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**Note:** Mid Term marks includes: Evaluation towards one best out of two minor tests (60% of marks), Assignments (20% of the marks), Class Surprise Tests, presentation, class attendance etc. (20% of the marks).
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Total | 15 | 5 | 12 | 28 | 250 | 450 | 700 |

*There will be 6-8 weeks' compulsory industrial training after 6th semester theory examination during summer vacation. Every student will submit the Industrial Training report within one month from the start of teaching of the 7th Semester. After that it will be evaluated by the team of Training & Placement Officers.*

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<td>MBA-CHE 5804</td>
<td>Project Management &amp; Entrepreneurship</td>
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<tr>
<td>CHE 5851</td>
<td>Project Work</td>
<td>- - 2 2 'S' or 'X'</td>
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<td>CHE 5852</td>
<td>Process Modeling &amp; Simulation Lab.</td>
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<td>CHE 5853</td>
<td>Process Control Lab.</td>
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<td>CHE 5854</td>
<td>Literature Survey, Report Writing and Seminar</td>
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<td>CHE 5855</td>
<td>*Summer Training</td>
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<td>CHE 5856</td>
<td>Viva Voce-II (Comprehensive)</td>
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All independent/self study courses shall be graded in terms of ‘S’ (Satisfactory) or ‘X’ (Repeat).

* At the end of the examination of 8th Semester, the students will undergo compulsory summer training for a period of 6-8 weeks. Every student will submit the Summer Training Report within one month from the start of teaching of 9th Semester. After that it will be evaluated by the team of Training & Placement Officers.
### SCHEME OF TEACHING AND EXAMINATION (2014-2015)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Teaching Hrs. per Week</th>
<th>End Term</th>
<th>Mid Term</th>
<th>Total marks</th>
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**Group-A (Functional Subject-1 & 2)**
1. Marketing Research and Consumer Behavior
2. Investment Analysis and Portfolio Management
3. International Human Resource Management
4. Supply Chain Management

**Group-B (Functional Subject-3 & 4)**
1. Advertising and Sales Management
2. Strategic Cost Management
3. Organizational Development
4. Enterprise Resource Planning

Students in the ninth semester will have to opt for FOUR functional subjects, selecting TWO each from Group A & B.
### SCHEME OF TEACHING AND EXAMINATION (2014-2015)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Subject</th>
<th>Teaching Hrs. per Week</th>
<th>End Term</th>
<th>Mid Term</th>
<th>Total marks</th>
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**Functional Subject-5**
1. International Business Management
2. International Financial Management
3. Industrial Relations and Labour Laws
4. Advanced Production Management

**Functional Subject-6**
1. Industrial and Rural Marketing
2. Management of Financial Services
3. Performance Management
4. Productivity Management

Students in the tenth semester will have to opt for TWO functional subjects, selecting ONE each from Functional Subject-5 & 6 above.

*The Comprehensive Viva-Voce-III examination (Paper MBA-CHE 51054) will cover the subjects taught during the 9th and 10th Semesters.*
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
FIRST SEMESTER

Paper Title: Mathematics-1 (Theory)
Paper Code: CHE 5101
Max. Marks: 50
Credits: 4
Time: 3 hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Convergence and divergence of infinite series and some simple problems, trigonometric and exponential functions of a complex variable, hyperbolic functions, separations into real and imaginary parts, summation of series ("C+IS" method only).

Successive differentiation, expansion of function, applications of maxima and minima of a function of two or more variables, curves in polar co-ordinates, angle between radius vector and tangent line, curvature, partial differentiation, Asymptotes singular and multiple points, curve tracing.

SECTION-B
Definite integrals and their properties, definite integrals as the limit of a sum of the fundamental theorem of integral calculus, determination of areas and lengths of curves, volumes and surfaces and solids of revolution. Double and triple integrals with their simple applications.

Solution of ordinary differential equations of first order and first degree with simple applications of engineering problems.

Books Recommended:
School of management Thought: Forerunners of Scientific Management; the era of Scientific Management: The human behaviour school; The social system school: Decision theory school. The mathematical and quantitative school; The systems school; The contingency theory of Management; Contemporary management thinkers; Contemporary organizational theories. Types of Organizations Need for Management, Efficiency & Effectiveness, Process of Management, Business Environment. Social Responsibility & Ethics.

SECTION-B

Books Recommended:
4. Rue and Books : Management theory and application.
SECTION-A

Classification of organic compounds: IUPAC nomenclature, Structural isomerism, Cis-trans isomerism. Shapes and Molecular orbital structures of compounds containing C, N and O. Conformations of alkanes. Organic reagents and reaction intermediates structures of dienes, pyridine, pyrrole, aromatic compounds. Optical isomerism, Chirality and optical activity; Enantiomers, Diastereomers, Meso-and Racemic compounds, Resolution of racemic mixture. Asymmetric synthesis, Walden Inversion, Configuration (D and L nomenclature), Absolute configuration (R and S nomenclature)

Chemistry of hydrocarbons: House synthesis, halogenation of alkanes, free radical mechanism, orientation, reactivity and selectivity. Cracking effect of structure on physical properties of compounds. Alkenes, catalytic hydrogenation, dehyration of alcohols, dehydrohalogenation, Saytzeff rule, electrophilic addition reactions, peroxide effect, mechanism of allylic substitution, acidity of 1-alkynes, conjugated dienes, 1,2-and 1,4-additions, free radical and ionic mechanisms of addition polymerisation reactions, ring-opening reactions of cyclopropane and cyclobutane, chemistry of benzene and alkylbenzenes, aromatic electrophilic substitution reactions, Friedel-Crafts reactions

SECTION-B

Delocalisation: Concept of aromaticity, stability of cycloalkanes, resonance concept, inductive and mesomeric effects, directive effects, activating and deactivating groups. Hydrogen-bonding.

Chemistry of functional groups: Alkyl and aryl halides, nucleophilic substitution, synthetic utility of Grignard reagents and alkyllithiums, mechanism of Grignard reactions of alcohols, benzylalcohol, acidity of phenols epoxy compounds, Anisole nucleophilic addition, benzaldehyde, acetophene, benzophenone, aldol condensation, acidity of acids, alkyl and aryl amines.

Synthetic utility of diazonium salts, basicity of amines, multistep synthesis.
Books Recommended:


5. Mukherji & Singh: Reaction mechanism in organic chemistry, Macmillan India Ltd.,

Paper Title: ENGINEERING MECHANICS (Theory)  
Paper Code : CHE 5104  Max. Marks 40  Credits : 3  Time: 3 hours  
Course Duration: 35 Lectures of one hour each.  
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Equipments: Force body diagram, equations of equilibrium and their applications to engineering problems, equilibrium of two forces and three-force member.  
Structure: Plane truss, perfect and imperfect truss, assumption in the truss analysis, analysis of perfect plane trusses by the method of joints, method of section and graphical method.  
Friction: State and kinetic friction, laws of dry friction, co-efficient of friction, angle of friction, angle of repose, cone of friction, frictional lock, friction of flat pivot and collered thrust bearings, friction of journal-bearing, friction in screws, derivation of equation $\mu_c = T_1/T_2$ and its application.  
Distributed Forces: Determination of centre of gravity, centre of mass and centroid by direct integration and by the method of composite bodies, mass moment of inertia and area moment of inertia by direct integration and composite bodies method, radius of gyration, parallel axis theorem, Pappus theorems, polar moment of inertia.

SECTION-B

Dynamics: Rectilinear motion, plane curvilinear motion-rectangular co-ordinates, normal and tangential coordinates.  
Kinetics of Particles: Equation of motion, rectilinear motion and curvilinear motion, work energy equation, conservation of energy, impulse and momentum, conservation of momentum, impact of bodies, co-efficient of restitution, loss of energy during impact.  
Kinematics of Rigid Bodies: Concept of rigid body, types of rigid body motion, absolute motion, introduction to relative velocity, relative acceleration (Corioli’s component excluded) and instantaneous centre of zero velocity. Velocity and acceleration polygons for four bar mechanism and single slider mechanism.  
Kinematics of Rigid Bodies: Equation of motion, translatory motion and fixed axis rotation, application of work energy, principles to rigid bodies conservation of energy.  
Vibration: Classification, torsional free vibrations-single rotor and two rotar systems. Spring mass system-its damped (linear dash pot) and undamped free vibrations, spring in series and parallel, simple problems.
Books Recommended:

3. Hidgen, Stiles : Statics and Dynamics, Longman
Introduction to Chemical Engineering (Theory)

Course Duration: 45 Lectures of one hour each.

Instructions for the paper setter: Total number of questions to be set = 08 with the following distribution:

Unit-I : 01 question, Unit-II : 02 questions, Unit-III : 02 Questions, Unit-IV: 03 questions

Students are required to attempt FIVE Questions selecting at least ONE question from each Unit. Q.1 from Unit-I shall be in the form of an Objective Type Question.

Unit-I

1. What is Chemical Engineering? A.I.Ch.E. Definition of Chemical Engineering. Brief history of Chemical Engineering. General aspects of Chemical Engineering like communications, human relations, technical reading and professional bodies. Engineering problems in chemical processes in scaling up from laboratory to commercial scale.

2. Systematic analysis of Chemical processes; unit operations and unit processes, material and energy balances, thermodynamics and kinetics, process instrumentation and control and economics.

3. Functions of a chemical engineer/career opportunities for chemical engineers.

4. Scope of chemical engineering with respect to the new emerging areas in the field of chemical engineering like environmental engineering, bio-chemical and bio-medical engineering, membrane separation techniques, polymer science and engineering etc.

5. Factors for selecting a suitable site for the location of a process plant.

(6 Hrs)

Unit-II

6. Systems of units and unit conversions involving process variables like pressure, viscosity, temperature, density/specific gravity etc.

7. Composition of mixtures and solutions; mass fractions/mole fractions, molarity and normality etc.

(10 Hrs)

Unit-III

8. P-V-T relations for gas and gas mixtures, calculations using ideal gas law, compressibility factor and van der Waal’s equations of state.

9. Liquid and liquid mixtures; Vapour pressures (cox chart, Duhrings lines, Clausius Clapeyron equation), vapour-liquid equilibrium calculations using Raoult’s law, Henry’s law.

10. Gas-vapour mixtures; humidity calculations from partial pressures and vapour pressures. Dry bulb, wet bulb and adiabatic saturation temperatures.

(12 Hrs)
Unit-IV

11. Introduction to material balances with and without chemical reactions, combustion calculations, use of by-pass, recycle and purge streams.

12. Introduction to energy balances: Various forms of energy, types of systems, intensive/extensive properties, general energy balance equation for a flow process, heat capacity and mean heat capacity, energy balances for simple flow processes.

13. Thermo chemical calculations: Laplace Law and Hess’s Law, heats of formation, heats of combustion, heats of reaction, Kirchoff’s equation for calculating heats of reaction at different temperature.

(17 Hrs)

Books Recommended:

TextBooks:


Reference Books:

Paper Title: PHYSICAL CHEMISTRY (Theory)
Paper Code: CHE 5106 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Solutions: Ideal and non-ideal solutions, Raoults’s law, change of free energy, enthalpy, and entropy on mixing of liquids, distillation of binary solutions. Partially miscible liquids such as Phenol- water, triethylamine- water, and Nicotine- water systems. Henry’s law, Nernst distribution law, Colligative properties of dilute solutions. Abnormal molar mass, degree of dissociation and association of solutes.

Chemical Kinetics: Rate equation of reactions of various orders, rate mechanism, kinetics of complex reactions. Concept of energy barrier and energy of activation. Theories of reaction rates, measurement of extent of reaction, zero order reactions. Rates of flow systems. Lindemann theory of unimolecular reactions.


SECTION-B


Electrochemical Cells: Reversible and irreversible cells, e.m.f. and its measurement, cell reactions and e.m.f., thermodynamics of electrode potentials, half-cell potential and its determination, Nernst equation, concentration cells, liquid junction potential, determination of activity co-efficient from cell potential data, potentiometric titrations.

Books recommended:
4. Rose, J.: Dynamics of Physical Chemistry, Lond Pitman
Paper Title: ORGANIC CHEMISTRY LAB. (Practical)
Paper Code CHE 5151 Max. Marks: 50 Credits: 2
1. Lab – Safety
2. Preparation of Benzamide & Aspirin-Purification, determination of melting point and percentage yield.

Paper Title: ENGINEERING GRAPHICS -1 LAB. (Practical)
Paper Code CHE 5152 Max. Marks: 25 Credits: 1
Introduction to Engineering Graphics, Methods of projections, Theory of orthographic projection.
Conventional practices, dimensioning as per BIS SP 46-1988
Pictorial sketching
Projection of points, lines and planes on principal planes
Projection on auxiliary planes

Recommended Books
1. James D. Bethune: AutoCAD, Pearson Publishers

Paper Title: PHYSICAL CHEMISTRY LAB. (Practical)
Paper Code CHE 5153 Max. Marks: 50 Credits: 2
1. Surface tension of liquids using Stalagmometer and calculation of Parachor values.
2. Distribution of Iodine between water and carbon tetrachloride.
3. Kinetics of the hydrolysis of methylacetate in the presence of hydrochloric acid.
4. Adsorption of acetic acid on activated charcoal.
5. Viscosity of liquids and composition of a binary solution.
6. Conductometry
   • Variation of equivalent conductance and specific conductance on dilution.
   • Dissociation constant of acetic acid.
   • Solubility of sparingly soluble salts.
   • Conductometric titrations of HCl vs NaOH and acetic acid vs NaOH.
7. Potentiometric titration of HCl vs NaOH and acetic acid vs NaOH and determination of dissociation constant of acetic acid.
8. Colorimetry
   • Verification of Lambert-Beer Law.
   • Determination of concentration of solution of KMnO$_4$/K$_2$Cr$_2$O$_7$.
   • Determination of composition of Fe-Salicylic Acid Complex by Job’s Method.

