engineering disciplines.

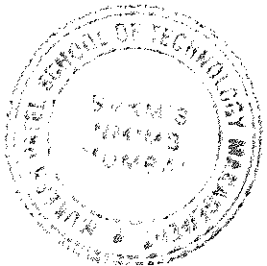
Outcomes:

After successful completion of this course, students should be able to

- To analyze and solve simple dc & ac circuits using network theorems & ac fundamentals.
- Assemble and conduct experiments on bread board.
- Function on multidisciplinary teams.

Detailed Syllabus:

Unit	Description	Duration
1.	**D.C Circuit (only independent sources)** Series and Parallel connection, Star Delta Conversion, Source Transformation, Kirchoff's laws, Mesh and Nodal Analysis, Superposition theorem, Thevenin's theorem, Norton's theorem & Max Power Transfer theorem.	12
2.	**AC Fundamentals** Alternating quantities, RMS & Average values, form factor, frequency, crest factor, series combination of R-L, R-C & RLC (with resonance) & parallel circuits (with resonance). Three phase circuit. Concept of balanced load and analysis with phasor diagram. Expression for total power, KW, KVAR & KVA.	12
3.	**Magnetic Circuit** Laws of magnetic force, definitions of field intensity, magnetic potential, flux & flux density, permeability, intensity of magnetization & susceptibility. Simple and composite magnetic circuits, comparison between electric and magnetic circuits, leakage flux, Faraday's laws of electromagnetic induction, induced emf, self inductance, mutual inductance, coefficient of magnetic coupling, inductances in series and parallel.	08



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4.	**Single phase transformer** Emf equation, determination of efficiency & regulation by direct loading. Estimation of regulation and Efficiency by OC & SC test.	08
5.	**DC and AC Motors** DC Motor: Construction and working principle, types of motors, DC motor characteristics, applications. AC Motor: Construction and working principle of 3 phase induction motor, applications.	05
	Total	**45**

Text Books:

1. Vincent Del Toro (2010), Electrical Engineering Fundamentals, *Prentice Hall India Learning Pvt. Ltd., 2nd Edition.*

Reference Books:

1. Harry Cotton (1967), Principles of Electrical Technology, *Pitman Publishers, 7th Edition.*
2. Cathey, Nasar & Prabhat Kumar, Schaum's Outlines (2010) - Basic Electrical Engineering, *Tata McGraw Hill Education Pvt. Ltd, 3rd Edition.*
3. B. L. Theraja (2004), Fundamentals of Electrical Engineering and Electronics, S. *Chand & Co., 2nd Edition.*

Term Work:

1. At least ten laboratory experiments
2. Two term tests
3. Assignments based on the whole syllabus, duly recorded and graded.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Engineering Mechanics-I				Code: MBAB01004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	2	0	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To develop thorough understanding of physical and mathematical principles
- To get acquainted with the various systems of forces
- To acquire the knowledge of principle of virtual work
- To know the concept of pin jointed frames
- Inculcate the ability to conduct experiments for better understanding of various principles

Outcomes:

After successful completion of this course, students should be able to

- Determine the resultant / equilibrant of various coplanar force systems.
- Analyse the system of forces in equilibrium.
- Analyse the beams using the principle of virtual work.
- Evaluate the internal forces in determinate pin jointed frames.
- Conduct experiments for better understanding of various principles.

Detailed Syllabus:

Unit	Description	Duration
1.	**System of Coplanar forces:** Introduction to coplanar & non-coplanar force system, forces and their components, resultant of coplanar force system - concurrent forces, parallel forces, non-concurrent non-parallel system of forces, moment of force about a point, couple, Varignon's theorem.	07
2.	**Equilibrium of coplanar force system:** Meaning of equilibrium, free body diagrams, equilibrium of concurrent, parallel and non-concurrent non-parallel (general) system of forces and couples. Types of supports, determination of reactions at supports for various types of determinate beams.	07
3.	**Forces in space:** Rectangular components of forces in space, Resultant of concurrent forces, moment of a force about a point, moment of a force about a given axis, resultant of general force system, Equilibrium of a particle in space.	08
4.	**Analysis of pin jointed plane trusses:** Perfect truss, method of joints, method of section	07

5.	**Friction:** Laws of friction, angle of friction, angle of repose, cone of friction, Equilibrium of bodies on rough horizontal and inclined plane, application to problems involving wedges, ladder. Belt friction, flat belts on the flat pulleys.	10
6.	**Principle of virtual work:** Application to determine the reactions of determinate beams with / without internal hinges	06
	Total	**45**

Text Book:

1. Beer & Johnson (2011), "Engineering Mechanics", *Tata McGraw Hill.*
2. R. C. Hibler (2004), "Engineering Mechanics", *McMillan Publishers*

Reference Books:

1. F. L. Singer (1954), "Engineering Mechanics", *Harper & Raw Publication*
2. D. S. Kumar (2009), "Engineering Mechanics", *Tata McGraw Hill*
3. Macklin & Nelson (2012), "Engineering Mechanics", *Tata McGraw Hill*
4. A. K. Tayal (2008), "Engineering Mechanics", *Umesh Publication*

Term Work:

Term work should consists of the following

1. Minimum five assignments covering the prescribed syllabus.
2. Report of minimum six experiments performed from the list given below.

List of Experiments:

1. To find reactions of simply supported beam (Parallel force system)
2. To verify polygon law of forces (Concurrent & non-concurrent force system)
3. To verify Lami's theorem using simple jib crane
4. Equilibrium of non-concurrent non parallel force system
5. To verify moment equilibrium condition using bell crank lever
6. To determine coefficient of friction using friction plane
7. To determine coefficient of friction using angle of repose method
8. Simple Screw Jack

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Computer Programming – I				Code: MBAB01005	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
2	2	0	3	--	Scaled to 50 marks

Pre-requisite: Nil

Objectives:

- To enable the students to understand the basic concepts of programming and help them build programming logic.
- To help them understand programming constructs like input/output, statements, operators, expressions, decision making and branching, looping, arrays, functions, structures, unions and pointers.

Outcomes:

After Successful completion of this course students will be able to

- Illustrate Flowchart and Algorithm for given Problem.
- Develop and Execute C Programs using Basic Programming Constructs.
- Implements C Program using various Data Types and Functions.
- Solving Programming Problem using Pointers.

Detailed Syllabus:

Unit	Description	Duration
1.	**C programming Language:** History of C, Program Development Life Cycle, Compiling and executing C Program, Algorithms and Flow Charts.	02
2.	**The Components of C Program:** Program's Components, Variables and Constants, Data Types, Statements Operators and Expressions	03
3.	**Fundamentals of I/O:** Formatted Input and Formatted output	02
4.	**Basic Program Control:** Decision Making and Branching, Decision Making and Looping: For, While and Do-while , Nested Looping	05
5.	**Arrays:** One Dimensional Array declaration and Initialization, Multidimensional Array, Dynamic Array.	03
6.	**Character Arrays & Strings:** Declaration and Initialization of String, Reading and Displaying String, Arithmetic Operations on Characters, Putting String Together, String Comparing, String Handling Functions.	02
7.	**Functions:**	04

	Need of User defined functions, Definition and declaration of functions Returns values and their types, Function calls, Categories of functions and Recursion	
8.	**Understanding Pointers:** What is Pointer, Pointers and Simple Variables, Pointers and Array, Pointers and String, Passing Arrays to Functions, Passing Pointers to functions	05
9.	**Structures & Unions:** Simple Structure, Complex Structure: Containing Arrays, Structures & Arrays of Structure, Structures and Pointers, Union	04
	Total	**30**

Text Book:

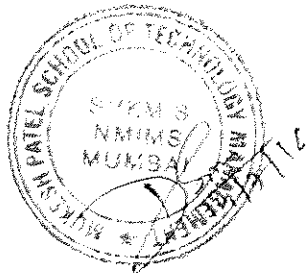
1. Programming in ANSI C E. Balaguruswamy, *Tata McGraw Hill, 6th Edition,* 2012

Reference Books:

1. Programming in C Ashok N Kamthane, *Pearson Educations, 2nd Edition,* 2011.
2. Mastering CK. R. Venugopal, S. R. Prasad, *Tata McGraw Hill, 2nd Edition,* 2015

Term Work:

1. Two Test and at Least 10-Experiments covering the entire syllabus.



SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Workshop Practice				Code: MBAB01006	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Practical	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
0	4	0	2	--	Scaled to 50 marks

Objectives:

- To impart hands on experience of different workshop practice on various trades.
- To impart knowledge of basic tools used for different workshop jobs.
- To introduce basic concepts of electrical and electronic instruments and its applications

Outcomes:

After successful completion of the course, students should be able to

- Select appropriate tools for workshop jobs
- Decide suitable joining process required for the jobs.
- Carry out basic electrical wiring.
- Prepare PCB layout

Detailed Syllabus

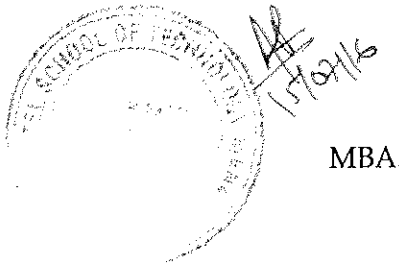
Unit	Description	Duration
1.	**Fitting:** Use and setting of fitting tools for chipping, instructions for safety in various Workshop Trades, cutting, filing, Marking, centre punching, drilling, tapping.	12
2.	**Carpentry:** Use and setting of carpentry hand tools like hacksaws, jackplanes, chisels and gauges for construction of various joints. Wood turning Demonstration. Term work to include one job involving a joint.	12
3.	**Fabrication of Metals and Plastics:** Edge preparation for welding jobs. Arc welding for different jobs like lap welding of two plates, butt-welding of plates Use of hand tools for sheet metal fabrication. Sheet metal fabrication of jobs involving cutting, shearing, bending, edge folding, soldering, brazing etc.	12
4.	**PCB Laboratory Exercises:** Layout drawing, positive and negative film making, PCB etching and drilling, tinning and soldering techniques	12
5.	**Wiring:** Study of cables used in Electrical & Electronic transmissions. Study of Electrical Fittings – Switches, Plugs, Holders, Connectors, Earthing	12

	Electrical Wiring for lighting and appliances Series & Parallel Connections.	
	Total	60

Term Work:

Minimum one job on each of the following:

1) Fitting
2) Carpentry
3) Welding
4) Sheet metal
5) Plastics
6) Wiring



SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: I	
Course: Constitution of India				Code: MBAB01007	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
2	0	0	0	--	Scaled to 50 marks

Objectives:

- To understand the basic aspects of the constitution of India, the evolution, the directive principle & important provisions.
- To understand the implications of important constitutional provision on Business and Professionals

Outcomes:

- This will enable students to understand fundamental political principles, procedures, powers and duties of a government.
- Students will know their rights as a citizen of India

Detailed Syllabus

Unit	Topics	Duration
1.	The Constitution, its evolution including history of freedom struggle	05
2.	Fundamental rights and duties, exceptions with examples, individual responsibilities & duties, application to Business	05
3.	Directive principles of the state policy, it's emphasis & it's impact on future legislation, in particular as related to business	05
4.	Parliamentary procedures and practices	05
5.	Centre, State Relations, Procedures in the legal relationship, Emergency provisions under article 370 & 371, safeguards for minorities, , Services under the Union and States, application to business	05
6.	Voting behaviour in India and present political scene. Responsibilities of Business in relation to the Constitution.	05
	Total	**30**

Prescribed Text:

1. Dr. Durga Das Basu, (2011) Introduction to the Constitution of India. *Lexis Nexis.*

Reference Book:

1. N. A. Palkhiwala, (1999). "We the People": India: The Largest Democracy. *UBS Publishers & Distributors Ltd.*

Term work

1. Class Test/ Assignments/ Case studies/ Projects/ Presentations.

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Engineering Mathematics-II				Code: MBAB02001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	0	2	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To provide an understanding of Matrices and differential equations in technical subjects.
- To impart knowledge of Beta & Gamma functions and multiple integrals, its applications to solve engineering problems.

Outcomes:

After successful completion of this course students will be able to :

- Solve problems based on matrices, Beta and Gamma functions, differential equations and multiple integrals.
- Evaluate Beta and Gamma function and their relations.
- Analyse suitable methods to solve differential equations and multiple integrals.
- Relate the concepts of matrices, Beta and Gamma functions, differential equations and multiple integrals to solve engineering problems.

Detailed Syllabus:

Unit	Description	Duration
1.	**Prerequisites:** Idea of curve tracing in Cartesian and polar forms with respect to the curves: Straight lines, Circles, Parabolas, Ellipse, Hyperbolas, Astroid, Cardioids and Lemniscates of Bernoulli. Concepts of solid geometry: Planes, Spheres, Cones, Cylinders, Ellipsoids and Paraboloids.	02
2.	**Matrices:** Introduction ,Types of matrices- Symmetric, Skew-Symmetric, Hermitian, skew-Hermitian, Orthogonal and Unitary, Adjoint of a matrix, Inverse of a matrix using adjoint method, Rank of a matrix, Rank by Normal form and Echelon form.	06
3.	**Beta and Gamma functions:** Definition of Beta and Gamma functions and their properties; Relation between Beta and Gamma functions; Duplication formula.	06
4.	**Differential Equations:** First order and first degree Exact differential equations and those which can be reduced to Exact form by use of integrating factor (four rules), Linear differential equations and equations reducible to linear form.	16

	Solutions of Linear differential equations of higher order with constant coefficients: Complementary functions, Particular integrals of the differential equations of the type $f(D)y = X$, where $= e^{ax}, \sin(ax+b), \cos(ax+b), x^m, e^{ax}V(x), xV(x)$. Cauchy's homogenous linear differential equation and Legendre's differential equation, Method of variation of parameters. **Applications of differential equations in modelling:** First-order Equations, Free Mechanical Oscillations, Forced Mechanical Oscillations.	
5.	**Multiple Integrals:** **Double Integration** - Introduction , Double integration in Cartesian and Polar Co-ordinates, Evaluation of integrals over a given region, Change of order of integration, concept of Jacobians, Change of Co-ordinate system, Area and Mass of a lamina and volume. **Triple Integration** - Evaluation in Cartesian, Cylindrical and Spherical Co-ordinates, Volume.	15
	Total	**45**

Text Books:

1. Robert Wrede (2010), Murray Spiegal, *Schaum's Outline of Advanced Calculus, Third Edition.*
2. B. S. Grewal (2013), "Higher Engineering Mathematics", *Khanna Publishers.*

Reference Books:

1. Erwin Kreyszig (2010),"Advanced Engineering Mathematics", *Wiley Eastern Ltd, 10th edition.*
2. G. Birkhoff and G.C.Rota, Ordinay Differential Equations (2003), *4th Edition, Wiley Singapore Edition.*
3. Alan Jeffrey (2003), Handbook of Mathematical Formulas and Integrals, *Academic Press, 3rd Edition.*
4. Murray R. Spiegel (2009), Schaum's Outline of Advanced Mathematics for Engineers and Scientists (*Schaum's Outline Series*).

