

3rd Semester

Chemical engineering

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Exam			ESE	Subject Total	Credit
						TA	CT	Total			
Theory											
1	MA301	Mathematics-III	3	1		30	20	50	100	150	4
2	ME 302	Engg. Mechanics-II	3	1		30	20	50	100	150	4
3	EE 303	Electro Technology-I	3	1		30	20	50	100	150	4
4	CH 384	Fundamentals of Chemical Engineering	3	1		30	20	50	100	150	4
5	CH 385	Material Sc & Cor. Engg	3	1		30	20	50	100	150	4
6	CH 386	Chemical Process Industries	3	1		30	20	50	100	150	4
Practicals/Drawing/Design											
7	CH387	Chemical Engg. Drawing			3	30	20	50		50	2
8	ME 302L	Engg Mech-II Lab			3	30	20	50		50	2
9	EE 303 L	Electro Technology-I Lab			3	30	20	50		50	2
10	CH 386 L	Che Process Industries Lab			3	30	20	50		50	2
11	CH 387	General Proficiency							50	50	2
Total			18	6	12						

Total Marks: 1150

Total Periods: 36

Total Credits: 34

TA: teachers assessment

CT: Class Test

ESE: End Sem Exam

Detailed Syllabus

MA 301: MATHEMATICS-III (Common to all Branches)

Theory-100 marks.

Sessional- 50 marks.

Time- 3 Hrs.

Unit-I: Linear Algebra:

40 Marks.

Some Special types of matrices such as symmetric and skew-symmetric, hermitian and skew-hermitian, idempotent, nilpotent, involuntary, orthogonal, unitary and their properties; Triangular and echelon form, pivot elements; Trace, Differentiation and integration of matrices; Inverse of a matrix, Theorems on inverse, elementary operations and elementary matrices, equivalent matrices, computation of inverse by elementary transformations, reduction of matrices to triangular form and normal form; partitioning, inverse by partitioning, rank of a matrix, evaluation of rank, Theorems on rank.

Vector spaces and subspaces, linear independence, basis and dimension, row space, column space, null space, row rank, column rank, equality of row rank, column rank and rank of a matrix.

Solution of a system of non-homogeneous linear equations, solution of a system of homogeneous linear equations, Consistency of a system of linear equations.

Orthogonally: Inner product, orthogonal vectors, orthogonal metrics and Gram-Schmidt orthogonalization.

Eigen values and Eigen vectors and their properties, Cayler-Hamilton's theorem, Reduction of a matrix to diagonal form, necessary and sufficient condition for diagonalization.

Unit-II: Statistics:

40 Marks.

Probability, probability distributions and characteristics: Dispersion skewness and kurtosis, random experiments and sample space, definitions of probability, Laws of probability, Baye's theorem, random variable, Probability distribution of a discrete random variable, Mean and Variance of a discrete random variable, Probability distribution of a continuous random variable, Expectation and moments, Binomial distribution, Poisson distribution, Normal distribution.

Elementary sampling theory: Sampling with and without replacement, Sampling distribution of mean, proportion, sum and difference. Central limit theorem and its significance.

Statistical estimation theory: Biased and un-biased estimates, efficient estimate, point & interval estimate. Confidence limits for the estimates of mean, proportion, difference and sum.

Statistical decision theory: Statistical hypothesis, Null hypothesis, Test of significance involving normal distribution.

Unit-III: Laplace transformation:

20 Marks.

Laplace transformation of elementary functions, inverse Laplace transform, Linearity, Laplace transforms of derivatives and integrals, shifting Theorems, Laplace transform of unit step function, Direc-delta function, Differentiation and integration of transforms, convolution, Application to differential equations.

Text/Reference:

1. Advanced Engineering Mathematics. : Peter V O' Neil. : Wiley Eastern Ltd.
2. Advanced Engineering Mathematics. : Jain & Iyenger. : Narosa.
3. Higher Engineering Mathematics. : B. S. Grewal. : Laxmi Publication.
4. Linear Algebra & its applications. : Gilbert Strang. : Thomson Books.
5. Probability & Statistics. : Murray R. Spiegel. : Schaum's outline series, Mc Graw Hill.