Books Recommended:
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
SECOND SEMESTER

Paper Title: MATHEMATICS-II (Theory)
Paper Code : CHE 5201  Max. Marks 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

*Relationship between cartesian, cylindrical polar and spherical polar co-ordinate systems*: standard forms of equation of sphere, cone, cylinder.


SECTION-B

*Vectors*: Gradient, Divergence, Curl, Statement of Green’s Gauss and Stoke’s Theorem and their simple applications.

Linear Differential Equations with constant Coefficients, Homogeneous Linear Equations, method of variation of Parameters, Simultaneous Linear Differential Equations with Coefficients.

Books Recommended:


Paper Title: APPLIED PHYSICS (Theory)
Paper Code : CHE 5202  Max. Marks 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

*Relativity*: Frames of reference, Michelson – Morley experiment, Galilean and Lorentz transformation, Lorentz Fitz Gerald contraction, time dilation, postulates of special theory of relativity, variation of mass with velocity, mass energy relation.

*Mechanics*: Surface tension, how to calculate surface tension for a drop, experimental determination of surface tension by Jaeger’s method.
Viscosity: Coefficient of viscosity, critical velocity, Poiseuille’s equation for flow of a liquid through a tube, motion in viscous medium, Reynolds number, Bernoulie’s equation and its applications; venturimeter and pitot tube.

Physics of Materials: Magnetic materials, classification of materials, ferromagnetism, ferri and anti ferromagnetism, hysteresis. Superconductivity, Meissner effect, thermodynamics of superconducting transitions, qualitative idea of BCS theory.

SECTION-B

Optics: Ultrasonics: production, detection and uses of ultrasonics.
Interference: Formations of colours in thin films, Newton’s rings, Michelson interferometer.
Diffraction: Diffraction at a single slit, double slit diffraction grating, its theory, dispersive power and resolving power.
Polarization: Polarization by reflection, scattering, absorption and double refraction. Quarter wave and half wave plates, production and analysis of plane, circular and elliptically polarized light.
Fiber optics: Basic principle, step index and graded index fiber, qualitative idea of signal distortion and dispersion, transmission losses, fiber optics sensors and their applications.
Laser: Elementary ideas, He-Ne and Ruby laser, uses.
Holography: Basis principle, theory.
Quantum Physics: Difficulties with classical physics, blackbody radiation, photoelectric effect, Compton effect, Debroglie hypothesis, uncertainty principle, time dependent and independent Schrodinger’s equation, properties of well behaved wave function. Operators and their expectation value. X-ray diffraction and Bragg’s law.

Books Recommended:

Paper Title: CHEMISTRY (INORGANIC) (Theory)
Paper Code : CHE 5203  Max. Marks 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section A
1. Quantum theory and atomic structure: Introduction to wave mechanics, the Schrodinger equation, the Schrodinger equation as applied to hydrogen atom, the origin of quantum numbers and shapes of orbitals.
2. Chemical Bonding: Molecular orbital and valence bond theories of bond formation and application of molecular orbital theory to the formation of homonuclear and simple heteronuclear diatomic molecules.
3. The Solid State: A recapitulation of close packing of spheres, structures of NaCl, CsCl, ZnS, CaF2, crystal defects and applications of defect structures (transistors, rectifiers, photovoltaic cells and computer chips).
4. Coordination Compounds: Part 1: Werner’s theory, effective atomic number, bonding of transition metal complexes: valence bond theory, crystal field theory, crystal field splitting in tetrahedral, octahedral and distorted octahedral (square planar) crystal fields. Thermodynamic aspects of
coordination compounds (crystal field stabilization energies of octahedral and tetrahedral complexes, spectrochemical series).


Section B

6. Organometallic Compounds: Nomenclature, types of ligands and bonding in organometallic compounds, use of organometallics in industry.

7. Inorganic polymers: Types of inorganic polymers, polyphosphazenes, polysiloxanes – their structures and properties.


9. Metal toxicology: Toxic effects of heavy metals with special reference to Cd, Pb, Hg and As.

10. Theory of quantitative inorganic analysis.

Books Recommended:

Paper Title: PROCESS PLANT MATERIAL AND ENERGY BALANCES (Theory)
Paper Code: CHE 5204 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Review: Stoichiometric and composition relationship gas laws; Gaseous mixtures, vapor pressure, humidity, etc.
Material Balances for Non-reaction systems including balances involving recycle and by-pass streams.
Material Balances for Reacting systems including balances involving recycle and purge streams.

SECTION-B
Combustion Calculations.
Energy balances on nonreactive and reactive systems.
Books Recommended:


Paper Title: STRENGTH OF MATERIALS (Theory)
Paper Code : CHE 5205 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


Compound Stresses and Compound Strains: Oblique stress, simple tension, state of pure shear, pure normal stresses of given planes, general two-dimensional stress system, principle planes, principle stresses, maximum shear stress, Mohr’s stress circle, Poisson’s ratio, principle strains in three dimensions. Principle stresses determined from principal strains, analysis of strain, Mohr’s strain circle, volumetric strain, elastic constants and relations between them, numerical problems.

Shearing Force and Bending Moments in Beams: Shearing force, bending moment, types of load on beams, types of supports, relations between w, V and M. Concentrated loads, uniformly distributed loads, graphical method, numerical problems.

Bending Stresses and Shearing Stresses in Beams: Pure bending, graphical determination of moments of inertia, bending stress, composite beams, reinforced concrete beams, moments of inertia variation of shear stress, rectangular section, I-section, principle stresses in I-beams, solid circular sections, thin circular tubes, numerical problems.

Axial and Bending Loading Combined: General eccentric loading, eccentric longitudinal loads, load eccentric about both the axes, middle third rule of rectangular section, middle quarter rule of circular sections, numerical problems.

Deflection of Beam: Introduction, Macauly’s integration method, moment area method, superposition method, deflection due to shear, numerical problems.

SECTION-B

Torsion of Shafts: Circular shafts, shafts of varying diameter, compound shafts, combined bending and torsion, torsion of thin circular tubes, combined end thrust, bending and torsion, equivalent torque, equivalent bending moment, numerical problems.

Struts and Columns: Definition, pin ended (hinged) struct axially loaded, direction fixed at one end and free at the other, direction fixed at one end and position fixed at the other, struct with eccentric load, limitations of Euler theory, Rankine-Gordon formula, struct with lateral loading, numerical problems.

Stresses and Strains in Thin Shells: Thin cylinder under internal pressure, thin spherical shell under internal pressure, cylindrical shell with hemispherical ends, volumetric strain, modifications for built-up shells, numerical problems.

Stresses and Strains in Springs: Close coiled helical springs, open coiled helical springs, leaf springs, numerical problems.
Strain Energy and Theories of Elastic Failure: Strain energy in tension energy in compression, strain energy in shear, strain energy in bending, strain energy in torsion, strain energy under compound loading, theories of elastic failure and their graphical representation, numerical problems.

Books Recommended:


Paper Title: ENVIRONMENTAL STUDIES (Theory)
Paper Code : CHE 5206 Only Qualifying Exam. Credit : Nil
Course Duration: 22 Lectures of one hour each.

The Multi-disciplinary nature of Environmental Studies: Definition, scope and import for public awareness.
Ecology and Ecosystems: Definition of ecology: Structure and function of ecosystem; conserver and decomposers; Energy flow in the ecosystem; Ecological succession; Food webs and ecological pyramids.
Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).
Biodiversity and its conservation: Introduction - Definition: Genetic species and ecosystem diversity. Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diver Hotspots of biodiversity; Threats to biodiversity: Habitat loss, poaching of wildlife, man wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Natural Resources: Natural resources and their conservation:
(a) Air Resources: Features, composition, structure; air quality management.
(b) Forest Resources: Use and over-exploitation, deforestation, case studies, timber mining, dams and their effects on forests and tribal people.
(c) Water Resources: Use and over utilization of surface and ground water, flood conflicts over water, dams benefits and problems; water quality management; water resources e.g. rivers, lakes, ground water, etc. Fluorosis and arsenic problems.
(d) Mineral Resources: Draw on and exploitation, environmental effects of extracting mineral resources, case studies.
(e) Food Resources: World food problems, changes caused by agriculture and effects of modern agriculture, fertilizer-pesticide problems, water logging, sal studies.
(f) Energy Resources: Growing energy needs, renewable and non-renewable energy of alternate energy sources. Case studies.
(g) Land Resources: Land as a resource, land degradation: Man induced landslides, soil and desertification.
Role of an individual in conservation of natural resources and prevention of
Equitable use of resources for sustainable lifestyles; Disaster management
earthquake, cyclone and landslides.
Environment Pollution: Definition - Air pollution: Definition, causes, effects a
measures: Air Quality Management; Air Pollution Case Studies.
Water Pollution: Definition, causes, effects and control measures; Case studies; Wa
Management: Definition, causes, effects and control measures.
Marine pollution.
Thermal pollution.
Soil pollution: Definition, causes and control measures: Case studies.
Noise pollution.
Nuclear hazards waste management.
Waste management through cleaner technologies: Reuse and recycling of wastes.
Solid waste management: Causes, effects and control measures of urban and industri
hazardous waste; bio-medical waste; Role of an individual in prevention of pollution
case studies.
Disaster Management: Floods, earthquake, cyclone and landslides.
Social issues and the Environment: From Unsustainable to Sustainable development
problems related to energy; Water conservation, rain water harvesting, watershed m:
Resettlement and rehabilitation of people: Its problems and concerns. Case
Environmental ethics: Environmental value relationships; Environmental ethics a
preservation; Climate change: Global warming, acid rain, ozone layer depletion, nuclear
and holocaust. Case studies. Wasteland reclamation; Consumerism and waste
Legislation to Protect the Environment: Environmental Protection Act; Air (Pre
Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife
Act; Forest Conservation Act; Environmental Impact Assessment (EIA); Env
Management Systems (EMS); Environmental Information Systems (EIS); P.I.L.: Publ
and Role of NGO's; ISO 9000 and 14000; Issues involved in enforcement of env
legislation; Public awareness.
Environmental Economics: Environment and standard of living.
Human Population and the Environment: Population growth, variation among nations;
exploration "Family Welfare Programme"; Environment and human health; Human R
education; HIV/AIDS; Women and Child Welfare; Role of Information Technology

Paper Title: ENGINEERING GRAPHICS-II LAB. (Practical)
Paper Code: CHE 5251 Max. Marks: 25 Credits: 1
Projection of solids, solid modeling
Section of solids
Elementary development and intersection of solids
General introduction to isometric views
Applications: Drawing of threaded fasteners and assembly drawing using 1st angle/3rd angle projections.
Introduction and application to CAD software.

Recommended Books
1. James D. Bethune: AutoCAD, Pearson Publishers
Paper Title: PHYSICS LAB. (Practical)

Paper Code: CHE 5252  Max. Marks: 25  Credits: 1

Coefficient of viscosity of water by flow through a capillary tube, Surface tension of water by Jaeger's method, Mechanical equivalent of heat by Calandar and Borne's apparatus, Refractive index of the material of glass prism by spectrometer, Wave length of sodium light by Newton's rings, Wavelength of sodium light by diffraction grating, Vertical and horizontal distance using sextant, Density of a given wire using sonemet box, Magnetic-meters, Internal resistance of Leclanche cell by Post Office Box and voltmeter method, Conversion of a galvanometer into an ammeter or a voltmeter of a given range, comparison of e.m.f.'s of two cells by (I) Potentiometer (II) Lumsden's method, Value of H by using tangent galvanometer and copper voltmeter, Accuracy of a given meter being copper voltmeter, Total intensity of earth's magnetic field using dipcircles.

Books Recommended:

Paper Title: INORGANIC CHEMISTRY LAB. (Practical)

Paper Code: CHE 5253  Max. Marks: 50  Credits: 2

1. Volumetric Analysis
   (i) Redox Titrations:-
       Titrations involving
       a. KMnO₄ (Estimation of C₂O₄²⁻)
       b. K₂Cr₂O₇ (Estimation of Fe²⁺/Fe³⁺ and Fe²⁺ + Fe³⁺ mixtures )
       c. Iodine [Iodometry & Iodimetry] (Estimation of Cu²⁺, AsO₃⁻³ and Sb⁺³)
   (ii) Complexometric Titrations- Determination of Zn by EDTA titration.

2. Gravimetric Analysis
   (a) Estimation of Ba²⁺/SO₄²⁻ as BaSO₄
   (b) Estimation of Fe²⁺/Fe³⁺ as Fe₂O₃

Paper Title: BEHAVIOUR SCIENCES AND COMMUNICATION SKILLS (Practical)

Paper Code: MBA-CHE 5254  Max. Marks: 25  Credits: 1

1. Need and Importance: Need of good communication skills, Presentation skills – with and without physical media (Computer and Multimedia Projector), Communication skills in a group – Group discussion, communication skills in an employment interview, Communication skills and proper body language, Professional and Social etiquette, Professional meeting skills.

2. Role Playing: Role playing as an event comparer, Role playing as Chairman, Role playing as team leader. The workshop would involve learning of practical skills to develop and perfect communication ability. Students would be required to give presentations both as an individual and in a team. Group discussions would be held to develop the communication skills while in a group. Role playing would require the students to practice the knowledge and expertise gained in communication skills to various situations where they would be required to perform the roles mentioned.

The students would be evaluated on the basis of their communication skills, participation in various activities and on the ability to work in a team.