Term Work:

As per institute norms.

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Engineering Physics				Code: MBAB02002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	2	0	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To enable students to understand the basic principles of advanced physics theory and practice.
- To enhance the student's ability to meet the needs of engineering applications
- To impart training to help the students develop skill sets for creating entities from basic and applied sciences.

Outcomes:

After Successively completion of this course, student will be able to

- Discuss different mechanical, electrical and thermal properties of materials; describe different cubic lattices, their parameters and defects observed in the crystals. Hence illustrate X – Ray diffraction techniques to identify crystal structure.
- Classify the solids according to energy bands; explain the theory of pn junction, biasing and calculate the conductivity, carrier concentration and position of Fermi level for semiconductors.
- Discuss the concepts of motion of charge in electric and magnetic field, demonstrate its applications and manipulate the displacement of electron.
- Describe the concept of interference, diffraction, mechanism of laser beam generation, working principle of optical fiber, their applications and calculate different related parameters.
- Discuss different production methods of ultrasonic waves and its application in the field of engineering.
- Explain the concept of superconductivity, types of superconductors, and their applications. Also calculate the critical parameters of superconductors.

Detailed Syllabus:

Unit	Description	Duration
1.	**Crystal Structure:** Structure of cubic crystals (SC, BCC, FCC), Miller indices, planes and direction, ligancy and critical radius ratio in ionic crystal. Imperfections: point, line, surface & volume (introductory). Determination of crystal structure using X-ray diffraction techniques.	06
2.	**Semiconductors Physics:** Formation of energy bands and classification of solids into conductors, semiconductors and insulators. Intrinsic and	06

	extrinsic semiconductors. Fermi levels in semiconductor, energy gap and its temperature dependence. Physics of semiconductor junction. Hall Effect and application.	
3.	**Electricity and magnetism:** Motion of charges in electric and magnetic fields. Application of electric and magnetic field to determine e/m. Electrostatic focusing system. Magnetostatic focusing system, CRO and its uses.	06
4.	**Optics:** Interference: Analytical treatment of interference. Interference in thin film in reflected system. Wedge shaped film. Newton's rings and applications. Diffraction: Fraunhoffer's diffraction at single slit, double slits, N Parallel slits (Mathematical derivation not expected). Diffraction grating, resolving power of grating, dispersive power of grating.	06
5.	**LASER:** Spontaneous and stimulated emission. Population inversion. Pumping, Lasing action. Ruby Laser, He-Ne Laser, CO2 Laser, Semiconductor Laser, Applications. **Fiber Optics:** Total internal reflection. Principle and working of optical fibers. Different types of optical fibers: Step index single mode, Step index multimode and graded index multimode fibers. NA for step index fiber, V Number, Dispersion and Losses in optical fiber, Applications.	08
6.	**Ultrasonics:** Production of ultrasonic waves by magnetostriction and piezo electric methods. Applications of Ultrasonic: Echo sounding (SONAR), thickness measurement, cavitation, non-destructive testing and flaw detection.	04
7.	**Superconductors:** Theoretical Explanation of super conductors: BCS Theory. Meissner effect. Josephson effect. Type-I & Type-II Superconductors. Properties and uses of superconductors.	04
8.	**Properties of materials:** Mechanical and physical properties: Stress, Strain, Strength, Stiffness, Hardness, Toughness, Elasticity, Ductility, Malleability, Fatigue, Creep, Density, Melting point, stress strain behavior of different materials. Plastic deformation: tensile properties, free stress and strain, hardness Electrical Properties: electrical conductivity, electrical resistivity, ferroelectricity, piezoelectricity, Dielectric strength	05

	Thermal properties: heat capacity, thermal expansion, thermal conductivity, thermal stresses.	
	Total	45

Text Books:

1. Dattu R Joshi (2010), "Engineering Physics", *Tata McGraw Hill 1st Edition.*
2. M.N. Avadhanulu, P.G. Kshirsagar (2013), "A Textbook of Engineering Physics" *S.Chand Publication, 9th Edition.*

Reference Books:

1. Arther Beiser (2009), "Concept of Modern Physics", *Tata McGraw Hill, 6th edition.*
2. R.K.Gaur and S.C.Gupta (2003), "Engineering Physics", *Dhanpat Rai & Co., New Delhi.*
3. Ajoy Ghatak (2009), "Optics", *Tata McGraw Hill, 4th Edition.*
4. James F.Shackelford and Madanapalli K. Muralidhara (2007), "Materials Science for Engineers" *Pearson Education, 6th edition.*
5. Halliday and Resnick (2008), Fundamentals of Physics- *Wiley India, 8th edition.*
6. Jenkins and White (2011), "Optics", *MC Graw Hill, 4th Edition.*

Term Work:

Term work consists of

1. Class test papers
2. Assignments covering syllabus (Minimum 2)
3. Report of lab experiments performed (Minimum 10)
4. Viva Examination

14/07/16

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Basic Electronics				Code: MBAB02003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	2	0	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- Understand the construction, working principle, characteristics and simple applications of basic electronic devices.
- Understand the application of these devices in making advanced circuits like amplifiers and oscillators.
- To impart hands-on experience in assembling and testing circuits.
- Get exposed to inter disciplinary engineering disciplines.

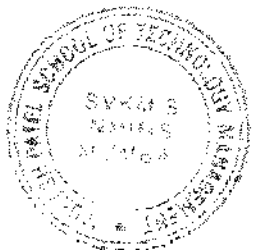
Outcomes:

After successful completion of this course, students should be able to

- Design simple circuits using diodes, BJTs and FETs
- Compare different classes of power amplifiers
- Select components based on data sheet parameters
- Assemble and conduct experiments on bread board
- An ability to function on multidisciplinary teams

Detailed Syllabus:

Unit	Description	Duration
1.	**Diode and its Applications:** Introduction to Semiconductor Diode Theory, DC Analysis and Models of diode, AC Equivalent Circuits of diode. Diode Types: photodiode, Light-Emitting Diode, Schottky Barrier Diode, Zener Diode, Temperature Effects, Understanding Manufacturer's Specifications. Applications: Rectifier Circuits - Half Wave and Full Wave Rectification, Filter circuits, Ripple Voltage and Diode Current. Zener Diode Circuits - Zener diode as voltage regulator. Clipper and Clamper Circuits.	14
2.	**Bipolar Junction Transistor:** Basic Bipolar Junction Transistor, Transistor Structures, NPN Transistor: Forward-active Mode Operation, PNP Transistor: Forward-active Mode Operation, Circuit Symbols and Conventions, Current-Voltage Characteristics, Non ideal Transistor Leakage Currents and Breakdown, DC Analysis of Transistor Circuits. Basic Transistor Application: Switch, Amplifier. Bipolar Transistor Biasing – Bias Stability, Fixed Bias, Collector-	12



	to-Base Bias, Voltage Divider Bias. Understanding Manufacturer's specifications. BJT amplifier frequency response. Figure of merit of an amplifier.	
3.	**Field Effect Transistor:** Junction Field-Effect Transistor & MOSFET- symbols, Drain and Transfer characteristics & study of different parameters. JFET Biaisng Methods (fixed bias, voltage divider bias and self bias). FET amplifier frequency response. Figure of merit of an amplifier.	10
4.	**Output Stages and Power Amplifiers:** Introduction to Power Amplifiers, difference between voltage and power amplifier, ac load line, characteristic and efficiency of Class A,B, AB, C and Push Pull amplifier.	05
5.	**Oscillators:** Positive feedback and basic Principles for Oscillation, Classification of transistor oscillators: Phase-Shift Oscillator, Wien-bridge Oscillator, Colpitts Oscillator, Hartely Oscillator, Crystal Oscillator.	04
	Total	**45**

Text Books:

1. Donald A. Neamen (2001), Electronic Circuit Analysis and Design, *McGraw Hill International, 2nd Edition.*
2. David A. Bell (2008), Electronic Devices & Circuits, *Prentice Hall India Pvt. Ltd, 5th Edition.*

Reference Books:

1. Donald Schilling & Charles Belove (1989), "Electronic Circuits Discrete and Integrated", *McGraw Hill International, 3rd edition.*
2. Martin Roden (2002), Gordon Carpenter, William Wieserman, "Electronic Design", *Shroff.Publishers, 4th edition.*
3. Robert Boylestad & Louis Nashelsky (2007), "Electronic Devices & Circuit Theory", *Pearson Education India - 9th Edition.*
4. B.L. Theraja (2004), "Fundamentals of Electrical Engineering and Electronics", *S. Chand & Co., 2nd Edition.*

Term Work:

1. At least ten laboratory experiments.
2. Two term tests.
3. Assignments based on the whole syllabus, duly recorded and graded.

SVKM's NMIMS
Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Engineering Drawing				Code: MBAB02004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Practical (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	4	0	5	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To introduce different curves used in engineering
- To acquire the concepts of projections of an object
- To develop competence in correct expression of the visualized objects.
- To familiarize the students with the use of drafting software in engineering drawing and concepts of orthographic projections

Outcomes:

After successful completion of this course, students should be able to

- Draw the different curves used in engineering
- Draw the projections of points, lines, planes and solids.
- Generate drawings with the help of computer software
- Draft the orthographic, isometric and oblique projections of a machine components

Detailed Syllabus:

Unit	Description	Duration
1.	Engineering Curves: Conics-Parabola, Ellipse, Hyperbola. Involutes, Cycloidal Curves: Cycloid, Epicycloid, Hypocycloid. Spirals, Helix.	08
2.	Projection of Points & Lines inclined to both the Reference Planes including HT, VT. Projection of Planes inclined to both the Reference Planes, Auxiliary Planes.	08
3.	Projection of Right regular Solids: Regular Polyhedrons (Tetrahedron, Hexahedron), Prisms, Pyramids, Cylinders, Cones inclined to both the reference Planes. Sections of solids cut by inclined planes.	10
4.	Development of Lateral surfaces of solids cut by inclined plane and curved plane	04
5.	Orthographic Projections, Sectional views of Orthographic Projections	06
6.	Isometric Projections	04
7.	Oblique Projections :-Auxiliary views of Machine parts	03
8.	Introduction to Machine Parts: Types of nuts, bolts, screws, studs and riveted joints	02
	Total	45

Text Book:

1. N.D.Bhat (2007), "Elementary Engineering Drawing", *Charotar Publishing House.*

Reference Books:

1. M.B.Shah & B.C.Rana (2005), "Engineering Drawing", *Pearson Education.*
2. T.Jeyapovan (2005), "Engineering Drawing and Graphics", *Vikas Publishing House Pvt. Ltd.*
3. H.G.Phakatkar (2011), "Engineering Graphics", *Nirali Prakashan.*
4. K.Venugopal (2007), "Engineering Drawing and Graphics", *New Age International Publishers.*
5. K.L.Narayana & P.Kannaiah (1988), "Engineering Graphics", *Tata McGraw-Hill Co. Ltd., New Delhi.*
6. Giesecke, Mitchell, Spencer & Hill (2008), "Technical Drawing", *Macmillan Publishing Co. Inc. New York.*

Term Work:

Term work should consists of the following

1. Two A2 size drawing sheets comprising minimum 3-4 problems on each unit.
2. Total eight computer drafted A3 size drawing sheets consisting of 2 to 3 problems on each module and class assignments.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Engineering Mechanics-II				Code: MBAB02005	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
3	0	2	4	Scaled to 70 marks	Scaled to 30 marks

Objectives:

- To know the concept of centroid and moment of Inertia
- To get acquainted the dynamic system in equilibrium and the motion characteristics of particles
- To study the forces developed on bodies in motion

Outcomes:

After successful completion of this course, students should be able to

- Determine the centroid and moment of Inertia of a plane area
- Evaluate the velocity, acceleration and displacement of a moving body
- Analyse the forces developed on the moving body

Detailed Syllabus

Unit	Description	Duration
1.	**Centroid and moment of inertia:** Centroid and moment of inertia of thin wires & plane areas, parallel axis theorem. Introduction to polar moment of inertia, product of inertia and mass moment of inertia.	07
2.	**Kinematics of particle:** Velocity and acceleration in terms of rectangular coordinate system, rectilinear motion, motion along plane curved path, tangential and normal component of acceleration, acceleration - time , velocity- time graphs and their uses, relative velocity, projectile motion, simple harmonic motion.	12
3.	**Kinematics of rigid bodies:** Translation, pure rotation and plane motion of rigid bodies, instantaneous centre of rotation for the velocity for bodies in plane motion, link mechanisms (upto two links).	06
4.	**Kinetics of particles:** Newton's laws of motion, D'Alembert's principle, equation of dynamic equilibrium, linear motion, curvilinear motion. **Kinetics of rigid bodies:** D'Alembert's principle for bodies under translational motion, rotational motion about a fixed axis and plane motion. Application to motion of bars, cylinders, spheres.	10
5.	**Energy and Momentum principles:** Work done by a force, potential and kinetic energy, power, work energy equation, principle of conservation of energy, momentum, principle of	10

	conservation of momentum, impact of solid bodies, elastic impact, semi-elastic impact and plastic impact.	
	Total	45

Text Book:

1. Beer & Johnson (2011), 'Engineering Mechanics', *Tata McGraw Hill.*
2. R. C. Hibler (2004), "Engineering Mechanics", *McMillan Publishers.*

Reference Books:

1. F. L. Singer (1954), 'Engineering Mechanics', *Harper & Raw Publication.*
2. D. S. Kumar (2009), "Engineering Mechanics", *Tata McGraw Hill.*
3. Macklin & Nelson (2012), "Engineering Mechanics", *Tata McGraw Hill.*
4. A. K. Tayal (2008), "Engineering Mechanics", *Umesh Publication.*

Term Work:

Term work should consists of the following

1. Minimum seven assignments covering the prescribed syllabus.

Program: MBA. Tech. (All Branches)					Semester: II
Course: Computer Programming–II					Code: MBAB02006
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
2	2	0	3	--	Scaled to 50 marks

Pre-requisite: Nil

Objectives:

- To enable the students to understand the basic concepts of object oriented programming and help them build programming logic.
- To help them build classes and understand the re usability of classes.

Outcomes:

After successful completion of this course, students will be able to:

- Develop and execute C++ program using basic programming constructs, various data types and functions.
- Implement object oriented concepts classes, objects, constructor, destructor, operator overloading, type conversion.
- Implement object oriented concepts inheritance, virtual functions and polymorphism.
- Implement the concepts of file handling and generic programming using templates.

Detailed Syllabus:

Unit	Description	Duration
1.	**Principles of Object Oriented Programming:** Software Crisis, Software Evolution, Basic Concepts of OOP	02
2.	**Beginning with C++:** What is C++?, Applications of C++, Structure of C++ Program, Creating, Compiling, Linking	02
3.	**Tokens, Expressions and Control Structures:** Basic Data Types, User Defined Data Types, Derived Data Types, Variables, Operators in C++, Scope Resolution Operator, Manipulators, Control Structures	03
4.	**Functions in C++:** Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Default Arguments, Function Overloading, Friend and Virtual Functions	04
5.	**Classes and Objects:** Specifying a Class, Memory Allocation for Objects, Static Members, Arrays of Objects, Objects as Function Arguments, Returning Objects	02
6.	**Constructors & Destructors:** Constructors, Constructors with Default Arguments, Dynamic	03

	Initialization of Objects, Copy Constructor, Dynamic Constructors, Destructors	
7.	**Operator Overloading & Type Conversions:** Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators Using Friends, Rules for Overloading Operators, Type Conversion	03
8.	**Inheritance:** Defining Derived Classes, Single Inheritance, Making Private member Inheritable, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes	04
9.	**Virtual Functions and Polymorphism:** Need for Virtual Functions, Pointer to Derived Class Object, Pure Virtual Functions, Dynamic or Late Binding	03
10.	**File Handling:** Files and Streams, Opening and Closing a File, Sequential I/O Operations	02
11.	**Templates:** Function Templates, Class Templates	02
	Total	30

Text Book:

1. E. Balaguruswamy (2011), "Programming in C++", *Tata McGraw Hill Education, 5th Edition.*

Reference Books:

1. Herbert Schildt, "The Complete Reference C++", *Tata McGraw Hill Education, 4th Edition, 2003.*

Term Work:

As per Department and Institute Norms for Term-work.

Program: MBA. Tech. (All Branches)				Semester: II	
Course: Communication Skills				Code: MBAB02007	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorial Hours per week	Credit	Theory (3 Hrs, 70 Marks)	Internal Continuous Assessment (ICA) As per Institute Norms (50 Marks)
2	0	2	3	Scaled to 70 marks	Scaled to 30 marks

Objectives:

To familiarize students on the following:

- To maintain good linguistic competence through accuracy in pronunciation, stress, word accent, intonation and grammar and vocabulary.
- To increase students' ability to improve and utilize the skills necessary to be a competent interpersonal communicator, increase the students understanding of his or her own communication behaviour and that of others.
- To help students and professionals coming from different fields to comprehend the finer nuances of communication skills and to realize their communication potential.

Outcomes:

The students will be able to:

- To acquire strategic competence to use spoken and written language in a wide range of communication strategies and respond appropriately in different sociocultural and professional contexts.
- To familiarize students with business writing of organizations and develop in them an ability to critically analyze them.
- To help students cultivate the habit of reading passages and improving their reading skills and comprehension, inferring meanings and summarizing.
- To provide an insight in to the understanding of technical writing.

Detailed Syllabus:

Unit	Description	Duration
1.	**Communication theory:** Meaning, Definitions, components, objectives, Importance of communication for Engineers, Methods and Importance of Communication (Oral Written And Non- Verbal). Barriers to Communication.	12
2.	**Vocabulary Building:** Synonyms and Antonyms, One-word substitutes.	02
3.	**Techniques to improve communication:** 3.1 Reading Skills - Reading, comprehending, scanning, skimming, inferring meanings from contexts. 3.2 Speaking Skills - Voice Modulation, Good Pronunciation,-	04

	Speaking without Fear, -Extempore & Prepared Speaking, role play in different situations. 3.3 Listening Skills - Barriers to Listening, Listening & Note Making. 3.4 Writing Skills - Effective Sentences & Paragraphs-, Summarizing, The 7 C's of effective writing.	
4.	**Business Correspondence:** Principles of correspondence, Language, Style, Types of formats, Complete Block/ Modified block/ and Semi block Types of letters: Request letters, Enquiry letters and Reply to Enquiries (Enquiry for a product, services, or information, asking for quotation, placing an order, and replies to same). Letters of Claim and Adjustments.	10
5.	**Technical Writing:** Framing Definitions, writing instructions, Types of expositions, (Description of an object and Explanation of a process).	02
	Total	30

Prescribed Text:

1. Dr. Meenakshi Raman and Dr. Sangeeta Sharma, (2008). *Communication Skills.* Oxford University Press.

Reference Books:

1. R.C Sharma and Krishna Mohan (2002), Business Correspondence and Report Writing, *Tata McGraw Hill Publications, 3/e.*
2. Meenakshi Raman and Prakash Singh (2006), Business Communication, *Oxford University Press.*
3. Ronald B. Adler and George Rooman (2006), Understanding Human Communication. *Oxford University press, 9/e.*
4. Rai Urmila, Rai S.M. (1989), Business Communication. *Himalaya Publishing house.*
5. K K Sinha (2000), Business Communication.
6. Kitty O Locker, Stephen Kyo Kaczmarek (2013), Business Communication: Building Critical Skills, *Mc Graw Hill.*

Term Work:

List of Assignments:

1. 2 assignments on vocabulary topics.
2. 3 assignments on techniques to improve communication.
3. 1 Practical session through self-introductory speeches.
4. 3 assignments on Communication Theory.
5. 4 assignments on Business Correspondence.
6. 2 assignments on Technical Writing.
7. 2 practical sessions on speech.
8. 2 class test based on all the topics.

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) Chemical				Semester III	
Sub: Process Calculation-I				Code: MBCH03001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Mathematics, Physics & Chemistry of Standard XII
Course Objective:	This subject aims at first familiarizing the student with the day-to-day calculations done in chemical industry. An expertise in this calculation is vital for the plant personnel, design engineers & managers. These calculations are prerequisite to learning remaining core courses in chemical engineering and they form basis of designing various chemical equipments.
Course Outcome:	Applying computational skills in performing material balance of chemical plants

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**Units and Dimensions:** dimension & systems of units, fundamental quantities, derived quantities, conversions, recommendation for use of units	5
2	**Basic Chemical calculations:** mole, atomic mass & molar mass, equivalent mass, solids, liquids & solutions, important physical properties of solutions, gases, conclusion	10
3	**Material Balance without chemical reactions:** The material balance, Solving material balance problems involving simultaneous equations, Solving material balance problems	10

	involving multiple, subsystems, Recycle, Bypass and Purge calculations, Use of linier models and matrix method in solving material balance problems, graphical solution of problems	
4	**Stoichiometric and Unit operations:** distillation, absorption & stripping, extraction & leaching, crystallization, psychrometry, drying, evaporation, less conventional operations	5
5	**Material Balance involving Chemical Reactions:** equations for chemical reactions, material balances involving chemical reactions, definition of terms, generalized approach for solving material balance problems involving chemical reactions, linier model for material balance problems involving chemical reactions, electrochemical reactions, recycling, parallel and bypassing operations, metallurgical applications	15
	Total	**45**

TEXT BOOKS:

1. D.M. Himmelblau, Basic Principles and calculations in Chemical Engineering, Prentice Hall of India Pvt. Ltd., Sixth Edition, 2005.
2. B.I. Bhatt & S.B. Thakore, Stoichiometry, Tata McGraw Hill Education Pvt. Ltd., 5 th Edition, 2010

REFERENCE BOOKS:

O. A. Hougen, K. M. Watson, R.A. Ragatz; Chemical Process Principles, Vol I, LBS Publishers & Distributors, 2nd edition, 2004.

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) Chemical				Semester III	
Sub: Fluid Mechanics-I				Code: MBCH03002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Applied Physics, Engineering Mechanics I & II
Course Objective:	Chemical industry processes variety of fluids in static and dynamic conditions. This course aims at providing following inputs- a) Understanding of nature of different fluids under sheer b) laws of static fluids c) rules and practices of handling fluids in motion d) preparing the students for selecting/ designing fluid handling and monitoring equipments.
Course Outcome:	Proficiency in understanding static and dynamic behavior of fluids and applying its principals in selection / sizing of fluid handling and measuring equipment.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**Scope & application of fluid flow.**	1
2	**Fluid Statics:** Concept of pressure and hydrostatic equilibrium. Barometric equation. Manometers of various types.	6

3	**Fluid flow phenomena:** Velocity fields, velocity gradients and the shear stress field in laminar flow. Viscosity and kinematic viscosity, Newtonian and Non-Newtonian fluid behavior. Turbulence. Reynolds number and transition from laminar to turbulent flow for Newtonian. Nature of turbulence, Eddy viscosity. Quantitative description. Flow in boundary layers & velocity profiles.	8
4	**Basic equations of fluid flow:** Equation of continuity. Equations of motion & Equation of mechanical energy. Bernoulli equation with and without friction. Correction terms in Bernoulli equation, application to various cases.	6
5	**Flow of incompressible fluids:** Skin friction & wall shear in a cylindrical tube, Hagen-Poiseuille equation for Newtonian fluids. Laminar flow of Newtonian fluids. Turbulent flow in pipes & close conduits. Friction factor, effect of roughness parameter. Flow through non-circular cross-section, change in velocity or direction.	8
7	**Metering of fluids:** Types, principles, and applications of different types of flow meters.	4
8	**Pumps**: Types of pumps and their applications. Centrifugal pump vs Positive Displacement pump. Centrifugal Pump performance curves and the affinity laws. Cavitations, NPSHA, NPSHR, Suction Specific Speed. Suction lift, Priming. Principle of mechanical seal	8
9	**Non-Newtonian Fluids:** Types of non-Newtonian fluids and their rheology, Examples and Applications.	4
Total		45

TEXT BOOKS:

1. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th ediion, 2005.
2. Coulson J.M., Richardson J.F., Backhurst J.R., Harker J.H., Gulson & Richardson's Chemical EngineeringVol.1,2, Butterworth – Heinemann, 6th edition, 2004.

REFERENCE BOOKS:

1. Bansal, R.K., A Textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publication Pvt. Ltd, 9th edition, 2011.
2. Badger, W.L., Banchero, J.T., Introduction to Chemical Engineers, Tata MCGraw Hill, 12th Edition, 2005.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) Chemical				Semester III	
Sub: Strength of Material & Fabrication				Code: MBCH03003	
Teaching Scheme				**Evaluation Scheme**	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Applied Chemistry, Applied Physics and Engineering Mechanics I & II
Course Objective:	Objective of the Syllabus is to make the students conversant with: a) Various types of forces/loading and the resultant stresses there on to which mechanical components and structures are subjected to. b) to provide understanding of various design aspects of chemical equipment and to introduce students to various fabrication techniques along with codes and standards used in industries.
Course Outcome:	Understanding the stress and strain in materials undergoing different loading and conditions, different techniques used in joining of components and fabrication techniques. Application of these principals in mechanical designing of chemical equipments.

Detailed syllabus

Units	Topics	Duration (Hrs.)

1	**Stress and Strain:** Strain, modulus of elasticity, modulus of rigidity, bulk modulus, yield stress, ultimate stress, factor of safety, shear stress, Poisson's ratio, analysis of members made of composite materials.	4
2	**Shear Force and Bending Moment:** Axial force, shear force and bending moment diagrams for statically determinate beams (excluding beams with internal hinges) for different types of loading.	4
3	**Thin Shells:** Thin cylindrical and spherical shells, volumetric strain, cylindrical shell with hemispherical ends.	4
4	**Theory of Bending:** Bending equation, section modulus and its significance.	4
5	**Direct and Bending stresses:** components subjected to eccentric loading, stress distribution.	5
6	**Theory of torsion:** torque equation, polar modulus of section, torsional rigidity.	4
7	**Columns and struts:** Basic concepts, slenderness ratio, Fixty coefficient, Rankine's & Eulers Equations for buckling load.	4
8	**Components subjected to combined stresses:** Principal stresses, torsional & axial load, torsion and bending - guest equation, Rankine's equation, ST. Venant's equation, Torsion, bending and axial loads – Henky's equation.	5
9	**Techniques of joining** Brazing & Soldering – materials, tools, techniques and applications Welded joints – Classification of various types of welding, Advantages & limitations of welded joints, Types of welded joints, types of welds and their symbols (including drawing representations.), strength of welded joints, various types of welding, techniques, applications and selections, flaws in welded	5

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	joints. Rivetting – Types of rivets and riveted joints, strength of riveted joints, efficiencies of riveted joints. Bolted joints – Types of bolts, nuts and locking devices, bolted joints for fluid tight applications, types of gaskets and selections.	
10	**Lining of Vessels & Pipes:** Need for lining, materials for lining, surface preparations, Q.C tests, codes / standards employed for various lining techniques.	2
11	**Non – destructive testing:** Dye penetration method, magnetic particle method, ultrasonic testing, Radiographic testing: Xrays & Γ ray testing.	2
12	Fabrication with plastics: Welding & joining techniques, machining, FRP fabrication	2
	Total	45

TEXT BOOKS:

1. M. D. Dayal, Strength of Materials, M. D. Dayal publication, 3rd edition, 2008.
2. M.V. Joshi, Process Equipment Design, Mcmilan Publisher, 3rd edition, 2005

REFERENCE BOOKS:

1. B. C. Bhattacharya, Chemical Engineering Equipment Design, CBS Publication, 2005.
2. Hajara & Choudhari & I, Work Study Technology Vol. Vol. II, Media Promoter publisher, 11th edition, 2004.
3. O. P. Khanna, Material Science & metallurgy, Dhanpatrai publication, 2008