Books Recommended:
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
THIRD SEMESTER

Paper Title: OPERATIONS RESEARCH (Theory)
Paper Code: MBA-CHE 5301 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Linear Programming: problem formulation, graphical method, simplex method, duality sensitivity analysis.
Transportation model, Transhipment problem, traveling salesman problem, Assignment models, Sequencing model, Replacement model.

SECTION-B
Theory of Games: Pure strategy games, principle of dominance; mixed strategy games (Algebraic, Graphical & Linear programming method), 2-person, non-zero- sum games.
Queuing Theory: Introduction, elementary queuing system; single channel queuing model, queuing cost behaviour, multiple channel queuing model, Poisson arrivals and Erlang service distribution; benefits and limitations of queuing theory.

Books Recommended:

Paper Title: MECHANICAL OPERATIONS (Theory)
Paper Code: CHE 5302 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
- Motion of particle through a fluid: Stoke’s Newton’s law. Free and hindered setting.
- Setting tank and double cone classifiers
- Batch and continuous thickeners
- Settling chamber, cyclone, filter bag and electrostatic precipitators.

SECTION-B
Filtration: Plate and frame filter press, continuous rotary vacuum filter, filter aids, theory of filtration for non-compressible cakes.
Centrifugation: Tubular bowl centrifuge, disk centrifuge and batch basket centrifuge.
Mixing and Agitation: Basic ideas and characteristics of mixing equipment power consumptions scale-up.
Conveying: Mechanical and pneumatic conveying systems, storage & handling of materials.

Books Recommended:


Paper Title: ENVIRONMENTAL ENGINEERING (Theory)
Paper Code : CHE 5303 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Ambient air and water standards. Principal sources of pollution.
Inter-relationship between energy and environment pollution. Prevention of environmental pollution through conservation, raw material substitutions, process and equipment modifications. A case study on the concept of zero discharge.
Air Pollution:
- Principal air pollutants and their usual sources.
- Effect of air pollutants on human health, animals, vegetation and materials.
- Atmospheric dispersion of air pollutants, temperature inversions, Estimation of pollutants by Gaussian plume model.
- Process and equipments used for the control of particulate pollutants.

SECTION-B
Water Pollution:
- Types of water pollutants, their sources and effects.
- BOD and COD
- Waste water treatment techniques and equipments, flocculation, skimming, flotation, etc.
- Primary Treatment-through settling.
- Secondary Treatment—Aerobic and anaerobic digestion, activated sludge process, trickle filter and oxidation ponds.

**Solid wastes:** Control and disposal, sanitary landfill, incineration, pyrolysis gasification and recycling.

**Books Recommended:**


**Paper Title:** FLUID FLOW (Theory)

**Paper Code :** CHE 5304       **Max. Marks** 50       **Credits :** 4       **Time:** 3 hours

**Course Duration:** 45 Lectures of one hour each.

**Note for the Paper setter:** The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**

**Fluid Statics:** Normal forces in fluids, Pressure Measurements, Forces on Submerged bodies, Buoyancy and Stability.


**Flow of Incompressible Fluids:** Laminar and Turbulent flow in pipes, Velocity Distribution in Pipes, Frictional Losses in Pipes and Fittings, Fanning equation, Estimation of economic pipe diameter. Derivation of HAGEN-POISEULLI and f=16/Re equations.

**SECTION-B**

**Dimensional analysis** and its Applications to Fluid Flow.

**Flow of compressible fluids:** Compressible flow and flow through nozzles.

**Flow Measurements:** Pilot tube, Orifice, Venturi, Rotameter and Notches, wet gas metre etc.

**Fluid Machinery:** Classification and Performance of Pumps, Turbines, Compressors, and Blowers, Selection and Specification, Net positive Suction Head.

**Books Recommended:**

Paper Title: MANAGERIAL ECONOMICS (Theory)

Introduction to Managerial Economics: Nature Scope and Importance of Managerial Economics, opportunity costs, incremental principle, time perspective, discounts and equi marginal principles.

Demand Concepts and Analysis: Individual Demand, Market Demand, Kinds of Demand, Determinants of Demand, Demand Functions, Functions, Demand Schedule and Law of Demand.

Theory of Consumer Behavior: Cardinal Utility Approach and Ordinal Utility (Indifference Curves) Approach;

Elasticity of Demand: Concept, Types, Measurement and importance.

Demand Forecasting: Sources of Data-Expert Opinions, Surveys and Market Experiments;

Time Series Analysis: Trend Projection; Barometric Forecasting-Leading Indicators, Composite and diffusion Indices.

Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions.

Cost concepts and Analysis: Concept of Cost, Short run and Lung-run Cost Curves, Relationships among various costs, Break-even Analysis.

Revenue Curves: Concept and Types.

Perfect Competition: Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Long Run;

Monopoly: Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Lung Run; Price Discrimination;

Imperfect Competition: Monopolistic Competition, oligopoly and Barriers to Entry.

References:
8. Mote, Paul Gupta: Managerial Economics, Vikas Publisher, New Delhi, 1st ed.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**
Correlation & Regression: Types of relationship, methods of measuring co-relation, Karl Pearson’s, Product moment and Spearman’s rank correlation, concurrent deviation, probable error; simple linear regression model and least squares estimates of regression coefficients, coefficient to determination, multiple correlation, partial correlation and multiple regression (upto three variables only).

Time Series and Forecasting: Variation in time series, trend analysis-fitting linear and second degree trends, method of semi-average, moving average, principles to least squares cyclic variations method to simple average, moving Lavenge, principle of least squares, cyclic variations, seasonal variation, method of simple averages, ratio to trend method, ratio to moving average method, method of link relatives, irregular variation.

**SECTION-B**
Analysis to Variance: Test for difference among more than two samples. Inference about a population variance and about two population variances, one way and two way analysis of variance.

Decision Theory: Decision making under uncertainity (Maximax, Maximin, Equally likely, Hurwicz criterion, Mini Max regret) and risk (expected profit/loss), using continuous distributions, Marginal Analysis, utility as a decision criterion, decision tree analysis.

**Books Recommended:**

**Paper Title : COMPUTER PROGRAMMING LAB.  (Practical)**

**Paper Code: CHE  5351  Max. Marks : 25  Credits : 1**

**C++ fundamentals**
- Control statements
- Loops and Decisions: Relation operators, Iterations: While Loop, for Loop, do Loop, Decisions: if statement, if else statement, nested if else statement, switch statement. Logical operators, other control statements: break statement, continue statement and go to statement.
- Programming and Compiling, Exercises
- Functions

**Books Recommended:**

**Paper Title : FLUID MECHANICS LAB.  (Practical)**

**Paper Code: CHE  5352  Max. Marks : 50  Credits : 2**
1. General study of pipe fittings, valves and other equipments in the unit operations laboratory.
2. Pressure drop for flow through pipelines, valves & fittings.
3. Characteristics of pumps.
4. Flow measurement by the use of orificemeter, venturimeter, rotameter & pitot tube.
5. Flow over weirs and notches.
6. Flow measurement of compressible fluids.

Paper Title: ENVIRONMENTAL ENGINEERING LAB
Paper Code: CHE 5353  Max. Marks: 50  Credits: 2

1. To find BOD of water sample.
2. To find COD of waste sample.
3. To find the total dissolved solids (TDS) and its volatile and non-volatile components.
4. To find the total suspended solids (TSS) and its volatile and non-volatile components.
5. To do the chromium separation by different techniques from electroplating wastes.
6. To find the phenol content of water sample and evolution of parameters.
7. To operate the electrodialysis apparatus.
8. To find the biodegradation constant (K) and the effect of timing on it.
9. To use the membrane separation techniques for salt brine and reverse osmosis process for sugar.
10. To use stack monitoring kit to find:
   (a) Efficiency of a cyclone.
   (b) Dust sampling.

Note: Any six of the above mentioned experiments are to be conducted.
SYLLABUS FOR FIVE YEAR INTEGRATED  
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.  
FOURTH SEMESTER

Paper Title: MATHEMATICS – III (Theory)  
Paper Code: CHE 5401  Max. Marks 50  Credits: 4  Time: 3 hours  
Course Duration: 45 Lectures of one hour each.  
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Solution of differential equations in series with reference to Bessel and Legendre equations, elementary properties of Bessel and Legendre functions.  
Solution of difference equation with constant coefficients.  
Formation and classification of partial differential equations, first order linear equations, standard forms of non linear equations, Charpit’s method, homogeneous linear equations with constant coefficients.  
Solution of partial differential equations of engineering interest by method of separation of variables.

SECTION-B

Function of complex variable, analytic functions, Cauchy’s theorem, Cauchy’s integral formula, introduction to Tayler’s series and Laurent’s series, Residues, theorem and its simple applications.

Books Recommended:

Paper Title: ORGANIZATIONAL BEHAVIOUR (Theory)  
Paper Code: MBA-CHE 5402  Max. Marks 50  Credits: 4  Time: 3 hours  
Course Duration: 45 Lectures of one hour each.  
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction to Organization Behavior: Definition and meaning of OB, impact of other sciences (Anthropology, Sociology, Psychology) on OB, perception, self esteem, attitude & personality, meaning of culture, impact of technology on OB.  
Motivation, Learning & Leadership: Meaning of Motivation, Content theories of motivation (Maslows Hierarchy of needs, Herzberg’s two factor theory), Process theories (Vroom’s Expectancy theory, Porter-Lawler Model), Motivation applied (Job design, job rotation, goal setting, MBO), various methods of motivating employees, Behavioral & Cognitive theories of learning, Leadership theories (Trait theory, Fiedler’s Contingency theory, Path –Goal leadership theory), Leadership styles (Blake &
Mouton managerial grid, Hersey & Blanchard’s life cycle approach

SECTION B

Group behavior: Group Dynamics, conflict, power & politics, Group behavior, types of groups, group decision making, conflict in organizations and reason, interpersonal conflict, intergroup conflict, meaning of power, classification of power, politics in organizations

Organization environment & Communication: Authority & responsibility, delegation and division of work, quality of work life, communication process, modes of communication in organization and barriers to communication, formal & informal communication

Recommended Books:

Paper Title: FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING (Theory)
Paper Code: CHE 5403 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION A

DC Circuits and Single Phase A.C. Fundamentals: General introduction to Electrical Engineering, Kirchoff’s Laws, Mesh and Node analysis, Superposition theorem, Thevenin Theorem, Norton Theorem, Maximum power transfer theorem. Generation of alternating voltages and currents, Equations for AC quantities, cycle, time period, frequency, amplitude, calculation of R.M.S values, Average values for different waveforms, solution and phasor diagram of single phase AC circuit with sinusoidal source of excitation, series and parallel combination of R-L-C circuits.

Three Phase AC Fundamentals: Disadvantages of single phase system, star and delta connection in three phase circuits, relation between line and phasor quantities, power in three phase system, solution of three phase balanced circuits, power and power factor measurement by two wattmeter method.


SECTION B

Semiconductor Diodes and Transistors: General introduction to Electronics. Concept of stiff Voltage and Current Source. PN Junction, Depletion layer, Barrier Potential, Forward and Reverse Bias, Breakdown voltage, V-I characteristics, Half wave and full wave rectifiers, Zener diode. Introduction to junction transistors, Transistor amplifying action, CB, CE, CC-configuration characteristics.

Digital Electronics: Binary and Hexadecimal number system, conversion of numbers from one system to other, OR, AND, NOR, NAND, NOT Gates, Universal Gates, Exclusive OR, NOR gates, De-Morgan’s Theorem, Boolean Relations: Commutative, Associative and Distributive Laws. Concept of flip-flops, RS,JK flip flops, shift register.

Books Recommended:


Paper Title: HEAT TRANSFER (Theory)
Paper Code : CHE 5404     Max. Marks 50     Credits : 4     Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Conduction: Steady state conduction in one dimensional system, general conduction equation, effect of variable thermal conductivity, steady state conduction involving internal heat generation, lagging on pipes, the critical thickness of insulation on pipes, extended surfaces of uniform thickness and fin effectiveness, fin efficiency.

Convection: Free and forced convection, concept of heat transfer co-efficient, dimensionless numbers in free and forced convection, Dimensional analysis, Determination of Heat transfer coefficient using heat and momentum transfer analogies, experimental determination of heat transfer coefficient and common working correlations.

Radiation Heat Transfer: Black Body radiation, and grey body radiation, physical mechanism, radiation properties and shape factor, heat exchange between non-black bodies, radiation shields pyrometry and effect of radiation on temperature measurement.

SECTION-B

Condensation and Boiling: Condensation heat transfer phenomenon, film condensation on vertical plates and cylinders as well as on horizontal cylinders. Effects of non-condensable gases and vapor velocity on condensation, pool boiling, forced convection boiling, working correlations for pool boiling.
**Evaporation:** Types of evaporators, single and multiple effects, single and multiple effects calculations, evaporator capacity, economy, effect of liquid head and boiling point elevation, methods of feeding.

**Heat Exchangers:** Various types of heat exchangers, overall heat transfer coefficients, heat exchanger mean temperature differences, heat exchanger effectiveness and the number of transfer units.

**Books Recommended:**


**Paper Title:** ENGINEERING MATERIALS (Theory)
**Paper Code:** CHE 5405 **Max. Marks:** 50 **Credits:** 4 **Time:** 3 hours
**Course Duration:** 45 Lectures of one hour each.

**Note for the Paper setter:** The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**

**Atomic Structure:** Review of bonding in solids, structure --property-processing Relationships

**Crystal Structure:** Space lattice, crystal systems, Miller indices, effect of radius ratio on co-ordination, structures of common metallic, polymeric, ceramic, amorphous and partly crystalline materials.