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) Chemical				Semester III	
Sub: Heat Transfer Operations				Code: MBCH03004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2		4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Applied mathematics I & II, Applied physics.
Course Objective:	To prepare a strong base of fundamentals of heat energy transport processes. Develop analysis skills through examples of heat transfer and to acquaint students with principles and operations of heat transfer equipments.
Course Outcome:	Applying the knowledge gained in designing of Heat transfer equipments for different applications.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**Introduction:** Applications of heat transfer; Mechanisms of heat flow; Basic considerations.	02
2	**Heat Transfer by Conduction:** Fourier's Law; Comparison with Newton's law of cooling; Thermal Conductivity; Steady – state Conduction; Conduction Through a Flat Slab; Compound Resistances in Series; Conduction Through a Thick – walled Cylinder; Critical Radius of Insulation; Conduction Through a Spherical Shell and to a Particle; Unsteady – State Conduction: Semi – infinite Solid; Heating of Particles; Systems with Negligible Internal Resistance; Systems with Varying Fluid Temperature.	08

3	**Individual or Surface Heat Transfer Coefficient:** Concept and Definitions; Temperature Gradients; Overall Heat Transfer Coefficients (U); Resistance Form of U; LMTD; Heat Transfer Between Fluid Separated by a Cylindrical Wall; Wilson Plot; Fouling Factors; Typical Heat Exchange Equipment: Shell and Tube Heat Exchanger, Double Pipe Heat Exchanger; Enthalpy Balances.	05
4	**Forced and Natural Convection:** Thermal Boundary layer and Flow Regimes; Dimensional Analysis: Principles and Applications; Various empirical Correlations: Graetz, Dittus-Boelter, Sieder – Tate and Colburn Equations; Estimation of Wall Temperature; Cross – sections other than Circular: Equivalent Diameter.	06
5	**Heat Transfer with Phase Change** Condensation: Models and Features; Theory and Derivation of Nusselt's Equation; Correlations for Vertical Surface or Tube, Vertical Plate, Single Horizontal Tube and Stack of Tubes; Heat Transfer to Boiling Liquids; Pool Boiling of Saturated Liquid: 4 Mechanisms; Nucleate Boiling; Simplified Equations to Estimate the Boiling Heat Transfer Coefficient; Concept of Maximum Flux and Critical Temperature Drop;	04
6	**Radiation Heat Transfer** Fundamental facts and Definition of Terms: Emissivity, Absorptivity, Black Body, Grey Body, Opaque Body; Stefan – Boltzman Law; Kirchhoff's Law;' Basic Equations for Heat transfer by Radiation; Various Cases of Radiation Between Two Surfaces; The Greenhouse Effect.	06
7	**Heat Exchange Equipment** Types of Heat Exchange Equipment and their Utility: Shell and Tube Heat Exchanger, Plate – type Exchangers, Condensers, Boilers, Calandrias, Air – cooled Exchangers, Crossflow Heat Exchangers, Scraped – surface Exchangers, Extended – surface Heat Exchangers; Helical Coils in Agitated Vessels; Jackets on Agitated Vessels; Direct – contact Exchangers; Criteria of Selection; General Design for Shell and Tube Heat Exchanger; Multipass Exchangers; Kern's Method and Donohue Equation to Estimate Shell Side Heat Transfer Coefficient; Effectiveness – NTU Method	07
8	**Heat Transfer through Extended Surfaces** Types and Applications: Longitudinal and Transverse Fins; Efficiency of Fin; Overall Heat Transfer Coefficient.	02

9	**Evaporation** Types of Tubular Evaporators: Performance: Capacity and Economy; Boiling Point Elevation; Heat Transfer Coefficients; Overall Coefficient; Balances for Single – Effect Evaporators with Negligible and Appreciable Heat of Dilution; Multi – Effect Evaporators: Methods of Feeding, Capacity and Economy, Effect of Liquid Head and Boiling Point Elevation; Vapor Recompression.	05
	Total	45

TEXT BOOKS:

1. Kern, D.Q., Process Heat Transfer, Tata McGraw – Hill Ed., 2008.
2. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th edition, 2005.

REFERENCE BOOKS:

1. Coulson, J.M. et.al., Coulson & Richardson's Chemical Engineering, Vol. 1,2, 3, 4, 5th Ed, Butterworth Heinemann Ltd., 2004.
2. McKetta, J.J. et.al., Ed., Heat Transfer Design Methods, Marcel Dekker, 1992.
3. Perry, R.H., et.al, Perry's Chemical Engineers ' Handbook, 7th Ed., McGraw – Hill, International Edition, 1997.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (Chemical)				Semester III	
Sub: Chemical Engineering Thermodynamics				Code : MBCH03005	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 70 marks	Scaled to 30 marks
Objective:		Introduction to first and second law of thermodynamics and its applicability to chemical engineering systems. Deviations from ideal gas law, methods of estimating system volume. Definition of various thermodynamic functions and their estimation from measurable parameters. Importance and application of phase equilibria. Importance and applications of chemical reaction equilibria.			
Prerequisite:		HSC level Chemistry, Integration & differentiation of mathematical equations			
Outcome:		Understanding of thermodynamics of various processes, calculation of thermodynamics parameters, Application of phase equilibria, chemical reaction equilibrium for different systems.			

Detailed Syllabus

Unit	Description	Duration(Hr)
1	**Introduction and First Law of Thermodynamics** Systems and surroundings Heat and work interactions in thermodynamic processes. Basic concepts of thermodynamic equilibrium, State functions, State postulate and Phase rule, Reversible and Irreversible processes. First Law of Thermodynamics, Concepts of	8

	Internal Energy (U) and enthalpy (H); Thermodynamic analysis of Flow Process. Joule - Thomson effect.	
2	**Second law of** Thermodynamics Cartons Cycle, Concept of Entropy (S) Refrigeration; Availability and Lost work.	7
3	**Volumetric Properties of pure substances and mixtures** Review of ideal and real gas behavior; Compressibility factor; Compressibility factor charts; Pitzer's acentric factor; Equations of State – Van der Waals, Virial, Redlich – Kwong, Soave - Redlich - kwong, Peng – Robinson equations and their application to mixture of gases. Liquid phase – Extension of equations of state to describe liquid phase.	8
4	**Thermodynamic Properties and Relations** Definitions of Helmholtz free energy (A) Gibbs free energy (G) Fugacity and Fugacity coefficient of pure components; Maxwell Relations, Residual Properties, Thermodynamic Charts, Diagrams and – their constructions and use.	7
5	**Phase Equilibria** Phase equilibria at low and moderate pressures, High pressure gas liquid and vapour liquid equilbria, Liquid – liquid and solid liquid equilibria.	8
6	**Chemical Reaction Equilibrium** The standard Gibbs free energy change and equilibrium constant, effect of temperature on equilibrium constant, homogeneous and heterogeneous reactions, effect of operating conditions on degree of conversion at equilibrium, adiabatic reaction temperature.	7
	TOTAL	45

TEST BOOK:

1. Rao, Y.V.C., Chemical Engineering Thermodynamics, Universities Press, 2011.
2. Smith J.M. Sr. Van Ness, H.C.: Introduction to Chemical Engineering Thermodynamics, Tata McGraw Hill, 6th edition; 2008.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

REFERENCE BOOKS

1. Glasstone, Thermodynamics for Chemists, Affiliated – West Press, 2005.
2. Kyle B.G., 'Chemical and Process Thermodynamics: Prentice Hall of India, 3rd edition, 2004.
3. Hougen O.A. Watsoxi, W.M. Ragatz R.A; 'Chemical Process Principles', Vol 2, CBS, 2nd edition, 2004.
4. Daubert, T.E.: Chemical Engineering Thermodynamics, Tata McGraw Hill, International Edition, 1985.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester IV	
Sub: Process Calculation-II				Code: - MBCH04001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	-	3	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Process Calculation-I
Course Objective:	To acquire computing skills in a) energy balances of chemical processes b) combustion operations c) Stoichiometric of industrial processes
Course outcome:	Applying the computational skills in doing energy balances of various chemical processes and combustion operations. Analysis of material and energy balances of industrial processes.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	**Energy Balances:** Energy & thermo-chemistry, Energy balances, Heat capacity, Sensible heat changes in gases at constant pressure, Sensible heat changes in liquids and solids, Heat capacity of gaseous mixtures, Heat capacity of liquid mixtures, Latent heats, Enthalpy changes for pure substances and their mixtures in ideal states, Equilibrium flash calculations of a multicomponent system, Enthalpy changes accompanying chemical reactions, Absolute enthalpy, Standard heat of reaction, Adiabatic reactions, Thermo-chemistry of mixing processes, Dissolution of solids, Liquid-Liquid mixtures, Gas-Liquid system, Heat of solution by partial molar quantities, Data sources.	25
2	**Combustion:** Fuels, Calorific values of fuel, Coal, Liquid fuels, Gaseous fuels, Air requirement & Flue gases, Combustion calculations.	10
3	**Stoichiometry of Industrial Problems**	10

TOTAL	45
TEXT BOOKS 3. D.M. Himmelblau, Basic Principles and calculations in Chemical Engineering, Prentice Hall of India Pvt. Ltd., Sixth Edition, 2005. 4. B.I. Bhatt & S.B. Thakore, Stoichiometry, Tata McGraw Hill Education Pvt. Ltd., 5 th Edition, 2010	
REFERENCE BOOKS 1. O. A. Hougen, K. M. Watson, R.A. Ragatz; Chemical Process Principles, Vol I, LBS Publishers & Distributors, 2nd edition, 2004	

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (Chemical)				Semester IV	
Sub: Fluid Mechanics-II				Code: MBCH04002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	-	3	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Applied Physics, Engineering Mechanics I & II, Fluid Mechanics-I
Course Objective:	This second part of the course aims at developing the understanding of behavior of compressible fluids and energy requirements for transportation and imparting knowledge about two phase flow, mixing of fluids and flow of fluids in packed and fluidized beds. The course aims at preparing students for selecting / designing equipments in the areas of topics covered.
Course Outcome:	Proficiency in understanding static and dynamic behavior of fluids and applying its principals in selection / sizing of fluid handling and measuring equipment.

Detailed Syllabus

Unit	Topics	Duration hr
1.	**Pipes and fittings:** Materials and Specifications of pipes and pipe fittings. Equivalent Length of fittings. Concept of Economic pipe diameter. Types of valves and their applications.	3
2.	**Pipe Networks:** Calculations of pressure drop in pipe network systems. Application of Bernoulli's principle.	6
3.	**Flow of compressible fluids:** The basic relations. Acoustical velocity and Mach number of ideal gas. The asterisk condition. Stagnation temperature of a high speed fluid.. Processes in compressible flow: Isentropic flow, Adiabatic friction flow, Isothermal	6

	frictional flow (no numerical).	
4.	**Fans, Blowers and Compressors:** Types of fans, blowers and compressors. Reciprocating, Rotary and Centrifugal compressors. Adiabatic, Isothermal and Polytropic compressions. Concept of surging. Vacuum pumps, Ejectors and Gas turbines.	8
5.	**Gas / Liquid & Liquid / Liquid Two Phase Flow:** Flow types and regimes in horizontal & vertical flow, Regime maps, Phase hold ups, Practical methods of evaluation of pressure drops & their details, Air lift pump. Behaviour of Non-Newtonian fluids in two phase flow.	6
6.	**Mixing of fluids:** Types of agitators and their applications and selection. Flow pattern in agitated vessel and prevention of swirling. Standard turbine design. Flow number, Power number, and Calculation of power requirement in agitated vessels. Motionless mixers.	8
7.	**Flow past Immersed Bodies:** Friction and pressure drop in flow through beds of solids, Motion of particles through fluids, terminal velocity. Fluidization phenomena, types of beds and pressure drop.	8
	TOTAL	45

TEXT BOOKS:

1. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th edition, 2005.
2. Coulson J.M., Richardson J.F., Backhurst J.R., Harker J.H., Gulson & Richardson's Chemical EngineeringVol.1,2, Butterworth – Heinemann, 6th edition, 2004.

REFERENCE BOOKS

3. Bansal, R.K., A Textbook of Fluid Mechanics & Hydraulic Machines, Laxmi Publication Pvt. Ltd, 9th edition, 2011.
4. Badger, W.L., Banchero, J.T., Introduction to Chemical Engineers, Tata MCGraw Hill, 12th Edition, 2005.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester IV	
Sub: Mass Transfer Operations - I				Code: - MBCH04003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Process Calculations-I & II, Fluid Mechanics-I & II, and Heat Transfer Operations
Course Objective:	In this subject, the student is expected to learn – a) the basics of mass transfer, its similarity to the other transport phenomena and more importantly the differences. b) concepts of diffusion, estimation of diffusion co-efficient, interface mass transfer and their co-relations c) various theories of mass transfer and co-relations of mass transfer co-efficients d) concept of stage, equilibrium stage and cascade operation e) design of absorption process and equipment f) design of drying process and equipment g) design of humidification/ dehumidification process and its equipment
Course outcome:	Understanding the principals of various mass transfer operations like absorption, drying and humidification/ dehumidification and applying them to design of mass transfer equipments.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	Fick's Law of diffusion, Definition of various fluxes and relations between them. Diffusivity - definitions, methods of estimations, Binary and Multi-component situations. Special cases of binary mass transfer- equi-molar counter diffusion and diffusion of one component through non-diffusing second component, numerical examples. Diffusion in solids. Numerical examples	06
2	Mass transfer coefficient definitions and evaluation, in a) laminar flow and b) Turbulent flow. Theories for evaluation of mass transfer	05

	coefficients. Evaluation of mass transfer coefficient through analogy with heat and momentum transfer. Numerical examples	
3	Inter phase mass transfer: Equilibrium. Mass transfer coefficient in individual phases. Overall mass transfer coefficients and relations between local and overall coefficients. Concept of phase with major resistance to mass transfer. Numerical examples. Methods of contacting phases: stage wise and continuous contact. Co-current, counter-current and cross current operations. Examples of applications. Equilibrium stage definition and concepts. Steady state, equilibrium stage operations: Material balances. Concept of operating line and equilibrium lines. Theoretical stage, point and stage efficiency, overall efficiency. Continuous contacting, concepts of NTU, HTU, HETP etc.	07
4	Equipment for gas-liquid contacting: Construction, sizing and operation (Mass transfer coefficients, efficiencies, general characteristics, dimensions and operating characteristics) Gas dispersed and liquid continuous-Sparged vessels, tray towers and mechanically agitated vessels. Liquid dispersed in continuous gas phase-Venturi scrubbers, spray chambers, wetted wall columns etc. Cocurrent flow of gas and liquid. Packed towers. Comparison of stage wise and continuous contacting equipment.	07
5	Gas absorption: Equilibrium (solubility of gases in liquids), effect of temperature and pressure, reference substance plots, ideal and non-ideal solutions. Heat of solution, factors affecting choice of solvents. Single component isothermal gas absorption: stage wise and continuous contact. Co-current, counter-current and cross current operations. Concentrated and dilute solutions. Numerical examples on dilute solutions only. Single component adiabatic gas absorption: Equations and methods of calculations. (Numerical examples not included). Multi component isothermal gas absorption. Equations and methods of calculations (numerical examples not included) Absorption with chemical reaction: Examples with mass transfer controlling, equations qualitative description of solutions. (Numerical examples not included) Equipment description	07
6	Humidification Operation: Vapor liquid equilibrium and Enthalpy. Numerical examples. Vapor-gas mixtures: Definitions, saturated and unsaturated mixture characteristics, Review of Psychometric charts. Adiabatic saturation and Wet bulb temperature. Numerical examples. Adiabatic operations: (Air-water systems) Water coolers, Cooling towers. (Numerical examples not included). Non-adiabatic operations: Evaporative cooling, (Numerical examples not included). Design considerations. Equipment description.	06

7	Drying: Moisture - definitions, Equilibrium. Drying operations - batch, continuous, Batch drying - Mechanisms, rate of drying curve. Numerical examples. Continuous drying - Equipment and operation, Design methodology of rotary drum dryer. (Numerical examples not included).	07
	TOTAL	45

TEXT BOOKS:

1. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th edition, 2005.
2. Treybal, R. E., Mass Transfer Operations, 3rd Edition, McGraw Hill Newyork, 1981(Classic book).