**Imperfections in atomic arrangement:** various defects in atomic arrangement, diffusion phenomenon in solids, Fick’s first and second law of diffusion, solid solution, slip systems, various methods of strengthening materials, Schmid’s law.

**SECTION-B**

**Phase Diagrams and phase transformation:** binary phase diagrams -- Fe-Fe₃C, Cu-Ni, Pb-Sn.

**Materials:** Standards and specifications, unified alloy numbering system, ferrous metals and alloys, non-ferrous metals and alloys; overview of ceramic, polymeric and composite materials; Mechanical tests: standard test procedures for mechanical property determination-strength, toughness, fracture toughness, hardness, deformation, fatigue, creep etc.

**Corrosion:** Types and mechanism of corrosion, factors influencing corrosion, combating corrosion, selection of materials of construction for handling different chemicals.

**Books Recommended:**

4. Raghavan, V. : Material Science & Engineering, Prentice Hall of India

Paper Title : ELECTRICAL & ELECTRONICS ENGINEERING LAB. (Practical)
Paper Code: CHE 5451 Max. Marks : 50 Credits : 2
Note: Minimum eight experiments are to be done.
1. Overview of the equipments, instruments and procedure to be used, safety precautions and report writing.
2. To study resonance in R-L-C series and parallel circuit.
3. Measurement of power and power factor by three voltmeter method.
4. Measurement of power and power factor by three ammeter method.
5. To measure power and power factor using a single wattmeter in a single phase circuit.
6. Measurement of power and power factor of three phase balanced load by two wattmeter method.
7. To perform open circuit test and short circuit test on a single phase transformer and draw equivalent circuit.
8. To obtain magnetization characteristics of DC Machine
9. Study the forward and reverse biased diode characteristics.
10. Study the CB, CE, CC transistor characteristics.

Books Recommended:

Paper Title : PROCESS EQUIPMENT DESIGN (Practical)
Paper Code: CHE 5452 Max. Marks : 25 Credits : 1
2. General design considerations for pressure vessels: Design pressure, design temperature, materials, design stress (nominal design strength), welded joint efficiency and construction categories, corrosion allowance, design loads, minimum practical wall thickness.
3. Design of thin-walled vessels under internal pressure: Cylinders and spherical shells, heads and closures, design of flat ends, design of domes ends, conical sections and end closures.
4. Design of vessels subject to external pressure: Cylindrical shells, design of stiffening rings, vessels heads.
5. Design of vessels subject to combined loading: Weight loads, wind loads (tall vessels), torque.
6. Design of Foundation and supports.
7. Design of Bolted flanged joints and welded joints.

Books Recommended:
1. Battacharyya, B.C. : Introduction to Chemical Equipment Design Mechanical aspects, Chemical Engineering Education Development Centre.

Paper Title : PROCESS PLANT DESIGN – I (Practical)
Paper Code: CHE 5453 Max. Marks : 50 Credits : 2
2. Selection, specification & power requirements of process pumps, fans and blowers.
3. Design of settling equipments like Dor thickeners, dust chambers, cyclone separators and centrifuges.
4. Design of agitated vessels using various types of impellers.
5. Design of Conveyor system for solids.

Books Recommended:


Paper Title: PARTICLE MECHANICS LAB. (Practical)

Paper Code: CHE 5454 Max. Marks : 50 Credits : 2
Pressure drop and two phase flow characteristics in packed and fluidized beds, Measurement of drag force, Batch settling of slurries, Constant pressure filtration, Mixing, crushing, grinding, screening and particle size analysis.

Paper Title: BASIC WORKSHOP TECHNIQUES (PRACTICALS)

Paper Code CHE 354 Qualifying Credits : NC

Carpentry Shop: Introduction to various types of timber and particle, boards defects in timber, seasoning of wood. Description and use of carpenter’s tools, i.e. saws, planes, chisels, adze, etc. Different types of timber in common use, making of lap joint, Bridle joint, dovetail joint and Mitre joint.

Electric Tools: Exercise of wiring in link clip and casting and causing wiring of lights with switches in parallels, series and with 2 ways switches. Connecting energy meter, main switch and distribution board, testing a wiring installation for insulation resistance. Relevant Indian Electricity Rules.

Machine Shop: Classification of fabrication processes, machine tools and materials, introduction to working of lathe, shapper, milling and drilling machines, power hacksaw, shearing machine and grinding wheel. Simple turning, threading, drilling board and knurling operations on a lathe.

Welding: Use of arc welding and gas welding in making different types of joints.

Paper Title: VIVA VOCE-I (COMPREHENSIVE) (Practical)

Paper Code: CHE 5456 Max. Marks : 50 Credits : 2
The viva-voce examinations will be comprehensive and covering all subjects taught during first to fourth semesters.
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
FIFTHSEMESTER

Paper Title: RESEARCH METHODOLOGY (Theory)
Paper Code: CHE 5501 Max. Marks 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction: Meaning, Features, Objectives/Motives & types of Research; Attributes of good Research, Research Methods and Research Methodology; Research Process, Significance of Research in Managerial decision making.
Research Design: Meaning, Characteristics and various concepts relating to research design and classification of research design, Importance.
Measurement and Scaling: Data Types Nominal, Ordinal and Ratio scale; scaling techniques.
Formulation of Hypothesis: Meaning, Characteristics and concepts relating to testing of Hypothesis (Parameter and statistic, Standard error, Level of significance, type-I and Type-II errors, Critical region, one tail and two tail tests); Procedure of testing Hypothesis. Numerical problems based on chi-square test and Ftest(variance ratio test only).

SECTION – B

Data Collection: Sources of Data-Primary/Secondary Methods of collecting data; direct personal interview, indirect oral interview, information through local agencies, mailed questionnaire method, schedule sent through enumerators; questionnaire and its designing and characteristics of a good questionnaire.

Sampling Design: Meaning and need of Sampling, Probability and non-probability sampling design, simple random sampling, systematic sampling, stratified sampling, cluster sampling and convenience, judgement and quota sampling (non-probability), determination of sample size.

Data Analysis & Interpretation: Introduction to Multivariate analysis- Multiple and partial correlation, multiple regression analysis (with two independent variables), specification of regression models and estimation of parameters, interpretation of results. Analysis of Variance (ANOVA)-One way and Two way ANOVA. Introduction to discriminant analysis and Factor Analysis (Numerical not to be asked)

Report writing: Style/format, contents and essential steps for report writing.
**Suggested Readings:**

2. Ranjit Kumar: Research Methodology, Pearson Education 2009-02-20
3. Donald R. Cooper Pamela S. Schindler: Business Research Methods, Tata McGraw Hill
5. R. Pannerselvam: Research Methodology, Parentice Hall of India Limited.
7. William G. Zikmund: Business Research Methods, Thomson South Western Publication

**Paper Title:** CHEMICAL ENGINEERING THERMODYNAMICS (Theory)

**Paper Code:** CHE 5502  Max. Marks 50  Credits : 4  Time: 3 hours

**Course Duration:** 45 Lectures of one hour each.

**Note for the Paper setter:** The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**


SECTION-B

Phase Equilibria:
Partial molar properties, partial molar Gibbs free energy, Chemical potential and its dependence on temperature and pressure Ideal solutions (Lewis-Randel Rule).
Fugacity and its calculations. Dependence of fugacity of temperatures and pressure 

Chemical Equilibria:
Equilibrium constant in terms of measurable properties variations of equilibrium constant with temperature and pressure. Adiabatic reactions, Gibbs phase rule, equilibria in heterogeneous reactions.

Books Recommended:

Paper Title: CHEMICAL TECHNOLOGY (ORGANIC) (Theory)
Paper Code : CHE 5503 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Soaps and Detergents: Introduction, Raw materials, Manufacture of soap, Classification of detergents, finishing of detergents.
Water: Sources and Constraints, Consumption patterns; Impurities: dissolved, suspended, colloidal; Hardness of water; Water softening; Lime soda, Ion exchange.
Desalination: Classification of processes; Evaporative processes, Multieffect evaporation, multistage flash, vapour compression; Membrane processes, Reverse osmosis, electrodialysis.

SECTION-B

Sugar: Introduction; Sugar extraction, defacation, sulphitation, carbonation, concentration, crystallization, drying, refining; Uses of molasses and bagasse.
Carbon Technology: Introduction, Classification of activated carbons, raw materials and manufacture of activated carbons, precursors for carbon fibres, manufacture of carbon fibres from polyacrylonitrile, manufacture of carbon black by furnace black process, applications.

Nanotechnology: Introduction and synthesis of nano particles by RF plasma process.
Books Recommended


Paper Title: MASS TRANSFER – I (Theory)
Paper Code : CHE 5504 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Mass transfer operations, classification of mass transfer operations, choice of separation methods, methods of conducting mass transfer operations, design principles.
Introduction to mass transfer and diffusion, molecular diffusion in gases and liquids, diffusion coefficients for gases and liquids, diffusion in solids, types of solid diffusion.
Mass transfer coefficients, types of mass transfer coefficients, mass transfer coefficients in laminar flow, theories of mass transfer.
Interphase mass transfer, concept of overall mass transfer coefficient.

SECTION-B
Working principle, construction and industrial applications of various gas liquid contacting equipments like sparged vessels, mechanically agitated vessels, tray towers, packed towers, spray chambers, venturi scrubbers.
Humidification operations, psychometric chart, adiabatic saturation temperatures, wet bulb temperature, adiabatic operations, types of cooling towers.
Principle of drying, batch drying, drying curve, constructional details and working of different dryers.

Books Recommended:

Paper Title: ENERGY TECHNOLOGY (Theory)
Paper Code : CHE 5505    Max. Marks 50    Credits : 4    Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Fuels: Types of conventional fuels, their merits and demerits. Non-conventional/renewable energy sources, their importance for sustainable development and environmental protection.
Liquid fuels: Origin of petroleum, refining and distillation of crude oil, uses of petroleum products.
Gaseous fuels: Natural gas, manufacture of water gas and producer gas, gas cleaning methods.

SECTION-B
Furnaces: Classification of furnaces, draught, furnace atmosphere, Portland cement continuous rotary kiln, blast furnace, glass melting furnace
Alternate sources of energy:
➢ Introduction to solar radiation and evaluation of radiation incident on a solar collector.
➢ Applications of solar thermal energy such as solar water heater, solar cooker, solar concentrators and solar thermal power generation.
➢ Types of solar photovoltaic systems and applications.
➢ Photosynthesis and biomass conversion systems.
➢ Other renewable energy sources such as geothermal, tidal, ocean and wave.

Books Recommended:

Paper Title: NUMERICAL METHODS IN ENGINEERING
Paper Code: CHE 5506  Max. Marks 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

SECTION-B
Numerical Solution of Partial Differential Equations: Finite-Difference Approximation to Laplace’s Equation, Parabolic Equations and Hyperbolic Equations

Books Recommended:

Paper Title: CHEMICAL ENGINEERING COMPUTATION LAB. (Practical)
Paper Code: CHE 5551  Max. Marks : 25  Credits : 1
Errors analysis, Solution of linear and non-linear algebraic equations.
Numerical differential & integration.
Interpolation.
Least squares approximation.
Ordinary, partial differential equations.
Development of computer programmes based on the above topics using Matlab and their applications in chemical process computations.

Books Recommended:
1. Oils & Fats: Determination of Acid value, Iodine value, Saponification value.
2. Carbohydrates: Reducing and non reducing sugars by (i) Fehlings method (ii) Pavy’s method.
3. Soaps: Determination of free and combined alkali, total fatty matter, moisture and insolubles
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
SIXTH SEMESTER

Paper Title: CHEMICAL REACTION ENGINEERING–I (Theory)
Paper Code: CHE 5601  Max. Marks 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction and a brief review of the kinetics of homogeneous reactions.
Interpretation of rate data from constant volume and constant pressure systems.
Single Ideal reactors.
Design for single reactions.

SECTION-B

Design for multiple reactions
Thermal characteristics of reactors: temperature and pressure effects
Non-ideality in reactors and its effects on chemical conversion. One parameter models to represent the behaviour of chemical reactors

Books Recommended:

Paper Title: MASS TRANSFER-II (Theory)
Paper Code: CHE 5602  Max. Marks 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

SECTION-B


*Leaching*: Preparation of solid, countercurrent and crosscurrent multistage contact Shank’s system. Constructional details of equipment like Rotocel extractor, Hildebrandt extractor, Bollman extractor, Kennedy Extractor & Beet-Sugar Diffusion battery extractor.

*Adsorption*: Types of adsorption, nature of adsorbents, equilibria for adsorption systems. Brief manufacture and commercial applications and characteristics for common adsorbents. Stagewise & continuous contacting of fluid and solid phase. Description of contact filtration adsorption system. Hypersorber ion-exchange system.


**Books Recommended:**


**Paper Title: PROCESS INSTRUMENTATION (Theory)**

**Paper Code : CHE 5603**

Max. Marks 50  Credits : 4  Time: 3 hours

**Course Duration: 45 Lectures of one hour each.**

**Note for the Paper setter:** The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**

General Concept: Need and classification of measurements and instruments, Basic and auxiliary functional elements of a measurement system

Static and Dynamic Characteristics of Instruments:

Static Characteristics: Range and span, accuracy and static error, reproducibility and drift, sensitivity and dead zone.

Dynamic Characteristics: Speed of response and lag, fidelity and dynamic error, dead time.