REFERENCE BOOKS:

1. Coulson, J. M., Richardson, J. F., Backhurst, J. R. and Harker, J. H. Coulson & Richardsons Chemical Engineering, Vol 1, Butterworth Heinman, 6th edition, 2004.
2. Coulson, J. M., Richardson, J. F., Backhurst, J. R. and Harker, J. H. Coulson & Richardsons Chemical Engineering, Vol 2, Butterworth Heinman, 6th edition, 2004.
3. K. Sinnot, (Ed) Coulson & Richardsons Chemical Engineering, Vol 6, Butterworth Heinman, 6th edition, 2004.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (Chemical)				Semester IV	
Sub: Solid Fluid Mechanical Operations				Code: MBCH04004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Fluid Mechanics-I and SOMF
Course Objective:	This is an augmentation course for unit operations covering operations involving mainly physical changes. Principles, methods of analysis, operations of various equipments are important and it is desired that students becomes conversant with each factor.
Course Outcome:	Understanding of operations involving solid – fluid, solid – solid mixtures, equipments, their applications, working and selection.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	Introduction: Scope and application of Solid Fluid Operation.	02
2	Particulate System and Characterization Introduction to sub micron to mm range. Particle size, measurement methods, shape factor and its measurement, application, particle size distribution, their measurement and representations.	04
3	Size reduction of solids Characterization of comminuted solids. Criteria for Comminution. Energy and power requirements in Comminution (crushing laws), size reduction equipments and operations of the equipments.	08

4	Screening Efficiency of the screens, ideal and actual screens, screening equipments, capacity and effectiveness of screens.	05
5	Storage and handling of bulk solids Relevant properties of particulate masses such as Angle of repose/ internal friction etc. Equipments for solids conveying – conveyors, elevators and feeders.	02
6	Solid liquid Separation Sedimentation principles (gravity). Batch sedimentation phenomena of fine and coarse solids, Equipment for gravity thickening. Centrifugal sedimentation Principles, equipments for centrifugal sedimentation. Flocculation – Electrical phenomena at interfaces, interactions between particles, coagulation phenomena, and coagulation kinetics, effect of flocculation on sedimentation. Froth floatation., principle equipments. Jigging, Tabling, scrabbling etc. Filtration, Filtration Theory and principles (batch Filtration) constant rate, constant pressure filtration, effect of cake compressibility, Filtration cycles, filtration equipments (Batch and continuous types of Filtration and Theory equipment). Hydrocyclone construction / operation Principles, introduction to microfiltration. Pneumatic, Hydraulic conveying. Principles, Horizontal/ vertical Transport Equipments/ applications (No numerical problems) Gas solid separation (Gas cleaning) Solid separation, construction/ operation/selection/ specification of cyclone separators/ its design variations, fabric filters, Dust collectors, Electrostatic precipitator Size enlargement Mechanics of Agglomeration/construction/ operation/selection. Equipment like pressure compaction, pan granulators, Prilling, Drum granulators etc. (No numerical problems) Mixing of Solids-Solid mixing equipments construction/operation	24

	selection for free flowing solids and for cohesive solids.	
	Total	45

TEXT BOOKS

1. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th ediion, 2005.
2. Coulson, J. M., Richardson, J. F., Backhurst, J. R. and Harker, J. H. Coulson & Richardsons Chemical Engineering, Vol 1, 2, Butterworth Heinman, 6th edition, 2004.

REFERENCE BOOKS

1. Badger and Banchero, Introduction to Chemical Engineering, Tata McGraw Hill, 12th edition, 2006.
2. Chopey N.P., Handbook of Chemical Engineering Calculations, Tata MCGraw Hill, 3rd Ed, 2004.
3. Perry R. H., Green D., Perry's Chemical Engineering hand Book McGraw Hill, 7th Edition 1997.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (Chemical)				Semester IV	
Sub: Unit Processes in Chemical Industries				Code: MBCH04005	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2*	4	Scaled to 70 marks	Scaled to 30 marks

Course Prerequisite:	Applied Chemistry, Fluid mechanics-I & II, Heat transfer Operations
Course Objective:	Unifying concept of Chemical processes is introduced for understanding vast variety of chemical reactions. It helps student in having rational approach in tackling manufacturing aspects of diverse industrial chemicals.
Course Outcome:	Understanding of various unit processes practiced in manufacturing numerous organic chemicals.

Detailed Syllabus

Unit	Topics	Duration hr
1.	Introduction	2
2.	Nitration Introduction, Nitrating agents, Aromatic nitration, Kinetics & Mechanism of Aromatic nitration, Nitration of paraffinic hydrocarbons, Nitrate esters, N nitro compounds, Thermodynamics of nitration, Process equipment for technical nitration, Typical industrial nitration processes	7
3.	Amination A. Amination by reduction: Introduction, Bechamp reduction,	7

	Metal & acid reductions, Catalytic hydrogenation, Sulphide reductions, Electrolytic reductions, metal and alkali reductions, Sulphite reductions B. **Amination by ammonolysis:** Aminating agents, Catalysts, Physical and chemical factors affecting ammonolysis, Corrosion & pH of the autoclave charge, Kinetics & Thermodynamics of ammonolysis, Design of reactors & auxiliaries, Technical manufacture of amino compounds, Control of ammonia recovery system	
4.	**Halogenation** Introduction, Thermodynamics & kinetics of halogenation, Chlorination, Photohalogenation, Design & construction of equipment for halogenation, Technical halogenations	5
5.	**Sulfonation & Sulfation** Introduction, Sulfonating & sulfating agents, Kinetics Mechanism & Thermodynamics, Physical and chemical factors of Sulfonation & Sulfation, Desulfonation, Industrial equipment & techniques, Transition from batch to continuous processing, Technical prepaeration of sulfonates & sulfates	5
6.	**Oxidation** Types of oxidative reactions, Oxidizing agents, Liquid phase oxidation with oxidizing compounds, oxygen, Vapour phase oxidation of aromatic hydrocarbons, Kinetics & thermodynamics, Apparatus for oxidation	5
7.	**Hydrogenation** Introduction, Catalytic hydrogenation & hydrogenolysis, Kinetics & thermodynamics, Apparatus & materials, Industrial process	4
8.	**Esterification** Esterification by organic acids, Esterification of carboxylic acid derivatives, Esters by addition of unsaturated systems, Esters of inorganic acids, Esterification practice	3
9	**Alkylation** Introduction, Types of alkylation,, Alkylating agents, factors affecting	3

	alkylation, Equipments for alkylation, Effects of alkylation, Technical alkylation (alkylates for gasoline pool, cumene, ethyl benzene)	
10	**Hydrocarbon synthesis & Hydroformylation** Introduction, technology of Fischer Tropsh operation, Thermodynamics & Kinetic of Fischer – Tropsch reaction, Reactor development, Commercial operation, Processes related to the Fischer Tropsch operation (Oxo process for long chain alcohol)	4
	TOTAL	45

TEXT BOOKS:

1. P. H. Groggins, Unit Process in Organic synthesis, Tata McGraw Hill, 5th edition, 2009.

REFERENCE BOOKS

1. Pandey G. N., A text Book of Chemical Technolog , Vol I&II, Vikas Publications, 2009
2. I L Finar, Organic Chemistry, vol 1 & 2 Essex Pearson, 6th edition, 2005
3. Rao, G. N. and Sittig, M., Dryden's Outlines of Chemical Technolog , Affiliated East West Press, 3rd edition, 2005.

**Minimum of one industrial visit to a relevant organic industry*

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester IV	
Sub: Material Selection				Code: MBCH04105	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (70 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 70 marks	Scaled to 30 marks
Course Prerequisite:		Strength of Material and Fabrication.			
Course Objective:		To make students understand importance, selection criteria and application of various metallic and non-metallic materials used for construction of Industrial chemical equipment.			
Course Outcome:		Application of knowledge gained in selection of materials for various Chemical Industries.			

Detailed syllabus

Unit	Topics	Duration (Hr)
1	Various types of corrosion losses in the chemical industry and hence need for various material selection criteria.	03
2	Metals as material of construction (Ferrous and Non Ferrous) like steels, copper, aluminum, titanium, nickel and their alloys used in chemical industry. Non-metallic Materials as material of construction like: PVC, PE, PP, Fiber Reinforced Plastic (FRP), glass-lining etc. Introduction of fabrication methods for plastic pipes, plastic and rubber lining of	10

	equipment and piping.	
3	Chemical and Corrosive Environment: Corrosion due to water, steam, soil, atmospheric conditions, reducing and oxidizing agents, alkaline condition, ammonia and its compound, high temperature phenomena.	12
4	Practical material selection procedure: General Strategy, Materials for high temperatures and low temperatures application.	05
5	Material protection techniques such as cathodic protection, coating/wrapping, stress relieving, annealing etc.	05
6	Piping: Codes and standard for piping and ancillary items (valves, steam trap, strainer, etc), basic of piping layout.	10
	Total	**45**

TEXT BOOK:

1. Engineering Materials: Properties and Selection, Kenneth G. Budinski, Prentice Hall, 1996.
2. Petter Smith, Piping Materials selection and application, Gulf Professional Publishing, 2004.

REFERENCE BOOKS:

1. Hajara & Choudhari, Work Shop Technology Vol. I and Vol. II, Media Promoter publisher, 11th edition, 2004.
2. Mohinder L. Nayyar, Piping Handbook, McGraw Hill Education Publisher, 2000.
3. Perry R. H., Green D., Perry's Chemical Engineering hand Book McGraw Hill, 8th Edition 2008.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester V	
Sub: Chemical Processes-I				Code: MBCI105001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2*	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	MTO – I, HTO, CET, SFMO and PC-I & II
Course Objective:	The objective of this subject is to provide an insight to chemical industry and study of manufacture of major inorganic chemicals, to read and understand PFD, to understand how different unit operations are combined in single process.
Course Outcome:	Understanding the manufacturing process of different inorganic Chemicals with emphasis on various chemical engineering aspects.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	Introduction: Historical development of Chemical Industry. Material resources and Shortcomings, preparation of process flow diagrams and process and instrumentation diagrams and major process symbols.	02
2	Basic Inorganic Chemical Industries: Nitrogen industries manufacture of Ammonia, Ammonium. Sulphate, Urea and Nitric Acid including starting with coal as fuel, Phosphorous industries including the manufacture of. Phosphorous, phosphoric acid (wet and electrolytic) and super-phosphates, chlor-Alkali industries including manufacture of caustic soda, chlorine, hydrochloric acid, and hydrogen, Manufacture of Soda Ash, Manufacture of Sulphuric Acid starting with sulphur as well as pyrites burning and	22

	treatment of associated problems, Manufacture of Cement.	
3	Electrolytic Industries: Manufacture of Aluminum, Manufacture of Sodium metal, Manufacture of Sodium Chlorate, Zinc and Copper	12
4	**Industrial Gases:** Air liquefaction and Fractionation to manufacture Oxygen, Nitrogen, Helium, Argon and other rare gases, Manufacture of Acetylene	04
5	**Manufacture of Semi Conductors.**	05
	TOTAL	45

TEXT BOOKS

1. *Rao, G. N. and Sittig, M.*, Dryden's "Outlines of Chemical Technology", Affiliated East West Press, 3rd edition, 2005.
2. *Austin*, G.T., "Shreve's Chemical Process Industries", McGraw Hill, 5th edition. 2012

REFERENCE BOOKS

1. Pandey G. N., "A Text Book of Chemical Technology", Vol. I & II, Vikas Publications, 2009.

* Minimum one Industrial Visit in relevant Industry.