Temperature measurement:


Pressure measurement: Use of manometers, Bourdon gauge, bellows type gauge. Vacuum measurement–McLeod gauge, thermoionic type ionization gauge, pirani vacuum gauge. Measurement of pressure in corrosive fluids: Diaphragm seal, liquid seal and purge system.
SECTION-B

Liquid level measurement:
Direct measurement of liquid level – Float & tape liquid level gauge, float and shaft liquid level unit, hydraulic remote transmission of liquid level.
Level measurement in open vessels: Bubbler system, diaphragm box system, air trap system. Level measurement in pressure vessels – Differential pressure manometer, use of liquid seals with a manometer, displacement float liquid level gauge. Measurement of viscosity, conductivity, humidity and pH.
Density measurement – liquid level method, displacement meter and hydrometer.
Measurement of weight – spring scale, pneumatic force meter and hydrostatic force meter.
Process Instrumentation–Recording instruments, indicating and signaling instruments, control centre, transmission of instrument reading, instrumentation diagrams.

Books Recommended:
1. Eckman, Donald P. : Industrial Instrumentation, CBS Publisher and Distributors, Indian Reprint 2004.

Paper Title: PETROLEUM PROCESSING ENGINEERING (Theory)
Paper Code : CHE 5604
Course Duration: 45 Lectures of one hour each.

SECTION-A
Introduction to petroleum industry, world petroleum resources, petroleum industry in India. Origin, exploration & drilling of petroleum crude. Transportation of crude and products.
Crude pretreatment: Refining and distillation of petroleum crude, composition and classification of petroleum crude, methods of evaluation: ASTM, TBP and EFV distillation. Properties and specifications of petroleum products such as LPG, gasoline,naphtha, kerosene, diesel, lubricating oils and waxes.

SECTION-B
Separation Processes: Design and operation of topping and vacuum distillation units and tube still furnaces. Solvent extraction processes for lube oil base stock and for aromatics from naphtha and kerosene steams, solvent dewaxing.

Books Recommended:

REFERENCE BOOKS

Paper Title: CHEMICAL TECHNOLOGY (INORGANIC) (Theory)
Paper Code : CHE 5605       Max. Marks 50       Credits : 4       Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Chlor-Alkali Industry: Voltage efficiency, Current efficiency, Current density, Decomposition efficiency, Manufacture of soda ash by Solvay and Modified Solvay process, Manufacture of caustic soda.

Sulphuric Acid: Introduction, Manufacture of sulphuric acid by Chamber and Contact process, Material of construction, Storage and handling.
Ceramics: Introduction, Properties of ceramics, Classification of refractories, Important steps involved in the manufacture of refractories.

SECTION-B
Industrial gases: Manufacture and uses of carbon dioxide, oxygen and nitrogen, acetylene.
Paints: Introduction, Classification of paints, Manufacture of paints, Requirement of a good Paint.

Books Recommended:

Paper Title : HEAT TRANSFER LAB. (Practical)
Paper Code: CHE 5651       Max. Marks : 50       Credits : 2
1. Determination of heat transfer coefficient for different types of heat transfer equipment. Wilson plots.
2. Unsteady state heat transfer in jacketed vessels. (Open pan evaporator)
3. Correlation of instantaneous heat transfer coefficients with time study deposition of scale on a heating surface.
4. Determination of heat losses for insulated pipes
5. Study of double pipe heat exchanger and to determine overall heat transfer coefficient
6. Study the performance characteristics of a 1,2 - shell and tube heat exchanger
7. Study and operation of long tube, forced circulation and multiple effect evaporators.
8. Duhring plot for solutions involving nonvolatile solutes.

Paper Title : PROCESS PLANT DESIGN –II (Practical)
Paper Code: CHE 5652       Max. Marks : 50       Credits : 2
1. Process design and specifications of double pipe heat exchanger, shell and tube heat exchanger, plate type heat exchanger, condensor and reboiler.
2. Equilibrium procurement techniques – experimental and use of thermodynamics for its evaluation and then use in design height of distillation column. Calculations using McCabe Thiele, Plate-to-Plate calculation methods for fractionators, design of batch fractionating columns, design of fractionator internals for sieve-tray.
3. Absorber/Stripper design of stage-wise and continuous contact equipment (packed column), height of column and diameter calculation, design of various internals of absorber/stripper.
4. Process flow sheets, material and energy balance flow sheeting analysis.

Books Recommended:

Paper Title: CHEMICAL TECHNOLOGY LAB. (INORGANIC) (Practical)
Paper Code: CHE 5653    Max. Marks : 50  Credits : 2
1. Fertilizers (i) Determination of N-P-K Values
   (ii) Determination of micronutrients
2. Cement: Loss of ignition, silica, insolubles, estimation of Mg, Ca, Fe.
3. Water Analysis.

Paper Title: PETROLEUM PROCESSING ENGINEERING LAB. (Practical)
Paper Code: CHE 5654    Max. Marks : 50  Credits : 2
1. To plot ASTM distillation curve for gasoline, diesel oil.
2. To determine Flash point (Closed – cup) and smoke point for kerosene.
3. To determine Aniline point, Diesel Index and cetane number for diesel oil.
4. To determine pour point and cloud point for furnace oil and diesel oil.
5. To determine viscosity at different temperatures using Ostwald viscometer for hydrocarbon solvents.
6. To determine softening point and penetration number for asphalt and grease samples.
7. To determine viscosity index of lubricating oil by Redwood viscometer.
8. To determine water content in petroleum products by Dean and Starks method.
SYLLABUS FOR FIVE YEAR INTEGRATED BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.

SEVENTH SEMESTER

Paper Title: CHEMICAL REACTION ENGINEERING-II (Theory)
Paper Code: CHE 5701    Max. Marks 50    Credits : 4    Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Heterogeneous catalyses: A brief review of catalyses catalytic specificity. Preparation testing and characterisation of catalysts, catalyst poisoning and catalyst regeneration
Fluid Solid catalytic reaction: Kinetics; external transport processes, Reaction -and diffusion within porous catalysts. Effective diffusivity, thermal conductivity and effectiveness factors.

SECTION-B
Fluid - fluid reactions rate equations and their application to the design of reactors.
Fluid Solid non-catalytic reactors rate equations and their application to the design of reactors.
Analysis of rate data design outline and selection of fixed bed, fluidised bed and slurry reactors for fluid solid catalytic reactions.

Books Recommended:
1. Levenspiel, O : Chemical Reaction Engg., John Wiley

Paper Title: PROCESS ENGINEERING ECONOMICS (Theory)
Paper Code: CHE 5702    Max. Marks 50    Credits : 4    Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Interest and Investment Costs: Simple and compound interest. Nominal and effective rates of interest. Continuous interest ordinary annuity. Perpetuities and capitalized costs.
Taxes and Insurance: Types of taxes and tax returns, types of insurance and legal responsibility.
Depreciation: Types of depreciation. service life salvage value, present value and methods of determining depreciation, single unit and group depreciation.

SECTION-B

Optimum Design: Procedure with one variable, optimum reflux ratio in distillation and other examples.

Preliminary Steps in Plant Design: Plant design factors. project organization, plant location, preliminary data collection, process engineering.

Books Recommended:


Paper Title: TRANSPORT PHENOMENA (Theory)
Paper Code : CHE 5703 Max. Marks 50 Credits : 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Transport of momentum, heat and mass by molecular motion-Newton’s law of Viscosity, Fourier’s law of heat conduction, Fick’s law of diffusion
Transport properties – Viscosity, thermal conductivity and mass diffusivity
Emphasis on the analogy between momentum, heat and mass transfer with respect to transport mechanism and governing equations
Development of mathematical models of transfer process through shell momentum balance, shell energy balance and shell mass balance for solving specific problems of transport of momentum, heat and mass in laminar flow or in solids in one dimension.

SECTION-B
Development of general differential equations of fluid flow, heat transfer and mass transfer and their applications in solving one-dimensional steady state and unsteady state problems of momentum, heat and mass transfer.
Interphase transport of momentum, heat and mass and dimensionless correlation for each one of them.
Momentum, heat and mass transfer analysis.

Books Recommended:

Paper Title: MARKETING MANAGEMENT (Theory)
Paper Code : MBA-CHE 5704           Max. Marks 50  Credits : 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Introduction to Marketing: Definition; Scope and Importance of Marketing; Key Customer Markets; Concepts/Philosophies of Marketing; Holistic Marketing Concept; Marketing Tasks; Marketing Mix
Marketing Environment: Marketing Environment; New Marketing Realities; New Consumer Capabilities; Demographic Environment; Social-Cultural Environment; Natural Environment; Technological Environment and Political-Legal Environment; SWOT analysis.
Analyzing Markets: Marketing Research Process; Sources of data collection; factors influencing consumer behavior; buying decision process; post-purchase behavior; Organizational Buying; Stages in the Buying Process.
Market Segmentation: Levels of market segmentation; segmenting consumer markets; Niche Marketing; segmenting business markets; Michael Porter’s five forces model; Analyzing competitors; strategies for market leaders; Targeting and Positioning.

SECTION-B
Product Decisions: Product characteristics; classifications; differentiation; packaging and labeling; Product Life Cycle.
Pricing Strategies: Understanding Pricing; Setting the Price; Initiating and Responding to Price Changes; Reactions to Competitor’s Price Changes.
Marketing Channels: Marketing Channels; Role of Marketing Channels; Identifying Major Channel Alternatives; Types of Intermediaries; Channel-Management Decisions, Retailing, Wholesaling.
Marketing Communication: The Role of Marketing Communications; Communications Mix-Advertising, Sales Promotion, Public Relations and Publicity, Events and Experiences, Direct and Interactive Marketing, Personal Selling.

Books Recommended:
2. Ramaswamy, V.S. & Namakumari, S: Marketing management, planning, implementation and control, 3rd, Mechmillan.
3. Hepner H.W.: Modern Marketing- Dynamics and Management, 11th, UBS.
5. Britt and Boyd (ed): Marketing Management and Administration, 2nd, PHI.
7. Converse Paul and Harvey W.Hugg: Elements of Marketing, 7th ed., PHI.
Paper Title: REACTION ENGINEERING LAB. (Practical)
Paper Code: CHE 5754 Max. Marks: 50 Credits: 2
1. Kinetic studies in a batch reactor.
2. Kinetic studies in a plug flow reactor.
3. Kinetic studies in a CSTR.
4. Kinetic studies in a semi batch reactor.
5. RTD studies in CSTR.
6. Dispersion number for packed bed reactor.
7. Adiabatic batch reactor.

Paper Title: MASS TRANSFER LAB. (Practical)
Paper Code: CHE 5752 Max. Marks: 50 Credits: 2
1. Determination of mass transfer coefficients for naphthalene-air system.
2. To determine drying rate curves for different wet solids in a batch drier under constant drying conditions.
3. Fractional approach to equilibrium for liquid-liquid extraction from single drop.
4. Verification of Rayleigh’s equation for differential distillation.
5. Determination of flooding velocities in packed columns.
6. Determination of HETP for packed distillation columns.
7. Study and operation of a pilot sized distillation column under total reflux.
8. Study of different mass transfer equipments.

Paper Title: PROCESS PLANT DESIGN-III (Practical)
Paper Code: CHE 5751 Max. Marks: 50 Credits: 2
1. Design of liquid-liquid and liquid-solid extraction equipment (stagewise and continuous contact).
2. Design of Heterogeneous catalytic Reactors.
   2.1 Fixed-bed reactors
      (i) Isothermal and adiabatic
      (ii) Non-isothermal non-adiabatic
   2.2 Fluidized-bed reactors
      (i) Two-phase fluidized bed model
      (ii) Slurry reactors and
      (iii) Trickle-bed reactors.
3. Layout of chemical plant equipment, safety and hazard aspects of layout.

Books Recommended:
Paper Title: INDUSTRIAL TRAINING
Paper Code: CHE 5753     Max. Marks : 25     Credit: 1
Each student will be required to submit a report after each factory visit/training programme throughout
the entire course. The reports will be assessed by teachers in charge of the programme.

CHE 5851  PROJECT WORK
Each student is required to submit a project report on the design of a chemical plant, selecting the best
process with optimum equipment size and operating conditions. The object is to test the ability of the
student to apply his entire knowledge of Chemical Engineering principles to conceptualize, analyze and
solve the problems. To judge his knowledge and originality and capacity for application of laboratory data
in designing chemical plants and to determine the level of his proficiency at the end of the course.
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
EIGHTH SEMESTER

Paper Title: PROCESS DYNAMICS & CONTROL (Theory)
Paper Code: CHE 5801  Max. Marks: 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Incentives for chemical process control, design aspects of a process control system. Difference between feedback and feed forward control configuration. Hardware elements of a control system, Block Diagrams.
Laplace transform and transfer functions. Difference between lumped and distributed parameter systems, Dynamic behavior of first and higher order systems, interacting and non-interacting systems, dead time.
Different modes of control actions and their basic characteristics, controllers and their characteristics, control valve.

SECTION-B
Closed-loop transfer functions, transient response of simple control systems, Routh stability criterion, Root Locus.
Introduction to frequency response: Bode diagrams, control system design by frequency response: Ziegler-Nichols controller settings, stability using frequency response, gain margin and phase margin.
Introduction to advanced control techniques such as cascade control, feed forward control, ratio control, inferential control.

Books Recommended

Paper Title: HUMAN RESOURCE MANAGEMENT (Theory)
Paper Code: MBA-CHE 5802  Max. Marks: 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Introduction: Meaning, scope, objectives and functions of HRM; Importance of Human Resource Management; HRM & HRD a comparative analysis;
Environment of HRM: Role of government, internal and external forces; Human Resource Management practices in India.
Human Resource Planning: Definition, objectives, process and importance; Job analysis, description, specification & job evaluation; Recruitment, selection, placement and induction process;
Human Resource Development: Concept, Employee training & development; Career Planning & development; Promotions, demotions, transfers, separation, absenteeism & turnover;

SECTION-B

Job Compensation: Wage & salary administration, incentive plans & fringe benefits.
Performance Management: Concept & process, performance appraisal, Potential appraisal;
Quality of work life (QWL):Meaning, techniques for improving QWL.
Industrial Relations:Concept and theories, trade unions; Health, Safety & Employee welfare measures; Employee grievances and discipline, participation & empowerment; Introduction to collective bargaining.

Books Recommended:

Paper Title: CORPORATE LEGAL ENVIRONMENT (Theory)
Paper Code: MBA-CHE 5803 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Information Technology Act-2000: Objective of the act, documents excluded from the scope of the act, digital signatures, types of digital signatures in India, certifying authorities in India, regulation of certifying authorities, duties of subscribers, offences, appellate tribunal, penalties and adjudication

Company Law: Definition and nature of a company, kinds of companies, formation of a company, memorandum of association, articles of association, prospectus, membership in a company, shares, transfer and transmission of shares, meetings and proceedings.

SECTION-B


Consumer Protection Act 1986: Definitions under the act: complaint, consumer, defect, deficiency, unfair trade practice, consumer protection councils, redressal machinery under the act, district forum, state commission, national commission

Books Recommended:

Paper Title: Project Management and Entrepreneurship (Theory)
Paper Code: MBA-CHE 5804 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.
SECTION-A
Project Formulations and Planning, Private commercial criteria for project choice, project cycle, feasibility, marketing feasibility, Financing for Projects and financial feasibility, Project Implementation. Brief outline of social cost benefit analysis: rationale, UNIDO and Little Mirrlees approaches, UNIDO-IDCAS manual, shadow prices and conversion factors, applications in India. Planning and scheduling networks, critical path, PERT model, CPM model, PERT/cost, resource leveling and allocation.

SECTION-B

Books Recommended
4. IMD little and J.A. Mirrlees: Project Appraisal and Planning in Developing Countries, 1975.
5. Prasanna Chandra: Projects: Preparation, Appraisal Budgeting and Control, 7th edition, TMH.
8. Peter F. Drucker: Innovation and development.

Paper Title: FINANCIAL ACCOUNTING (Theory)
Paper Code : MBA-CHE 5805 Max. Marks : 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Accounting: Accounting and its functions; Accounting as an information system; Basic Accounting Concepts and Accounting Conventions; Accounting Principles; Generally Accepted Accounting Policies (GAAP); Accounting Standards.
Branches of Accounting: Financial Accounting; Cost Accounting; Management Accounting; Accounting Equation; Accounting Structure; Types of Accounts.
Rules regarding Journal Entries; Recording of Journal Entries; Ledger Posting; Cash book; Trial Balance; Preparation of Final Accounts; Trading Account; Profit & Loss Account; Balance Sheet; Treatment of Adjustments into trial balance.
Meaning of Management Accounting: Nature; Scope; Objectives; Functions of Management Accounting; Relationship between Financial and Management Accounting; Meaning of Financial Statement; Importance and Limitations of Financial Statement; Meaning and Objectives of Financial Statement Analysis; Limitation of Financial Analysis.
Tools of financial analysis: Ratio analysis; Common size statements; Trend analysis; Fund flow and cash flow statement.
Cost Accounting: Meaning, scope and classification of costs; Absorption costing; Marginal costing and break even analysis; Use of cost data in managerial decision making.
Cost Control Techniques: Preparation of budgets and their control; Zero base budgeting; Standard costing and variance analysis; Responsibility Accounting; Target costing; Kaizen costing; Activity based costing.

SECTION-B
Responsibility Accounting: Meaning; Steps involved in Responsibility Accounting; Responsibility Centre; Advantages of Responsibility Accounting.
Price Level Accounting: Meaning; Methods or Techniques of Price Level Accounting; Advantages; Disadvantages;
Social Accounting: Concept of Social Cost Benefit Analysis; Meaning of Social Accounting; Need; Social Accounting Approaches.
Human Resource Accounting: Meaning; Need; Methods of Human Resource Accounting; Objections Against Human Resource Accounting; HRA in India.

Books Recommended:

Paper Title: PROCESS MODELING & SIMULATION LAB. (Practical)
Paper Code: CHE 5852 Max. Marks: 25 Credit: 1
Functional design, property estimate as inputs for design. System concepts for computer aided design, computer aided flow sheet design. Process analysis. Process variables selection, equipment design through the selection of free parameters subject to constraints and other parameters, modular design. Simulation optimality. Dynamic design including control stability.
Typical equipments to be considered: heat exchangers, distillations columns, reactor and process equipments.

Books Recommended:

Paper Title: PROCESS CONTROL LAB. (Practical)
Paper Code: CHE 5853 Max. Marks: 50 Credits: 2
1. U-Tube manometer
   (a) To plot the response curve for a given input to a U-tube manometer.
   (b) To determine the transfer function from the response curve obtained in part (a).
2. Time constant of a mercury thermometer
   To study the dynamics of the given thermometer and compare the theoretical value of its time constant with the experimental value.
3. Analysis of valve
   Develop a block diagram representing the dynamic bahaviour of the given globe valve.
4. (a) Liquid level measurement
With the given Bubbler System for Liquid Level Measurement, evaluate liquid height in the tank and compare it with actual values.

(b) Calibration of Pressure Gauge

Calibrate a pressure gauge in the range 0 psi to 60 psi.

5. Temperature control system
   To maintain the temperature of the fluid at the set point value.

6. Time constant of liquid level tank
   To study the dynamics of liquid level in a tank and compare the analytical value of the time constant with the experimental value.

7. Liquid level control
   (a) To carry out the closed loop experiment on the given liquid level control system and record its response for step change in the inlet flow.
   (b) To plot the experimental response curve and comment on the response obtained.

8. Compurec
   Pressure control simulation with step input and sinusoidal input.

**Paper Title : LITERATURE SURVEY, REPORT WRITING & SEMINAR**

**Paper Code: CHE 5854**

No Credits  Qualifying

Forms of technical reports: aims and forms according to type of readership and extent of circulation. Abstracts, extended abstracts, tables, graphs. Visual representation of data: slides, microfilms, others techniques including those of audio-visual representation. Correct use of audio equipment. Research papers and their presentation and publication. Information retrieve direct and through abstracts. Practical training in writing and presentation of technical reports through audio-visual means. Technique of effective public speaking organized and imprompt discussions. Preparation of technical report on an assigned topic after survey of scientific, technical and commercial literature, using card indexes, microfilms and other information retrieval methods. Use of Computer softwares for report writing.

**Books Recommended:**

2. Sottle, R.T. : The Use of Chemical Literature, Butter Worths.

**Paper Title : VIVA VOCE-II (COMPREHENSIVE)**

**Paper Code: CHE 5856**

Max. Marks : 50  Credits: 2

The viva-voce examinations will be comprehensive and covering mainly chemical engineering and technology subjects covered during all the semester including the Eight Semester.
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
NINTH SEMESTER

Paper Title: FINANCIAL MANAGEMENT (Theory)
Paper Code : MBA-CHE 5901  Max. Marks : 50  Credits: 4  Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction to Financial Management: Meaning; Scope; Finance Function; Financial Goals; Agency Problem; Relationship of Finance with Accounts and Economics.

Sources of Finance: Features; Advantages and Limitations of Equity Shares; Preference Shares; Debentures; Term-Loans; Right Issue, Venture Capital, Private Equity GDR, ADR.

Cost of Capital: Meaning; Calculation of Cost of Debt Capital; Equity Capital; Preference Capital; Retained Earnings; Weighted Average Cost of Capital.

Capital Structure: Meaning; Determinants; Assumptions; Net Income and Operating Income Approach; Traditional Position; M-M Position; EBIT and EPS Analysis; Capital Structure and Taxation.

Leverage Analysis: Meaning; Types; Estimation of Financial; Operating and Combined Leverage; Relation of Financial Leverage with Risk and Return.

Management of Working Capital: Meaning of WC; Need of WC Management; Determinants of WC; Operating Cycle; Estimation of WC; Working Capital Financing; Trade Credit, Bank finance, commercial paper, factoring, money market instruments.

SECTION-B

Cash Management: Meaning; Facets of Cash Management; Motives for Holding Cash; Optimal Cash Balance; Short-term and Long-Term Cash Forecasting.

Receivable Management: Meaning; Credit Policy Variable; Credit Evaluation; Credit Decisions; Control of Account Receivable.

Inventory Management: Meaning; Need to hold Inventory; Objective of Inventory Management; Inventory Investment Analysis; Inventory Control System.

Capital Budgeting: Meaning; Basic Principles of Costs and Benefits; Investment Criteria; Pay back Method; Accounting Rate of Return method; Net Present Value Method; Benefit-Cost Ratio; Internal Rate of Return; Capital Rationing; Introduction to Basic Techniques of Risk Analysis in Capital Budgeting.

Dividend Decisions: Meaning and Types of Dividend; Issues in Dividend Policy; Traditional Model; Walter Model; Gordon Model; Miller and Modigliani Model; Bonus Shares and Stock Splits.

Corporate Restructuring: Meaning and forms of corporate restructuring, merger and amalgamation takeover and acquisition, types or forms of mergers and takeovers, their benefits and motives.

Suggested Readings:
GROUP-A

Paper Title: FUNCTIONAL SUBJECT-1/FUNCTIONAL SUBJECT-2 (Theory)

Students will have to opt for TWO functional subjects, from GROUP-A.

Paper Code: MBA-CHE 5902  Max. Marks: 50  Credits: 4  Time: 3 hours
Paper Code: MBA-CHE 5903  Max. Marks: 50  Credits: 4  Time: 3 hours

Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

1. MARKETING RESEARCH AND CONSUMER BEHAVIOUR

SECTION – A
Introduction to Consumer Behavior: Introduction, Applications of consumer behavior, Consumer behavior and marketing strategy, Consumer decision process, situational characteristics and consumption behavior, consumer decision making process, Post purchase behavior.

Factors Influencing Consumer Behavior: Consumer specific factors influencing buying behavior, psychological processes (motivation, perception, learning and memory) affecting consumer behavior; the buying motive, high involvement and low involvement buying situations, Consumer behavior in adapting new products, participants in buying decisions; Group influence- Definition, types of group (primary, secondary, formal etc.), Family influence, roles, FLC application.

SECTION – B
Introduction to Marketing Research: Meaning, scope and importance of marketing research; defining the market research problem and developing an approach, research design formulation, Rating Scales Juster, Likert, Semantic Differential, Thurston, Attitude Scales, preparing a written research report, organization of the report, ethical issues in marketing research.

Applications of marketing research: Research design classification, product research- developing products, specifications and attributes; Concept of test marketing; advertising research, Market and sale analysis research, sales forecasting, demand measurement.

Suggested Readings:-
7. A. Parasaruman et.al.: Marketing Research, Biztantra.
2. INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT

SECTION-A


Risk and Return: Concept of Risk, Components of Investment Risk, Measurement of Risk through Standard Deviation, Regression Equation, Covariance, Concept of Return, Expected Yield, Actual Yield, Holding Period Yield, Relationship between Risk and Return


Efficient Market Theory: Random walk; Weak form, semi-strong and strong form of market; Empirical tests; Comparison between random walk.


SECTION-B


Suggested Readings:-
2. Frank J Fabozzi.: Investment Management, Prentice Hall - Gale
8. V. K. Bhall: Investment Management, Sultan Chand and Sons.

3. INTERNATIONAL HUMAN RESOURCE MANAGEMENT

Section A

International HRM: Concept, Defining International HRM, Differences between domestic and international HRM, Variables moderating the difference between domestic and International HRM, Developments leading to global HRM, Issues in global organizations, Management of external environment, Relevance and importance of IHRM.

Sustaining International Business Operations: Approaches to staffing- ethnocentric, polycentric, geocentric, regiocentric, reasons and types of international assignments, role of expatriates, role of non expatriates.

Recruiting and selecting staff for international assignments: issues in staff selection, reasons for expatriate failure, factors moderating performance, selection criteria.

Training and development: Role of expatriate training, effective pre-departure training programmes, effectiveness of pre departure training, developing staff through international assignments.

Compensation: Objectives of International compensation, key components of international compensation programme, approaches to international compensation.

Re-entry and Career Issues: Repatriation Process, individual reactions to re-entry, Multinational responses, designing repatriation programme.

Section B

HRM in host country context: standardisation and adaptation of work practices, retaining, developing and retrenching staff.

Industrial Relations: Key issues in international Industrial relations, trade unions and international industrial relations, response of trade unions to multinationals.

Performance Management: Multinational performance management, performance management of international employees, Performance appraisal of international employees, Appraisal of HCNs.

Culture and IHRM: Concept of Culture, Cross Cultural Studies, Hofstede’s Model of National Culture

Cross Cultural Communication: Cultural Variables Affecting Communication, Managing Cross-Cultural Communication.

IHRM Trends and future challenges: International business ethics and HRM, research issues and theoretical developments in international HRM.

GHRM in Select Countries: America, Japan, China, Korea, Africa, Europe, India.

Suggested Readings:-
4. SUPPLY CHAIN MANAGEMENT

SECTION – A

Introduction to Supply Chain Management: Definition; Scope & Importance of Supply Chain Management; Key drivers of the SCM; Features of Supply Chain Management; Supply Chain Network – 1st Tier, 2nd Tier; Network decisions in SCM; Suppliers and Customers; Customer Service Dimension (Seven “R” Principles, Service after sale, Customer delight).

Role of Logistics in Supply Chains: Definition of Logistics Management; Scope and role of Transportation, Traffic & transportation; Relationship between transportation and other business functions, Transport Economics: Distance – volume-density, Freight Cost, Handling, Liability, market factors; Third party logistics (3 PL) & fourth party logistics service provider (4 PL), Logistics equipment; Reverse Logistics, Government rule & regulations related to Logistics; Purchase Cycle, Make or Buy, Price analysis, Negotiations.