SVKM's NMIMS

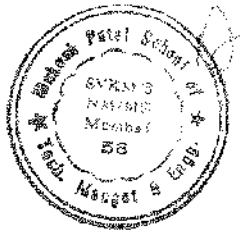
Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (Chemical)				Semester V	
Sub: Reaction Kinetics				Code: MBCH05002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Applied Chemistry, Chemical Engineering Thermodynamics, and Heat Transfer Operations
Course Objective:	To make students understand the concept of rate expressions, different method of analysis of experimental data, effect of temperature on reactions, catalytic and non catalytic heterogeneous reactions.
Course Outcome:	Understanding of parameters affecting reaction rate and analysis of experimental reaction data.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**INTRODUCTION:** Concepts of reactions, rate expressions, elementary reactions and order of reaction etc.	2
2	**CHEMICAL REACTION EQUILIBRIUM:** Homogeneous and heterogeneous reaction systems, Equilibrium constant and compositions in simple reactions, Multi phase and multi reaction equilibria.	3



3	**REACTION KINETICS OF HOMOGENEOUS SYSTEMS:** Formulation and solutions of rate equations for batch reactors for simple and complex reactions. Temperature dependency. Reaction mechanism and its influence on kinetics, search for plausible mechanism via reaction kinetics.	6
4	**METHODS OF ANALYSIS OF EXPERMENTAL DATA:** Integral methods of analysis of data, Differential methods of analysis of data. Partial analysis of the rate of reaction. Reaction with mass transfer.	14
5	**HEAT AND PRESSURE EFFECTS:** Temperature dependency of reaction rate constant. Heat of reaction and its variation with temperature. Variation of equilibrium constant and equilibrium conversion with temperature – effect of temperature on adiabatic and non-adiabatic conversion.	5
6	**NON CATALYTIC HETROGENEOUS REACTIONS:** Various models. Specific cases with respect to film diffusion controlling, ash diffusion controlling, chemical reaction controlling.	5
7	**CATALYTIC HETROGENEOUS REACTIONS:** Physical adsorption and chemisorption. Surface area, pore size distribution. Langmuir – Hinshelwood model. General mechanism by solid catalysed fluid phase reactions. Special cases when film resistance controls, surface phenomena controls, surface reaction controls, effect on reaction order, pore diffusion control. Intrinsic kinetics and various cases of adsorption and reaction stage controls. Concepts of effectiveness factor of catalyst and its dependence on catalyst properties and kinetic parameters.	10
	Total	45

TEXT BOOKS

1. Levenspiel, O; "Chemical Reaction Engineering", John Wiley & Co, 3 rd Edition, 2008.

REFERENCE BOOKS

1. Laidler, K.J ; "Chemical Kinetics", Tata Mcgraw Hill, 3rd edition, Pearson Eduction, 2005.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester V	
Sub: Mass Transfer Operations - II				Code: MBCH05003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Mass Transfer Operations-I
Course Objective:	The student is expected to learn mass transfer operations viz, distillation, Extraction, leaching, adsorption, crystallization and membrane separation and relevant equipment design
Course Outcome:	Understanding the principals of various mass transfer operations like distillation, extraction, leaching, crystallization, adsorption, etc. and applying these principals to design of mass transfer equipments.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**Review of Mass Transfer Operation -I:** Mass transfer coefficients, equilibrium stage operations etc.	1
2	**Distillation:** Vapor-liquid equilibria, ideal and non-ideal solutions, effect of temperature/pressure on P-x,y/T-x,y plots. Azeotropes, immiscible liquids etc, Flash distillation, binary and multi-component, Differential distillation, Rayleigh equation. Numerical examples, Multi stage distillation – Concept of stage by stage calculations for multi component systems. (qualitative	15

	procedure only), Multi stage distillation – Binary distillation. Ponchon-Savarit Method. Numerical examples. McCabe-Thiele Method. Numerical Examples, Packed bed distillation, Distillation with immiscible liquids – Steam distillation, Concepts of Azeotropic, Extractive and Reactive Distillation, Molecular distillation Types of columns used for distillation operations	
3	**Liquid-liquid Extraction:** Definition and comparison with other separation operations, Mutual solubilities of liquids, liquid-liquid equilibria, Effect of temperature and Pressure on equilibria. Ternary diagrams – their properties and use in representing liquid-liquid equilibria. Choice of solvent, Similarities between extraction and distillation operation. Single stage operations, Multi stage extraction – co-current, crosscurrent and counter-current (with and withou reflux), Numerical examples using all types of coordinates, Extraction in packed columns, Multistage extraction with reflux. Methods of calculations, Extraction equipment – description, design principles.	7
4	**Solid-liquid Extraction (Leaching):** Representation of equilibria. Construction of simple equilibrium curves, Similarities in calculations for liquid-liquid and solid-liquid extractions. Numerical examples for single stage, multistage – co-current, cross current and counter current operations, Equipments for leaching – description.	5
5	**Adsorption and ion exchange:** Types of adsorption, adsorption equilibria, Isotherms—Frieundlich and Langmuir. Effect of temperature and pressure etc, Stage (single/multi) wise cross current and counter current adsorption operations – graphical procedures, Application of Freundlich isotherm. Fixed bed adsorber design. Numerical examples using breakthrough curve data, Pressure swing and Temperature swing adsorption operations, Adsorption equipment – description and operation, Ion-exchange – equilibria, equipments and calculations, Application to chromatography, molecular sieves	6
6	**Crystallization:** Solubility curves, Theories of crystallization, Progress of crystallization, □L law of crystal growth, MSMPR model of crystallization. Population balance method, Material and energy balances for crystallizers. Numerical examples, Melt crystallizers, Crystallization equipment – description.	5

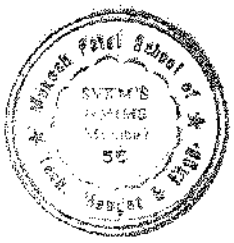
7	**Membrane Separation Operations:** Types of membranes – supported and unsupported. Modules for supported membranes. Transport through membranes – fluxes and polarization. Types of operations. Ultrafiltration, Reverse Osmosis, Electrodialysis, Pervaporation, Liquid membranes etc, Equipment and operations.	4
8	**Introduction to combination separation processes.** Principles of selection of separation processes.	2
	Total	**45**

TEXT BOOKS:

1. McCabe, W.L. Smith, J.C. Harriot, P. Unit operations of Chemical Engineering, McGraw Hill International Ed, 7th edition, 2005.
2. Treybal, R. E., Mass Transfer Operations, 3rd Edition, McGraw Hill Newyork, 1981 (classic book)

REFERENCE BOOKS:

1. Perry R. H., Green D., Perry's Chemical Engineering hand Book McGraw Hill, 8th Edition 2007.
2. Geankoplis, C. J. Transport Processes and Unit Operations, Prentice Hall, New Delhi, 4th edition, 2005.
3. Coulson, J. M., Richardson, J. F., Backhurst, J. R. and Harker, J. H. Coulson & Richardsons Chemical Engineering, Vol 1, 2 & 6, Butterworth Heinman, 6th edition, 2004.



SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester V	
Sub: Plant Utilities				Code: MBCH05004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Process Calculations- I & II, Fluid Mechanics- I & II, Heat Transfer Operations and Chemical Engineering Thermodynamics
Course Objective:	This course helps the students to know about utility of chemical industries viz. air, water, steam, other heating mediums, electric power and refrigeration.
Course Outcome:	Applying the knowledge gained in selection and sizing of various plant utilities.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	INTRODUCTION: Identification of common plant utilities Identify the utilities used in the plant and give an overview. Temperature levels in the plant and utility to be used at each temperature level Importance of utilities in Industries.	2

2	**WATER:** Raw water storage and treatment Treatment of water for soft water and D.M water and RO water. Cooling water system (water quality, circulation, storage and distribution diagram) Fire water system (water quality, storage and circulation system)	8
3	**STEAM & OTHER HEATING SYSTEMS:** Properties of steam Steam generation by boilers Types of boilers and their operation Steam generation by using process waste heat (Eg. Ammonia, sulfuric Acid and Naphtha cracking) Distribution of steam in plant (Quality and quantity) Efficient uses of steam (prime mover pressure/temp control, steam trap) Thermic fluid systems Dowtherm systems	15
4	*AIR:* Compressed air from blowers and compressors Selection of compressing equipments. Air drying system for instrument air and plant air. Humidification and Dehumidification of air. Inert gases like N_2, etc. as utilities.	6

5	**REFRIGERATION:** Principles of refrigeration. Refrigeration systems like compression refrigeration, absorption refrigeration and vacuum ejector system. Types of refrigerants. Creation of low temperature	8
6	**VACUUM SYSTEMS:** Selection of vacuum system for various process operations	4
7	**FLARING AND VENTING:** Introduction. Types of vent and flares	2
	Total	**45**

TEXT BOOK:

1. Daniel Flynn; Nalco Water Handbook, McGraw Hill, W.S, 2009

REFERENCE BOOKS:

1. Perry R. H., Green D., Perry's Chemical Engineering hand Book McGraw Hill, 8th Edition 2007.
2. Handbook of Industrial Water Treatment (http://www.gewater.com/handbook/index.jsp)

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester V	
Sub: Material Selection				Code: MBCH05105	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks
Course Prerequisite:	Strength of Material and Fabrication.				
Course Objective:	To make students understand importance, selection criteria and application of various metallic and non-metallic materials used for construction of Industrial chemical equipment.				
Course Outcome:	Application of knowledge gained in selection of materials for various Chemical Industries.				

Detailed syllabus

Unit	Topics	Duration (Hr)
1	Various types of corrosion losses in the chemical industry and hence need for various material selection criteria.	03
2	Metals as material of construction (Ferrous and Non Ferrous) like steels, copper, aluminum, titanium, nickel and their alloys used in chemical industry. Non-metallic Materials as material of construction like: PVC, PE, PP, Fiber Reinforced Plastic (FRP), glass-lining etc. Introduction of fabrication methods for plastic pipes, plastic and	10

	rubber lining of equipment and piping.	
3	Chemical and Corrosive Environment: Corrosion due to water, steam, soil, atmospheric conditions, reducing and oxidizing agents, alkaline condition, ammonia and its compound, high temperature phenomena.	12
4	Practical material selection procedure: General Strategy, Materials for high temperatures and low temperatures application.	05
5	Material protection techniques such as cathodic protection, coating/wrapping, stress relieving, annealing etc.	05
6	Piping: Codes and standard for piping and ancillary items (valves, steam trap, strainer, etc), basic of piping layout.	10
	Total	**45**

TEXT BOOK:

1. Engineering Materials: Properties and Selection, Kenneth G. Budinski, Prentice Hall, 1996.
2. Petter Smith, Piping Materials selection and application, Gulf Professional Publishing, 2004.

REFERENCE BOOKS:

1. Hajara & Choudhari, Work Shop Technology Vol. I and Vol. II, Media Promoter publisher, 11th edition, 2004.
2. Mohinder L. Nayyar, Piping Handbook, McGraw Hill Education Publisher, 2000.
3. Perry R. H., Green D., Perry's Chemical Engineering hand Book McGraw Hill, 8th Edition 2008.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VI	
Sub: Chemical Processes-II				Code: MBCH06001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2*	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	MTO-I&II, HTO, CET, CP-I, SFMO, PC-I & II
Course Objective:	Organic chemicals form a special group and the objective of this course is to study processes for manufacture of organic chemical with special emphasis on understanding application of the principles of chemical engineering. The methodology applied in teaching this subject is to emphasize on thermodynamics, kinetics, safety and energy required in process. The course is aimed at appraising the technical managers of not only the applications but also the techniques and thinking involved in process development.
Course Outcome:	Understanding the manufacturing process of different organic Chemicals with emphasis on various chemical engineering aspects.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	An overview of: - Feedstocks of organic chemical industry- coal, biomass and crude oil - The present day organic chemical process Industry in India.	03
2	The processes for manufacturing of following compounds of Petrochemical Industry starting from Naptha/Natural Gas(cracking and subsequent processing):	

2A	Aliphatic Compounds: C1 Compounds: Methanol and Chloromethane, Acetic Acid C2 Compounds: Ethylene and Ethylene Oxide, Glycol C3 Compounds: Propylene and Isopropyl Alcohol C4 Compounds: Butylenes and Butadiene	14
2B	Aromatic compounds: Benzene, Toluene and Xylene, Isomerization of Xylenes, Separation of Xylenes Isomers. Manufacture of Styrene, PTA, Caprolactum, Cumene and Phenol.	10
3	**Constructing flowsheets** of the following compounds: Methanol, Ethylene Oxide, Glycol, Butadiene, Isomerization and separation of Xylene, Phenol. This should include Material & Energy Balance.	10
4	**Production of Polymers:** Polyethylene, Polypropylene, Polyester and PVC	08
	TOTAL	45

TEXT BOOKS

1. *Rao, G. N. and Sittig, M.*, Dryden's "Outlines of Chemical Technology", Affiliated East West Press, 3rd edition, 2005.
2. *Austin*, G.T., "Shreve's Chemical Process Industries", McGraw Hill, 5th edition, 2012

REFERENCE BOOKS

1. Pandey G. N., "A Text Book of Chemical Technology", Vol. I & II, Vikas Publications, 2009.

* Minimum one Industrial Visit in relevant industry

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VI	
Sub: Chemical Reaction Engineering				Code: MBCH06002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Process calculations I & II, Fluid Mechanics I & II and Reaction Kinetics
Course Objective:	Variety of Reactors as used in Chemical Industry for manufacture of chemicals. The course aims at providing knowledge and skills for: (1) Major Types of Reactors, (2) Conversions in Ideal reactors for Major types of Reactions, (3) Characteristics of Real reactors, (4) Principles of Selection, Design, Operation of Real reactors.
Course Outcome:	Applying the concepts in selection of a reactor type. Analyzing experimental data for arriving at design and operating parameters for a given reaction.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	REACTORS: Ideal batch reactor, steady state mixed flow reactor and plug flow reactor, reversible and irreversible first and second order reactions in PFR, MFR, Graphical and Analytical techniques. Combination of reactors in series, parallel, series-parallel arrangements. Unequal sized MFR's in series. Recycle reactor and autocatalytic reaction.	10
2	DESIGN FOR PARALLEL REACTIONS: Various contacting patterns, qualitative and quantitative approach for product distribution, operating conditions for parallel reactions	5

3	MULTIPLE REACTIONS: Qualitative and quantitative approach for product distribution, application to various reactor types. The Denbigh reactions and their special cases.	6
4	NON IDEAL FLOW REACTORS: Concept of residence time distribution, methods of obtaining RTD – C,E,F curves, mathematical and experimental techniques. The step-tracer experiment, the convolution integral. Compartment model, Dispersion model, and Tanks in series model. Role of micro and macro mixing in ideal MFR, PFR, and non-ideal reactor cases.	14
5	SOLID CATALYZED REACTIONS: Experimental methods for finding rates, differential reactor, integral reactor, MFR, batch reactor for both gas and solid. Comparison of experimental reactors. Rate equation from differential and plug flow reactor, size of a PFR from rate equation and concentration data.	10
	TOTAL	45

TEXT BOOKS

1. Levenspiel, O; Chemical Reaction Engineering, John Wiley & Co, 3 rd Edition, 2008

REFERENCE BOOKS

1. Laidler, K.J ; Chemical Kinetic , Tata Mcgraw Hill, 3rd edition, Pearson Eduction, 2005.

20th May 2016

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VI	
Sub: Instrumentation and Process Control				Code: MBCH06003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year II
Course Objective:	For safety and quality control, instruments for measurements and control of process parameters are used in chemical industry. The course aims at providing knowledge and skill for: (1) Types of instruments and their use, (2) Automatic process control schemes and strategies, (3) Criteria for Stability of control schemes and selection of parameters.
Course Outcome:	Applying the selection criteria for instruments and deciding control scheme and parameters for a given process.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	INTRODUCTION: Motivation for process control, concept of feedback and feed forward control, process dynamics in time, Laplace, and frequency domains	2
2	CHEMICAL PROCESS INSTRUMENTATION AND CONTROL VALVES: General performance characterstics of instruments, transducers and their classification, electrically passive and active, elastic, resistance, capacitive, and inductive transducers for temperature, level, flow, and	10

	pressure measurements, other special types of instruments such as ultrasonic flow meter, pyrometer, and review of flow metes. Types of control valves and valve characteristics (inherent and effective)	
3	**DYNAMIC BEHAVIOUR OF SYSTEMS:** Models of first and second order systems and their transfer functions. Linearization of non-linear systems. Response to step, ramp, sinusoidal, pulse and impulse inputs. Systems in series interacting and non-interacting.	10
4	**MODELS OF CONTROL:** On-off control, proportional, integral, derivative modes and their combinations. Open-loop behavior of controllers. Open-loop Transfer functions of controllers.	4
5	**TRANSIENT RESPONSE:** Closed-loop transfer functions, transfer functions for servo and regulatory problems. Transient behavior of closed-loop systems.	4
6	**STABILITY OF CONTROL SYSTEM:** Criteria for stability of control system - Routh criterion, Root Locus criteria and Bode criteria. Controller Tuning.	8
7	**ADVANCE CONTROL STRATAGIES:** Ratio Control, Cascade Control and Feed forward Control.	3
8	**P & I DIAGRAMS:** Control Schemes for Chemical plant operations - Distillation column, Gas- absorber, Reactor, Heat exchanger.	4
	TOTAL	45

TEXT BOOKS:

1. Stephanopoulos G, Chemical Process Control, Prentice Hall of India, 2006.
2. Coughanouwr, Process Systems Analysis and Control, Tata McGraw Hill, 2nd edition, 1991.