SECTION – B

Inventory Management: Inventory Control, Planning & Managing Inventories; Warehouse Management (Receipt, issue, storage and preservation, stock verification, In bound and out bound distribution operations); Order Management; Competitive advantage through logistics and supply chain management; Responsive Supply Chain; Supply chain process integration, performance measurement; Value Chain, Value System and Supply Chain.

Planning demand and supply: Planning & Sourcing in Supply Chain, Demand forecasting, Type and Time horizon of forecast and category of forecasting, aggregate planning; Financial issues in Supply Chain - Macro and micro view, Asset management, Du Pont Model, Supply Chain Costing; Decision environment in SCM; Global supply chain perspectives - New business models, role of IT in SCM.

Suggested Readings:
4. RP Mohanty: Supply Chain Management-Theories and Practice, Biztantra.
5. Robert B. Handfield, Ernest L. Nicholas, Jr.: Introduction to Supply Chain Management, Pearson Education.

GROUP-B

Paper Title: FUNACTIONAL SUBJECT-3/FUNCTIONAL SUBJECT-4 (Theory)
Students will have to opt for TWO functional subjects, from GROUP-B.

Paper Code: MBA-CHE 5904 Max. Marks: 50 Credits: 4 Time: 3 hours
1. ADVERTISING AND SALES MANAGEMENT

SECTION – A

Introduction to Advertising: Advertising - an element in Marketing Mix, role and importance; Difference between advertisement and publicity; Advertising as a means of communication, Setting advertising objectives, DAGMAR approach to setting objectives; Media, selection, measurement of effectiveness of Media, Preparing advertising plan, Developing message, writing copy, advertising appeals and per-testing and post teaching copy Media decisions, media strategy and scheduling decisions; Planning and managing advertising campaigns

Integrated marketing Communications: Different types of advertising, public relations; advertising budget and relevant decisions; Advertising agencies; their role and importance; management problems of agencies; client-agency relations; advertising in India, problems and prospects. Role of Integrated Marketing Communications (IMC), Designing, Objectives Setting and Budgeting for IMC programs, developing effective communications, Managing Mass Communications: Events, experiences and public relations, measuring media.

SECTION – B

Sales Management: Sales organization, Sales Functions and its relationship with other marketing functions, The external relationship of the Sales Department e.g. with distributors; Government and Public, Functions and qualities of a Sales Executive, Environment Routing and Scheduling, International Sales Management.

Salesmanship: Theoretical aspects of Salesmanship, the process of selling, Sales forecasting methods, Sales budget, Sales force management; Recruitment, Selection, Training, Motivation and Compensation of the fields sales force and sales executive; The evaluation and control of sales force, Sales Territories, Sales Quotas.

Suggested Readings:
2. Raghuvir Singh: Advertising-Planning and Implementation, Prentice Hall India.

2. STRATEGIC COST MANAGEMENT

SECTION – A

Strategic Cost Management: Meaning, Nature and Significance of Strategic Cost Management, Limitations of Traditional Costing, Difference between Conventional Cost Analysis and Strategic Cost

Value Analysis: Meaning of Value Analysis and value addition, Strategic Application of Value Chain Analysis.

Strategic Positioning Analysis: Critical Success Factors and SWOT Analysis.


SECTION – B


Responsibility Accounting: Activity based Responsibility Accounting, Behavioural aspects of responsibility accounting, Transfer Pricing.


Productivity improvement: Various tools and techniques including Kaizen and Six Sigma.

Suggested Readings:

3. ORGANISATIONAL DEVELOPMENT

SECTION – A

Introduction to OD: Definitions of Organizational Development (OD), Growth and Relevance of OD.

History of OD: The Laboratory Training; Survey Research and Feedback; Action Research; Socio-technical and Socio-clinical Parallels, Second Generation OD.

Underlying Assumptions and Values: Assumptions about people as individuals, Assumptions about people in groups and about leadership, Assumptions about people in organizational systems, Assumptions that relate to values in the client organization, Values and belief system of behavioral scientist change agents.


OD Interventions - An Overview: A definition of OD interventions, nature of OD interventions, the major families of OD interventions, classification schemata for OD interventions.
**Team Interventions:** Teams and Work Groups - Strategic Units of Organizations, Team Building Interventions, the Family Group Diagnostic Meeting, The Family Group Team-Building Meeting, Role Analysis Technique Intervention, Role Negotiation Technique, Responsibility Charting, the Force Field Analysis Technique, Gestalt Orientation to Team Building.

**Intergroup Interventions and Third-Party Peacemaking Interventions:** Intergroup Team-Building Interventions, Third-Party Peacemaking Interventions, Organization Mirror Interventions, Partnering.

**SECTION – B**


**Structural Interventions and OD:** Suggested Criteria for Congruency-incongruency with OD, Job Design, Quality Circles, MBO and Appraisal, Socio technical Systems and Work Restructuring, Quality of Work Life Projects.

**The Collateral Organization:** A Task Force with a Difference, Physical Settings and OD, Similarities and Differences between OD and selected structural interventions.

**The Role and Style of the OD Practitioner:** External and Internal Practitioner, Competencies of an OD Practitioner, OD Practitioner Styles, the OD Practitioner and his role in Intervention Process, forming the practitioner-client relationship, Professional Values and Ethics for OD professionals, Ethical Guidelines and Dilemmas.

**Suggested Readings:**

5. D.R. Brown and D. Harvey: An Experiential Approach to OD, Pearson Education.

4. **ENTERPRISE RESOURCE PLANNING**

**SECTION – A**


Issues, Concerns and Purchasing: Disadvantages of ERP Solutions, users, developers, customers of ERP, purchasing or outsourcing, planning, purchasing and selection of ERP, Managing implementation partners; ERP strategy options and risk mitigation.
SECTION – B
Implementation of ERP: Implementation plan of ERP, Methods and tools, business process mapping, gap analysis, risks and dependencies, project timeline plan, project organization plan, structure and coding, data migration and historical record, prototype testing, user training program, knowledge management, disaster recovery plan, RDBMS, data communication system, hardware requirements, sample system architecture.

ERP Project Success and failure: Introduction to ERP Project success and failure with case studies, Current and future ERP market, key players and market shares, market issues; Continuous business improvement in ERP.

Suggested Readings:

Paper Title : WORKSHOP ON SOFT SKILLS (Practical)
Paper Code: MBA-CHE 5951   Max. Marks : 25   Credit: 1

SECTION – A
Meaning and importance of communication in business: Process, types of communication: formal and informal and their characteristics, essentials of effective business communication, Channels of communication, their effectiveness, limitations, Barriers of communication, approaches to effective Communication, Negotiation skills and participating decision making in Management

Presentations, Book Reviews and Summaries


Listening Skills: Listening to Specific Information, Identifying Main Issues, Seeing Beyond the Surface

Team Assignment: Effects of Competition on Individual and Group Behaviour, Competitive and Collaborative Team Behaviour; Team/ Group Dynamics, Team Assignment

SECTION – B

Stress Management: Symptoms of Stress, Coping Approaches.


Principles of clear writing, often misused words, applications and requests, positive and negative responses to requests, routine messages, memos, organizing meetings, preparation of agenda and minutes, business etiquette, telephone etiquette, e-mail etiquette.

Interpersonal Skills: Negotiations, social skills, assertive skills, cross-cultural communications.

Leadership Skills: Concepts of leadership, leadership styles, insights from great leaders.
Suggested Readings:
2. Poe & Fruchling: Basic Communication, AITBS.
5. Baugh, Frayer & Thomas: How to write first class Business Correspondence, Viva Books.

Paper Title : WORKSHOP ON DEVELOPING ENTREPRENEURIAL SKILLS (Practical)
Paper Code: MBA-CHE 5952   Max. Marks : 25   Credit: 1

SECTION – A
Entrepreneurship: Entrepreneurship and Economic Development; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth - Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs;

Identification and Product Selection: Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Project Finalization; Sources of Information.

SECTION – B
Small Enterprises and Enterprise Launching Formalities: Definition of Small Scale; Rationale; Objective; Scope; Role of SME in Economic Development of India; SME; Registration; NOC from Pollution Board; Machinery and Equipment Selection; Project Report Preparation; Preparing Project Report; Project Planning and Scheduling; Fundamentals of Tax Planning, Tax Benefits available to SME’s.

Role of Support Institutions and Management of Small Business: Director of Industries, DIC, SIDO, SIDBI, SIDC, SISI, NSIC, SFC; Marketing Management, Production Management; Finance Management; Human Resource Management; Export Marketing Concept of Venture Capital.

Suggested Readings:
SYLLABUS FOR FIVE YEAR INTEGRATED
BACHELOR OF ENGINEERING (CHEMICAL) WITH M.B.A.
TENTH SEMESTER

Paper Title: STRATEGIC MANAGEMENT (Theory)
Paper Code : MBA-CHE 51001 Max. Marks : 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION – A

Introduction: Conceptual framework of strategic management, Strategic formation process, Approaches to strategies decision making, Pitfalls, Techniques for improvement, Mission.

Objectives and Goals: Significance, Characteristics and formation of Missions, Objectives and Goals, Porter’s five force model and strategies groups, Competitive advantage, Distinctive Competencies.

Organizational Analysis through Internal Scanning: Value chain analysis, Organization structure and culture, Various strategies issues.


SECTION – B

Building and Restructuring Business: Start up route, Acquisition, Joint venture, Merger, Takeover, Restructuring, Retrenchment, Divestment, Harvest, Liquidation, Turnaround strategy.


Implementation of Strategy: Designing of structure, Designing of effective control system, ISO 9000, Strategic system, Strategic change process.


Suggested Readings:
Paper Title: BUSINESS ENVIRONMENT (Theory)
Paper Code: MBA-CHE 51002 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION – A

Economic Environment: Economic Environment of Business, Non- economic Environment of Business-Politico legal environment of business, Critical elements of socio – cultural environment; emerging rural sector in India and Indian Business; Social responsibility of business, Consumerism in India; Techniques of Environmental Scanning; Environmental Scanning of some important industries.

Economic Planning in India: Objectives, Strategies and Evaluation of current Five Year Plan; Public Sector in India; Privatization and Disinvestment; New Economic Policy-Liberalization and Structural Adjustment Programmes; Economic Systems.

SECTION – B

Economic Policies in India: Monetary Policy as an instrument of growth; Fiscal Policy and Indian business; Industrial Policy and Industrial Licensing in India; EXIM Policy, MRTP Act, FERA, FEMA.

International Economic Environment: Globalization - concept and emergence of globalization; Foreign Direct Investment; Benefits and Problems from MNCs; WTO-its role and functions, implications for India; Devaluation of Rupee

Suggested Readings:
1. Ruddar Datt & K.P.M. Sundaram: Indian Economy, Sultan Chand and Sons.

Paper Title: PRODUCTION AND OPERATION MANAGEMENT (Theory)
Paper Code: MBA-CHE 51003 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION - A

Operations Management: Concepts; Functions
Process Selection: Project, Job, Batch, Mass & Process types of Production Systems; Product-Process Mix

Facility Location: importance; Factors in Location Analysis; Location Analysis Techniques.
Facility Layout: Objectives; Advantages; Basic Types of Layouts.
Capacity Planning: Concepts; Factors Affective Capacity; Planning; Capacity Planning Decisions.
Production Planning & Control (PPC): Concepts; Objectives; Functions
Work Study: Productivity; Method Study; Work Measurement.

SECTION - B
Materials Management: Concepts; Objectives
Introduction to modern Productivity techniques: Just in time; Kanban System; Total quality management & six sigma.
Functions Purchasing Management: Objectives; Functions; Methods; Procedure
Stores Management: Types of Stores; Functions; Coding Methods
Value Analysis: Concepts
Inventory Management: Concepts; Classification; Objectives; Factors Affecting Inventory Control Policy; Inventory Costs; Basic EOQ Model; Re-order Level; ABC Analysis.
Maintenance Management: Concepts; Objectives; Functions; Types of Maintenance.

Suggested Readings:
1. Nair: Production & Operation Management, Tata McGraw Hill
2. Adam & Ebert: Production & Operation Management, Prentice Hall India
5. SN Chary: Production & Operations Management, Tata McGraw Hill

Paper Title: RESEARCH METHODOLOGY
Paper Code: MBA-CHE 51004 Max. Marks: 50 Credits: 4 Time: 3 hours

Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
Introduction: Meaning, Features, Objectives/Motives & types of Research; Attributes of good Research, Research Methods and Research Methodology; Research Process, Significance of Research in Managerial decision making.
Research Design: Meaning, Characteristics and various concepts relating to research design and classification of research design, Importance.
Measurement and Scaling: Data Types Nominal, Ordinal and Ratio scale; scaling techniques.
Formulation of Hypothesis: Meaning, Characteristics and concepts relating to testing of Hypothesis (Parameter and statistic, Standard error, Level of significance, type-I and Type-II errors, Critical region, one tail and two tail tests); Procedure of testing Hypothesis. Numerical problems based on chi-square test and Ftest (variance ratio test only).

SECTION – B
Data Collection: Sources of Data-Primary/Secondary Methods of collecting data; direct personal interview, indirect oral interview, information through local agencies, mailed questionnaire method, schedule sent through enumerators; questionnaire and its designing and characteristics of a good questionnaire.
Sampling Design: Meaning and need of Sampling, Probability and non-probability sampling design, simple random sampling, systematic sampling, stratified sampling, cluster sampling and convenience, judgement and quota sampling (non-probability), determination of sample size.