REFERENCE BOOKS:

1. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill, 2nd edition, 1996.
2. Luyben, Process Modeling and Simulation, McGraw Hill Publications, 2nd edition, 1990.

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VI	
Sub: Process Equipment & Accessories Design				Code: MBCH06004	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Strength of material & fabrication
Course Objective:	The objective of the course is to provide understanding of various design aspects of chemical industry equipments and their detailed drawings.
Course Outcome:	Application of principals in mechanical designing/ detailing of various chemical equipment.

Detailed syllabus

Unit	Topics	Duration (Hr)
1	**Introduction to Chemical Process Equipment Design** a) Types of Chemical process equipment – classification and selection. b) Design Fundamentals – steps in designing, various considerations in designing, Factor of safety & its significance, criteria in deciding FOS, Design stress, Design pressure, Design Temperature. c) Materials – their specifications & selection d) Various standards / codes & their specifications. e) Designing of manholes, nozzles, heads, flanges, supports for vessels	10

2	Reaction Vessel Design: Detailed design of an agitated reactor with heating/cooling arrangement. A brief introduction on design of different mechanisms of heating / cooling arrangement available for reactors should also be taught. Drawings of separate parts and assembly. Types of agitator vessels & their applications, methods of baffling.	12
3	Heat exchanger design: Detailed design of a shell and tube heat exchanger along with all accessories. Drawings of separate parts and assembly.	8
4	Design of distillation towers: Detailed design of distillation tower along with designing of column internals, and supports.	8
5	Pressure Vessel Design with accessories - Types of pressure vessels, Codes & standards for pressure vessels (IS: 2825: 1969), Materials of construction, Selection of corrosion allowance & weld joint efficiency Pressure Vessel Subjected to Internal Pressure. Complete Design as per IS: 2825: 1969 involving Shells, heads, nozzles, manholes & support. Pressure Vessel Subjected to External Pressure. Design of shell, heads, nozzles, flanged Joint, jackets & stiffening rings as per IS: 2825: 1969, Appendix F by use of charts, Analytical approach by elastic buckling & plastic deformation.	7
Total		45

TEXT BOOKS:

1. M.V. Joshi, Process Equipment Design, McMilan Publication, 3rd edition, 2005
2. R. C. Bhattacharya, Chemical Engineering Equipment Design, CBS Publication, 2005.

REFERENCE BOOKS

1. Eugene F. Megyesy, Pressure Vessesl Handbook, Pressure vessel publishing company,

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VI	
Sub: Industrial Safety				Code: MBCH06005	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Applied Chemistry, FM I & II, HTO, SFMO, CET, MTO-I & II.
Course Objective:	To understand the importance of "safety first" principle in the industry, safety related to toxicology and hygiene, safety related to fires and explosions, hazards identification and their remedies.
Course Outcome:	Understanding the importance of safety compliance to Chemical Industry. Application of principals to accident investigation, Hazard analysis & HAZOP analysis.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	INTRODUCTION: Safety concepts, definition, types of accidents, causes of accidents, direct & indirect effects of accidents. Role of safety considerations in chemical plant. Design & operations. Protective and safety equipments. Measure of risk liabilities of accidents laws. Rules regulations concerned to safety in chemical process plant for preventing the accident. Managerial aspects of safety. General aspects of post disaster mitigation & management within an organization & in society.	7
2	TOXICOLOGY & INDUSTRIAL HYGIENE: Toxins and their biological effects. Outline of their ingestion to and elimination	8

	from biological systems. Toxicological parameters, their definitions & outline of the measurement methods. Evaluation of exposure to toxicants and its impact. Source models, release and flow of toxic gases & liquids, flashing liquids, boiling liquids etc. dispersion models. Factors affecting dispersion and their modeling. Equipments used for prevention of toxic release in chemical plants.	
3	**FIRES & EXPLOSION:** The fire triangle & factors contributing to fire and explosions. Relevant material characteristics & properties. Concepts of ignition & ignition energy. Sources of ignition. Auto ignition, auto oxidation, adiabatic compression, electrostatic ignition, role of fuel sprays, mists and dusts on ignition process. Various types of explosions and conditions for their occurrence. Inserting and purging of equipment, ventilation of rooms, control of static electricity, sprinkler systems, fire-fighting systems.	10
4	**RELIEF AND RELIEF SYSTEMS:** Definitions, relief-requiring scenarios. Types of relief and locations. Relief systems, various options and their sizing and applications for single and multiphase flows. Deflagration venting for dust and vapor explosion.	10
5	**HAZARD IDENTIFICATION:** HAZOP, HAZAN & similar methods, safety review and other methods. Safety Audit. Risk assessment analysis of trees for risk assessment. Technique of risk assessment. Accident investigating and diagnosting. Well known case studies such as Bhopal, Flixburough etc.	10
	TOTAL	45

TEXT BOOKS

1. Crowl D.Y; Louvar J.F.; "Chemical Process Safety Fundamentals with applications", Prentice Hall, Englewood 2nd edition, 2001.

REFERENCE BOOKS

1. Kleitz T.A "What Went Wrong", Gulf Publications, 4th Edition, 1999.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

Course Structure Semester VII							
Sr No	Subject	Lectures hours per week	Practicals/ Tutorials hours per week	Examination Scheme		Credits	Remark
				Final Exam	IC A		
1	Energy System Designs	3	2	60	40	4	
2	Environmental Engineering	3	2	60	40	4	
3	TIP 08 Weeks TIP Evaluation & Viva		40		200	10	
		6	40 + 4	120	280	18	

Course Structure Semester VIII							
Sr No	Subject	Lectures hours per week	Practicals/ Tutorials hours per week	Examination Scheme		Credits	Remark
				Final Exam	ICA		
1	Process Optimization & simulation	3	2	60	40	4	
2	Seminar	0	2		50	1	
3	Project &Process Engineering	3	2	60	40	4	
		6	6	120	130	9	

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VII	
Sub: Energy System Design				Code: - MBCH07001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	All basic Chemical Engineering subjects
Course Objective:	To make students understand importance of energy conservation in chemical plants and numerous approaches possible for the same.
Course outcome:	Evaluation of interrelationship between Technology and Economics, with sustainable development.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	Energy Audit: Introduction; methodology and steps taken; Target setting, Reduction in losses, Improvements in the operations, Operating equipment near its best efficiency, more efficient equipment; preventive maintenance for energy efficiency; high frequency equipments. Energy efficient process technologies.	08
2	Energy Integration in the Process Industries: Design Of Heat Exchanger Networks (HENS): Minimizing utilities in heat Temperature interval method using graphical displays. Linear Programming method. Stream matching at minimum utilities. Stream matching at the pinch concepts of optimum approach temperature, Superstructures for minimization of annualized cost	09

3	Multiple Effect Evaporators: With and without vapor recompression, Distillation Column: Effect of pressure on heat integration, multiple effect distillation, Heat pumping, vapor recompression and reboiler flashing, Superstructures for minimization of annualized cost	07
4	Distillation Column: Effect of pressure on heat integration, multiple effect distillation, Heat pumping, vapor recompression and reboiler flashing, Superstructures for minimization of annualized cost	07
5	Co-generation of Energy: Introduction, advantages of co-generation, Waste heat boilers, Different types of co-generation power plants, Steam turbine systems, Gas turbine systems. Combined gas steam turbine systems, Diesel engine systems.	08
6	Renewable sources of energy: Solar energy-Photo voltaic cells, solar boilers, solar refrigerators, Wind energy, Fuel cells, Biogas, Biodiesel, Biomass gasification etc.	04
7	Importance of energy efficient process designs or active designs.	02
	TOTAL	45

TEXT BOOKS:

1. Seider W.D. and Seader J.D. and Lewin D.R.," Process Design Principles". John Wiley and Sons. Inc., 1988.
2. Douglas J.M."Conceptual Design of Chemical Process", McGraw Hill Book Co.,
3. Biegler L.T., Grossman E.I. and Westerberg, A. W., "Systematic Methods of Chemical Process Design", Prentice Hall International Ltd., 1999

REFERENCE BOOKS:

1. Larmine James, "Fuel Cells Explained", John Wiley and Sons., 2000.
2. Kreith F., "Principles of Solar Energy", McGraw Hill Book Co., 1978.
3. Freris L.L., "Wind Energy Conversion System", Prentice Hall, 1990.
4. Turner, "(Ed.) Energy Management Hand Book", John Wiley and Sons., 2000.

SVKM's NMIMS

Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VII	
Sub: Environment Engineering				Code: MBCH07002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	2	-	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	All basic chemical engineering subjects.
Course Objective:	To understand the importance for the control of various aspects of environment in Industry
Course Outcome:	Understanding of various control techniques for gaseous, liquid and solid pollutants and application of this concepts in selection / sizing equipments.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	INTRODUCTION: Importance of environmental pollution control, hydrological & nutrient cycles of environment, industrial pollution emissions & Indian standards, water (prevention & control of pollution) act, air (prevention & control of pollution) act. Banned chemicals like PCP, Banned dyes and pigments, formaldehyde, Catalyst based on heavy metals etc....	06
2	WATER POLLUTION AND WASTE WATER TREATMENT: Classification, sources & effect of water pollutants on human beings & ecology, DO depletion, sampling, measurement & standards of water quality- DO, BOD, COD, TOC, suspended solids, dissolved solids,	14

	volatile solids, alkalinity. Pretreatment, primary treatment, secondary treatment, tertiary treatment, advanced biological treatments, Reuse and Recycle principle	
3	**AIR POLLUTION :** Classification, sources & effect of air pollutants on human beings & ecology, acid rain, smog, green house effect, ozone depletion, global warming, stability, inversion, atmospheric dispersion, the Gaussian plume model, air pollutant sampling & measurement-Ambient air sampling, stack sampling, analysis of air pollutants-SO2, CO, H2S, nitrogen oxides, ozone & hydrocarbons. Equipment, system & process for particulate pollutants & gaseous pollutants.	15
4	**SOLID WASTE MANAGEMENT :** Classification of Solids, hazardous solids & nuclear waste solids management methods, Sludge, incineration, Recovery of precious chemical from waste.	08
5	**NOISE POLLUTION, RADIATION POLLUTION, THERMAL POLLUTION :** Sources, effect on man & environment, measurement & control	02
	TOTAL	**45**

TEXT BOOKS

1. Rao C. S., "Environmental Pollution Control Engineering", New Age International, 2nd edition, 2006.

REFERENCE BOOKS

1) "Pollution Control in Process Industries", S. P. Mahajan, Tata Mcgraw Hill Publication Company Ltd, 2006.

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VIII	
Sub: Process Optimization & simulation				Code: - MBCH08001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Applied Mathematics, chemical engineering subjects.
Course Objective:	To optimize and simulate chemical equipment's performance by using various mathematical models.
Course outcome:	Analysis and prediction of performance of chemical plants.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	Introduction and concept of optimization, Optimization problems in chemical engineering: Heat exchanger, reactor, fluid flow, separation chain, inventory control, analytical methods for unconstrained single variable optimization.	7
2	Numerical Method: Newton, Quasi-Newton, Secant, Region elimination method : (i) Golden section, (ii) Fibonnaci, (iii) Dichotomous. Numerical method for unconstrained multivarible optimization : Direct method : Univariate search, Conjugate directions search; Indirect method : Gradient, Conjugate gradient, Newton.	12
3	Simulation of single units (modules) Degrees of freedom (with and without system constraints. Coupling and decoupling of equations. Precedence ordering for Design /simulation (partitioning and tearing). Selection of design variables algorithm and persistent recycles.	10
4	Simulation of complete flow sheet: Degrees of freedom for flow sheet with	10

	connecting equations. Approaches to simulation (i) Sequential modular. Precedence ordering of modules (partitioning and tearing of flow sheets) (ii) Simultaneous Modular with literalized modules.	
5	Simulation Examples: Gravity Flow Tank, Three CSTR in Series, Nonisothermal CSTR, Binary Distillation Column, Batch Reactor	6
	TOTAL	**45**

TEXT BOOKS:

1. Thomas F. Edger and David. M. Himmelblau, Optimization of Chemical Process, McGraw Hill publication, 2001
2. William L. Luyben, Process Modelling, Simulation and Control for Chemical Engineers, McGraw Hill, Second Edition, 1973 (classic book)

REFERENCE BOOKS:

1. S. S. Rao, Engineering Optimization Theory and practice, Fourth edition, 2012
2. Amiya K Jana, Process Simulation & Control using Aspen, Prentice Hall of India, 2012

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VIII	
Sub: Seminar I				Code: - MBCH08002	
Teaching Scheme				Evaluation Scheme	
Lecture	Practical	Tutorials	Credit	Theory	Internal Continuous Assessment (50 marks)
-	-	2	1	NIL	50 marks

Course Prerequisite:	All basic chemical Engineering subjects
Course Objective:	For a specific topic conduct scientific literature survey and arrive at inferences and conclusions
Course outcome:	Importance of critically evaluating the literature

Unit	Topics	Duration (Hr)
1	Each one of the students will be assigned a Seminar Topic in the current and frontier areas of Chemical Engineering Research or Practice. The student has to conduct a detailed study/survey of the material available on the assigned topic and prepare a report, running to 30 to 40 pages. The student will make an oral presentation for a period of about 20 Minutes, followed by a brief question and answer session.	30
TOTAL		30

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester VIII	
Sub: Project and Process Engineering				Code: MBCH08003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	2	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year II & III
Course Objective:	The aim of this subject is to introduce the students to various requirements of project implementation. It also outlines important topics of process engineering.
Course Outcome:	Understanding of various aspects of project implementation. Application of systematic process engineering concepts to numerous design problems.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	Project Engineering a) Phases of a project cycle – Engineering, Procurement, Construction and Commissioning. b) Stakeholders in a project – customer, licensors, contractors, suppliers, lenders, statutory bodies, Government, society c) Types of contracts and their distinguishing features. d) Planning. WBS. CPM. Resource allocation. Monitoring and control. e) Responsibilities and qualities of a Project Manager f) Reasons for time and cost overrun.	22

2	Process Engineering: a) Flow sheet development – considerations of cost, safety and environmental impact. How different principles of chemical engineering are applied and integrated to develop a process flow diagram. a. Heat integration, Pinch technique b. Water recycle and reuse c. Inherent safety b) Conceptual Plant Layout a. Principles of economy, safety, environment, statutory regulations c) Equipment design, selection and specification a. Design basis b. Criteria for selecting equipment. How to evaluate alternatives? c. How to write a specification? Examples of major equipment. d) Deliverables of Process Engineering. Inputs to other engineering disciplines. Process Design Package (PDP), Basic Engineering Package (BEP), Front End Engineering Design (FEED) and Detailed Engineering	23
TOTAL		45

TEXT BOOKS

1. R. K. Sinnot, (Ed) Coulson & Richardsons Chemical Engineering, Vol 6, Butterworth Heinman, New Delhi, 2000.
2. J. M. Douglas, "Conceptual Design of Chemical Processes", McGraw Hill International Edition, 1988.