Data Analysis & Interpretation: Introduction to Multivariate analysis - Multiple and partial correlation, multiple regression analysis (with two independent variables), specification of regression models and estimation of parameters, interpretation of results. Analysis of Variance (ANOVA) - One way and Two way ANOVA. Introduction to discriminant analysis and Factor Analysis (Numerical not to be asked)

Report writing: Style/format, contents and essential steps for report writing.

Suggested Readings:
2. Ranjit Kumar: Research Methodology, Pearson Education 2009-02-20
3. Donald R. CooperPamela S. Schindler: Business Research Methods, Tata McGraw Hill
5. R. Pannerselvam: Research Methodology, Parentice Hall of India Limited.
7. William G.Zikmund : Business Research Methods, Thomson South Western Publication

Paper Title: FUNCTIONAL SUBJECT-5 (Theory)
Students will have to opt for ONE functional subject from the following.

Paper Code: MBA-CHE 51005 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

1. INTERNATIONAL BUSINESS MANAGEMENT

SECTION – A


SECTION – B

Decisions-Product Branding, Packaging, Pricing, Distribution, Sales, Sales & Promotion Decision &strategies.

**Emerging Issues:** Emerging Economies, e-business, Operating in a Borderless World, Export Promotion, Export documents and Procedures, Export Risk Insurance; Major problems of Indian Export Sector.

**Suggested Readings:**

**2. INTERNATIONAL FINANCIAL MANAGEMENT**

**SECTION – A**

**Internationalization of financial function:** International financial management - An overview, Objectives of international firm and impact of risk; Financial function in multinational corporation.

**Foreign Exchange Risk:** Foreign exchange market, foreign exchange risk and exposure, exposure information system, strategies for exposure management and techniques for foreign exchange rate projections, devices for foreign exchange risk and exposure devices.

**Managing Short-term Assets and Liabilities:** International working capital management, Investment of international money market; Euro currency and other important international money market, International ranking and payment settlement mechanism.

**SECTION – B**

**International Investment and Financing:** International financial instruments and markets, Country risk analysis, Cost of capital and capital structure of multinational corporate, International investment management; International mergers and acquisitions.

**Emerging Issues in International Finance:** Charges in international business & trade and its impact on international finance; Recent changes in international money and capital markets; Impact of international tax on international finance.

**Suggested Readings:**
3. INDUSTRIAL RELATIONS AND LABOUR LAWS

SECTION – A

Overview of Industrial Relations: Concept of IR, Nature of IR, Objectives of IR, Evolution of IR in India, Theories of IR, Systems approach to IR.
Trade Unionism: Concept of Trade Unions, Functions of Trade Unions, Approaches, Structures of Trade Unions.
The Trade Unions Act, 1926: Trade Union, Registration of Trade Unions, Rights and Liabilities of registered trade unions.
Grievance Handling: Grievance, Causes/Sources of Grievances, Grievance Redressal Machinery, Legislative Aspects of the Grievance Redressal Procedure in India, Domestic enquiry.

SECTION – B

The Workmen's Compensation Act, 1923: Workman, employer’s liability to pay compensation, disablement, amount of compensation.
Tripartite and bipartite bodies: Workers Participation in Management.

Industrial Relations and emerging scenario: Industrial Relations and technological change, International Labour Organisation (ILO): Objectives and Structure, Future of Industrial Relations
Standing Orders Act, 1948: Standing orders, certification of draft standing orders, duration and modification of certified orders.
Employee’s State Insurance Act, 1948: Contribution, principle employer, immediate employer, different benefits.

Suggested Readings:
6. S.N. Dhayani: Industrial Relations System, Sultan Chand and Sons
4. ADVANCED PRODUCTION MANAGEMENT

SECTION – A

**Operations Management:** Concepts, Functions


**Process Selection:** Project, Job, Batch, Mass & Process types of Production Systems, Product-Process Mix.

**Facility Location:** Importance, Factors in Location Analysis, Location Analysis Techniques.

**Facility Layout:** Objectives, Advantages, Basic Types of Layouts.

**Capacity Planning:** Concepts, Factors Affective Capacity, Planning, Capacity Planning Decisions.

**Production Planning & Control (PPC):** Concepts, Objectives, Functions.

**Work Study:** Productivity, Method Study, Work Measurement.

SECTION – B

**Materials Management:** Concepts, Objectives.

**Introduction to modern Productivity techniques:** Just in time, Kanban System, Total quality management & Six Sigma.

**Functions Purchasing Management:** Objectives, Functions, Methods, Procedure.

**Stores Management:** Types of Stores, Functions, Coding Methods

**Value Analysis:** Concepts.

**Inventory Management:** Concepts, Classification, Objectives, Factors Affecting Inventory Control Policy, Inventory Costs, Basic EOQ Model, Re-order Level, ABC Analysis.

**Maintenance Management:** Concepts, Objectives, Functions, Types of Maintenance.

**Suggested Readings:**

1. N.G. Nair: Production & Operation Management, Tata McGraw Hill
2. Everett E. Adam & Ronald J. Ebert: Production & Operation Management, Prentice Hall India
6. Gaither: Operations Management, Thomas Learning
8. M.M. Verma: Materials Management, Sultan Chand and Sons
Paper Title: FUNCTIONAL SUBJECT-6 (Theory)
Students will have to opt for ONE functional subject from the following.

Paper Code: MBA-CHE 51006 Max. Marks: 50 Credits: 4 Time: 3 hours
Course Duration: 45 Lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions. 4 questions from section A and 4 questions from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

1. INDUSTRIAL AND RURAL MARKETING

SECTION-A

Introduction to Industrial Marketing: Definition of Industrial & Consumer Product, Basis of Classification; Difference between Industrial & Consumer Marketing, Concept of Derived Demand, Classification of Industrial Consumers, Industrial goods, Key Characteristics of Organizational Buying Process.


SECTION – B


Promotion Strategies: Advertising, Sales Promotion, Communication in Rural Marketing - Language and Culture Distribution Strategies for rural Marketing and channels of distribution, Role of Co-operative, Government, financial institutions, public sector undertaking, regulated markets and public distribution systems, Intervention of IT in rural Markets

Suggested Readings:
2. Francis Cherunilam: Industrial Marketing Text and Cases, Himalaya Publishing House
2. MANAGEMENT OF FINANCIAL SERVICES

SECTION – A


Depository Services: Introduction to Depository Services, Depository Participants in India, Role of NSDL and CDSL, Difference Between NSDL and Bank, Services Offered By Depository Participants, Products Offered By Depository Participants, Process of Dematerialisation, Difference Between Physical and Electronic Holding of Securities.

Broking: Broking Services and Trading in Equity Broking and Trading in Debt;

Mutual Funds: Concept of Mutual Funds, Types of Mutual Funds, Advantages, Structure of Mutual Funds and tax treatment, SEBI and Mutual Funds Regulations;

Insurance Services: Introduction, Types of Insurance, Life Products, Non-Life Products.

SECTION – B

Debt Securitisation and Corporate Advisory Services: Introduction, Securitisation as a funding Mechanism, Securitisation of Mortgaged and Non-Mortgaged Assets Issue Management;

Credit Rating: Meaning of Credit Rating, Process of Credit Rating, and Factors affecting Rating, Types of Rating, Advantages and Disadvantages of Credit Rating, Methodology of Credit Rating, Credit Rating Agency Regulation Act 1974, Credit Rating in India.


Leasing: Definition, Types of Leases, Advantages, Disadvantages, Leasing and Commercial Banking Sector, Risk in Leasing, Lease Proposal Analysis, Comparison Between Lease and Hire Purchase, Legal Aspects of leasing, Taxation Aspects of leasing, Lease Accounting and Reporting.

Housing Finance: Introduction to Housing Finance, Housing Finance Schemes, Procedure of Loan-disbursement, Legal Framework of Housing Finance; Credit Cards, Types, Settlement Process, Mechanism, Member Establishment, Member Affiliates.

Factoring: Meaning, Forms, Functions, Legal Aspects, Evaluation.

Suggested Readings:
3. PERFORMANCE MANAGEMENT

SECTION – A

Performance Management: Definition, Disadvantages of poorly implemented Performance Management (PM) Systems - aims and role of PM Systems, Characteristics of ideal PM Systems.


Performance Management Theatre: Concept, pillars of Performance management theatre, planning managee performance and development, monitoring managee performance and development, annual stocktaking.

Planning Managee Performance and Development: Setting objectives, Organisational and individual performance plans, Components of Managee performance and development plan, setting mutual expectations and performance criteria

Monitoring and Mentoring Managee Performance and Development: Introduction, Supervision, Objectives and Principles of Monitoring, monitoring process, periodic reviews, problem solving, process and principles of managee development, role efficacy.

SECTION – B

Annual Stocktaking: Stock taking performance, stock taking discussions, stocktaking potential, Tools for stocktaking potential (assessment centres, 360 degree feedback, managee career development window).

Appraising for Recognition and Rewards: Pros and cons of appraising, appraiser and appraisee concerns, common rating errors, purposes for appraising, methods of appraisal, implementing the appraisal system

Reward Management: Definition, foundations of reward management, financial and non-financial rewards, factors affecting level of pay, developing reward processes.

Pay Structures: fixed vs variable pay, graded pay structures, broadbanding, developing pay structures.

Pay systems: team based pay, performance related pay, short term incentives, long term incentives, executive compensation, international compensation, benefits.

Suggested Readings:

4. PRODUCTIVITY MANAGEMENT

SECTION – A

Introduction: The concept of productivity; Needs for productivity culture; Management and productivity; Factors affecting productivity; Efforts in productivity management; Organizational effectiveness and productivity.

Sources of productivity: Labor, capital, efficiency in use of labor and capital, productivity and standard of living.
Measurement of Productivity: Productivity cycle; Productivity measurement and its need; Total productivity mode; Limitations of partial measures of productivity; Productivity evaluation in organizations; Productivity and industrial relations.

Productivity and business cycles: Cyclical pattern of labor productivity, market impact on productivity.

SECTION – B

Productivity and Planning: Productivity planning and improvement concepts, Strategies for productivity; International productivity management and experience; Indian experience in productivity.

Productivity and price trends: Factors influencing relative price, relationship of price and output.

Productivity and Government Policies: Productivity trends in selected industries engineering, fertilizers, textiles and in energy, Impact of government policies on productivity.

Productivity differences among countries: International differences in labor productivity, role of central planning errors and business cycles on productivity.

Suggested Readings:
3. Chandra: Dynamics of Productivity, South Publisher.
5. Prokopenko: Productivity Management, Oxford & IBH.

Paper Title: SEMINAR ON CORPORATE GOVERNANCE
Paper Code: MBA-CHE 51051 No Credit Qualifying

SECTION – A

Corporate Governance: Introduction, Overview.

Corporate Board: Attributes, Duties, Responsibilities, Liabilities; Shaping Directorial Competence and Board Effectiveness; Financial Institutions and Nominee Directors.

Corporate Governance and Security: Corporate Disclosure and Investor Protection, Corporate Restructuring and Revival of Sick Units, Corporate Reputation, Corporate Legitimacy and Corporate Crime.

SECTION – B

Culture: An introduction; organization culture - Building and maintaining; Managing cultural diversity in organization; Indian culture characteristics.

General Issues regarding Corporate Governance: Takeover Codes, Corporate Board Committees, Globalisation and Corporate Governance, Emerging Trends in Corporate Governance.

Suggested Readings:
2. C.V. Baxi: Corporate Governance, Excel books.
4. Dr. S. Singh: Corporate Governance, Excel books.
5. Swami (Dr.) Parthasarathy: Corporate Governance, biz tantra.
7. Jill Solomon: Corporate Governance & Accountability, Wiley India.
10. Subhash Chandra Das: Corporate Governance in India, Prentice Hall India.

**Paper Title:** WORKSHOP ON INFORMATION TECHNOLOGY AND SYSTEMS (Practical)
**Paper Code:** MBA-CHE 51052  Max. Marks: 25  Credit: 1

**SECTION – A**

**Introduction to Computers:** Classification of computers, Components of Computer System, Introduction to High level and low level languages. Software: System Software and Application Software, Networking concepts and Classification, Internet and intranet, Practical on Internet using emails, Use of search engines.

**MS Word:** Introduction to MS Word, Basic Formatting, Legal Numbering, Understanding Styles, Sections, Section Breaks, Headers and Footers, Complex Legal Documents, Tables in the Legal Environment, Track Changes, Compare & Merge Documents, Send for Review and Comments, Troubleshooting Track Changes, Mail Merge Tool.

**SECTION – B**

**MS Excel:** Spreadsheets and their uses in business, Excel basics, Rearranging, Worksheets, Excel formatting techniques, using formulas and functions.

**Data Structures and Descriptive Statistics:** Data Tables, Built-In Functions available from the AutoSum Tool, Additional Statistical Functions, The Analysis ToolPack, Frequency Distributions, Charts, Graphs, and Tables, Pivot Tables and Charts, One-Sample t-Test, One-Way Between-Groups ANOVA, Correlation and Regression, Chi-Square Tests

**MS Power Point:** Introduction to MS Power Point, Navigation, Views, Design Templates, Clip art, images, diagrams, Charts and Graphs, Drawing Tools, Layouts, Color Palettes, Multimedia Elements, Slide Transitions, Animations.

**Computer Security:** Introduction, Malicious Programs, Cryptography, Digital Signature, Firewall, Users Identification and Authentication, Security Awareness and Policies

**Suggested Readings:**

**Paper Title:** RESEARCH PROJECT (Practical)
**Paper Code:** MBA-CHE 51053  Qualifying  Credits: 2

**Paper Title:** COMPREHENSIVE VIVA-VOCE (Practical)
**Paper Code:** MBA-CHE 51054  Max. Marks: 50  Credits: 2