REFERENCE BOOKS:

1. George Stephanopoulos, Chemical Process Control, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, 2006.
2. M.S. Ray & M. C. Sneesby, Gordon and Breach, Chemical Engineering Design Project, Science Publication, 2nd Edition 1998.
3. Lorenz T. Beigler, E. Ignacio Grossman and Arthur W. Westerberg, Systematic methods of Chemical Process Design, Prentice Hall International Inc., 1997.

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Course Structure Semester IX *							
Sr No	Subject	Lectures hours per week	Practicals/ Tutorials hours per week	Examination Scheme Final exam	ICA	Credits	Remark
1	Economics of Chemical Projects	4	3	60	40	4	
2	Design Report I		6		100	2	
		4	9	60	140	6	

Note: Semester teaching is of 10 weeks.

Course Structure Semester X							
Sr No	Subject	Lectures hours per week	Practicals / Tutorials hours per week	Examination Scheme Final exam	ICA	Credits	Remark
1	Technical Elective	3		60	40	3	
2	Design Report II		4		100	2	
		3	4	60	140	5	

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MBA (Tech) (chemical)				Semester IX	
Sub: Economics of Chemical Projects				Code:MBCH09001	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
4	-	3	4	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year II, III & IV
Course Objective:	The aim of this syllabus is to acquaint students with the interrelationship between economics and technology in project implementation.
Course Outcome:	Parameters deciding in selecting process licensor, site location, site & its size. Various factors contributing to cost of project & their evaluation.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	**Introduction:** An overview of Chemical Industry, Different Types of projects, classification of projects, pre-project activities.	4
2	**Selection:** of project concept, capacity, technology supplier, location and site	7
3	**Cost Estimation:** elements of project cost- Land and site development Building and Civil works Know-how and engineering Expenses on foreign technicians and training of Indian technicians abroad Plant and machinery cost	11

	Miscellaneous fixed assets Contingencies Pre-operative expenses Margin money Project cost schedule	
4	**Cost of Production:**	4
5	**Financing of Project:** Introduction, Interest calculations, Depreciation calculations, profit projections.	5
6	Project Evaluation and Product Pricing: Break Even analysis, Ratio Analysis, Incremental Analysis, and Discounted Profit Flow Technique. Project Economics considerations, market consideration.	8
7	Introduction to Feasibility report writing with financial ratios	6
	TOTAL	**45**

Text Books:

1. V.V. Mahajani and S. M. Mokashi, Chemical Project Economics, Macmillan India Limited, 2005

Reference Books:

1. M.Peters & K. Timmerhaus, Plant Design & Economics for Chemical Engineer, TMH Publication, 5th edition, 2011.
2. Prasann Chandra, Fundamentals of Financial Management, TMH, 7th Edition, 2008.
3. IDBI- Handbook methodology of developing cash flow.

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester IX	
Sub: Design Report-I				Code: - MBCH09002	
Teaching Scheme				Evaluation Scheme	
Lecture	Practical	Tutorials	Credit	Theory	Internal Continuous Assessment (100 marks)
-	-	6	2	NIL	Weightage 100 marks

Course Prerequisite:	All Chemical Engineering Subjects
Course Objective:	Utilization of knowledge gained in earlier semesters including training for design of plant for a specified product.
Course outcome:	Integration of the knowledge acquired.

Unit	Topics	Duration (Hr)
1	For a given topic, determine for the following a) plant capacity, b) selection of process technology, c) Preparation of PFDs & P&IDs, d) Material and Energy balance with assumptions well stated. e) safety data sheets of key raw materials and finished products. f) Equipment list with material of construction.	
2	Report should consist of index, abstract, literature review, references and relevant information as specified above.	
	TOTAL	60

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester X	
Sub: Elective (Food Processing)				Code: MBCH10001	
Teaching Scheme				Evaluation Scheme	
Lecture	Practical	Tutorials	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (50 marks)
3	-		3	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year I, II, III
Course Objective:	To familiarized students with operations and processes specific to food processing Industries, the importance of process conditions related to food and its preservation & industrial manufacturing processes of some food products.
Course Outcome:	Familiarization with various techniques of food preservation and processing

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	**Introduction:** Classification of foods, Current status of Indian food industry, market opportunities, engineering challenges & R & D opportunities.	3
2	**Basic bio chemistry & microbiology of foods:** Food constituents (water, proteins, carbohydrates, lipids, vitamins, minerals, flavors), various characteristics like nutritional, sensory, etc. Food fortification, enzymes & microbiological productions. Fermentations, Enzymes,	6

	Immobilization of Enzymes	
3	**Ambient temperature processing:** Raw material preparation, size reduction, mechanical separation, emulsification, homogenization, mixing, forming, extraction, expression, membrane concentration, fermentation- equipments & applications	6
4	**Heat processing:** Using steam or water(pasteurization, sterilization), using hot air (baking & roasting), using hot oils (frying), by direct & radiated energy (microwave)- equipments & applications, Other typical equipments such as sprayed drier etc.	6
5	**Processing by heat removal:** Equipment & applications of freezing, freeze drying & freeze concentration.	4
6	**Food preservation, packaging & storage:** Food contamination & spoilage, modified atmospheric storage, modified atmospheric packaging, coating & enrobing, filling & sealing of containers; Indian laws pertaining to food industry & food production.	4
	Food Additives Definitions, uses and functions of: Acids, Bases, Buffer system, Chelating / sequestering agents, Low calorie and non-nutritive sweeteners, Antioxidants, Emulsifying and Stabilizing agents, Anti-caking agents, Thickeners, Firming agents. Flour bleaching agents and Bread improves. Anti-microbial agents/class-I and Class-II preservatives, clarifying agents.	5
7	**Manufacturing of various food products:** Biscuits, bread, cake; pulp, juices & powders; milk & milk products like- cheese, ice-cream, chocolate; solid & liquid foods, confectionaries, canned & bottled soft-drinks; health foods.	11
TOTAL		45

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TEXT BOOK:

1. Fellows, Food processing technology: principles & practice, woodhead pub ltd, England, 2nd edition, 2000

REFERENCE BOOKS:

1. Sharma S. K., Food process engineering, John Wiely & sons, Canada, 2000
2. Toledo, fundamentals of food process engineering, CBS publishers & distributors, New Delhi, 2nd edition, 1991
3. Shreeve's, chemical processes industries, Mc Graw Hills Pub, 5th edition, 2012

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MBA (Tech) (chemical)				Semester X	
Sub: Elective (Petroleum Refining Technology)				Code: MBCH10002	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	-	3	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year I, II, III
Course Objective:	To familiarize students with importance of present day refining practices including fractionation: thermal and catalytic, process and next generation processes.
Course Outcome:	Familiarization with various refining operations.

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	**Origin, formation and composition of petroleum:** Origin and formation of petroleum. Reserves and deposits of world, world economies of petroleum and its products. Indian Petroleum Industry.	4
2	**Petroleum processing & Fractionation:** Evaluation of petroleum, thermal properties of petroleum fractions, important products, properties and test methods. Dehydration and desalting of crudes, distillation of petroleum, blending of gasoline.	8
3	**Thermal and catalytic processes:** Thermal Cracking, catalytic cracking, Crackers, catalytic reforming, coking, Hydro-treating, Alkylations processes, Isomerization process,	10

	Thermal (Carbon Rejection) Processes, High Conversion Soaker Cracking Process. Utility plants in refinery	
4	**NewApproach in Refinery Processiug:** Various Refinery Configurations, Integrated Refinery Complex, Selection criterion of the refineryconfiguration, Opportunity crude processing challenges, Corrosion & Fouling monitoring techniques	13
5	**Feed stocks for petrochemicals:** Olefins productionand Naphtha cracking, aromatic production and separation	6
6	**Indian Petroleum Refining Scenario:** Present and future of Petroleum refining in India.	4
	TOTAL	**45**

TEXT BOOKS:

1. I. D. Mall; Petrochemical Process Technology, McMilan India Ltd, 2007

2 B.K.B. Rao, Modern Petroleum Refining Processes by, Oxford & IBH Publishing Pvt. Ltd, 5TH Edition, 2008

REFERENCE BOOKS:

1. James G Speight and Bani Ozum; Petroleum Refining Processes, Marcel Dekker, NewYork, 2009G.N. Sarkar, Advanced Petroleum Refining, Khanna Publishers, 1st edition, 2008.

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester X	
Sub: Elective (Biochemical Engineering)				Code: MBCH10003	
Teaching Scheme				Evaluation Scheme	
Lecture Hours per week	Practical Hours per week	Tutorials Hours per week	Credit	Theory (3 Hrs) (60 Marks)	Internal Continuous Assessment (As per ICA rules) (50 marks)
3	-	-	3	Scaled to 60 marks	Scaled to 40 marks

Course Prerequisite:	Chemical Engineering subjects of year I, II, III
Course Objective:	To introduce students to the biochemical stream and its relation to Chemical Engineering. This includes importance of biotechnology in modern day industries, & engineering aspects of designing biochemical systems.
Course Outcome:	Familiarization with various biochemical processes

Detailed Syllabus

Unit	Topics	Duration (Hr)
1	INTRODUCTION: An overview of industrial biochemical processes with typical examples, comparing chemical and biochemical processes, development and scope of biochemical engineering as a discipline. Industrially important microbial strains; their classification; structure; cellular genetics; typical examples of microbial synthesis of biological organisms. Introduction to metabolism and metabolic pathways. Transport across cell membranes	8
2	ENZYMES AND ENZYME KINETICS:	7

	Enzyme used in industry medicine and food, Their classification with typical examples of industrially important enzymes; Mechanism of enzymatic reactions; Michaelis-menten kinetics; enzymes inhibition; factors affecting the reaction rates; industrial production purification and immobilization. Immobilization methods, advantages and limitations	
3	MICROBIAL KINETICS: Typical growth characteristics of microbial cells; factors affecting growth; Monod model; modelling of batch and continuous cell growth; immobilised whole cells and their characteristics; free cell and immobilised cell reactors, advantages and limitations.	6
4	BIOREACTORS: Mode of operation: Batch, continuous and fed batch. Description of typical aspects of aerobic fermenter, Immobilised whole cell and enzyme reactors; high performance bioreactors; sterile and non-sterlie operations; Sterilization Reactors – Batch & continuous sterilization. Reactors in series with and without recycle; design of reactors and scaleup.	8
5	DOWNSTREAM PROCESSES AND EFFLUENT TREATMENT: Different unit operations in down streaming with special reference to membrane separations; extractive fermentation; anaerobic treatment of effluents; typical industrial examples for downstream processing and effluent disposal.	6
6	CASE STUDIES: Production of antibiotic – Penicillin; Production of HFCS; Production of Ethanol; Production of single cell protein; Production of Vitamin B12; Biological Waste Water Treatment; Recombinant DNA technology; Plant and Animal tissue culture.	8
7	IMPORTANT ASPECTS OF BIOCHEMICAL INDUSTRIES: Techno economics of biochemical industries; Legal, social and ethical aspects of biochemical Industries.	2

TOTAL	45

TEXT BOOKS:

Bailey, J.E.; Ollis, D.F.; Biochemical Engineering Fundamentals , McGraw-Hill, New York, 1972

REFERENCE BOOKS:

1. Aiba, S,; Humphery, A.E.; Milli, N.R.; Biochemical Engineering , Academic Press, 2nd ed, 1973
2. Shuler M. L, Kargi F.; Bioprocess Engineering, 2nd edition
3. D.G. Rao; Biochemical Engineering, Tata McGraw-Hill Education, 2005

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Mukesh Patel School of Technology Management & Engineering

MBA (Tech) (chemical)				Semester X	
Sub: Design Report-II				Code: - MBCH10004	
Teaching Scheme				Evaluation Scheme	
Lecture	Practical	Tutorials	Credit	Theory	Internal Continuous Assessment (100 marks)
-	-	4	2	NIL	Weightage 100 marks

Course Prerequisite:	All Chemical Engineering and Management subjects
Course Objective:	Utilization of knowledge gained in earlier semesters including trainings for economic viability of product undertaken in design project I.
Course outcome:	Integration of the knowledge acquired.

Unit	Topics	Duration (Hr)
1	This project will include: 1. Process design of major equipment 2. Process data sheets 3. Layouts 4. SHE considerations 5. Break even analysis 6. Profitability parameters 7. Conclusion and recommendations	
2	Report should consist of index, abstract, literature review, references and relevant information as specified above.	
	TOTAL	60