ME302: ENGINEERING MECHANICS – II (3-1-3) (for EE, INS, CH)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. Kinematics: Link, Pair, chain mechanism and inversions. Simple mechanism (description only), Crank slider, four bar, st. line, steering. Simple velocity and acceleration diagrams.
2. Machine elements:
 - a) Governor: functions, type expressions for height of watt and porter governors.
 - b) Flywheel: Fluctuations of energy, Co-efficient of fluctuation of energy and speed, function of flywheel.
 - c) Brake and Clutch: Working principles only. Simple problems illustrating use of above.
3. Balancing: Simple problems of rotary, primary unbalance, graphical solution.
4. Transmission of Rotary drive:
 - a) Belt and Rope Drive: Relations for torque, maximum power transmission, length of open cross belting slip, crowing of pulley.
 - b) Gear train: Nomenclature , types – simple, compound , epicyclic gear train including reverted gear train. Simple description of automobile gear train.

Laboratory: Six experiments covering the syllabus.

Books:

1. Theory of Machines by J. Lal , Metropolitan Books Ltd.
2. Theory of Machines and Mechanisms(3rd edition) by J.J.Uicker, Jr;G.R.Pennock & J.E.Shigley, Oxford University Press.
3. Theory of Machines by V.P.Singh,
4. Theory of Machines by A. Shariff

EE 303: Electro Technology-I (ME & CHE)

L – T - P
(3 – 1 – 2)

Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50

1. D C Machines:

Basic Constructional features, E M F equation of D C generator, Elementary Idea of DC machine winding-winding pitch, Lap and Wave windings. Types of generators. Characteristics of DC generator-the OCC and the load characteristics. The shunt generator-condition for voltage builds up. Load characteristics. Losses in a DC generator, Efficiency, Applications, Compound generators
Working principle of DC motor. Back EMF, Calculation of torque and power. Types of DC motors. Characteristics curves. Losses and Efficiency. Speed equation. Method of speed control. Method of starting. The 3 point, 4 point starter (calculations of the star resistors not required)

2. Transformer:

Physical description of transformer. Elementary theory of the ideal transformer, EMF equation, Voltage and current transformation ratio. No load and load phasor diagrams. Transformer reactance and impedances. Equivalent resistance & reactance. Simplified equivalent circuit, open and short ckt tests. Losses and efficiency. Condition for maximum efficiency. All day efficiency. Voltage regulation. Star and delta connection in 3-ph transformer. The auto transformer, basic working principle.

3. Induction motor:

Constructional features of 3-ph induction motor-principle of rotating magnetic field(mathematical treatment not required)Principle of operation of the 3-ph induction motor speed. Rotor emf, current and rotor cu loss, Torque, Starting torque .Maximum torque. Condition for maximum torque. Torque slip curves. Necessity of a starter. Methods of starting of squirrel cage and the slip-ring induction motors.
Introduction to single phase induction motor. Nature of a field and torque produced in single phase induction motors (details of double revolving field not required).Types of motors-split phase, capacitors motors.

4. A.C. Synchronous machines:

Principle of operation of alternators. Constructional features of cylindrical generators and salient pole generators, EMF equation, Armature reaction. Synchronous impedance. Regulation of alternators, determination by synchronous impedance method.

Principle of operation of the synchronous motor, Synchronous motor on no load, Synchronous motor on load, Behaviour of the Synchronous motor with change of excitation-V curves. Starting methods of Synchronous Motor. Application of Synchronous motor.

6. Measuring Instruments:

Dynamometer type wattmeter. Induction type wattmeter. Single phase induction type energy meter. Errors and compensations.

Books:

1. Langsdorf : 'Theory of Alternating Current Machines' Tata McGraw Hill
2. Kingsley, Fitzereld : Electric Machinery (McGraw Hill)
3. Say : Performance and Design of Alternating Current Machine.
4. Guru, B.S., and Huseyin R. Hizirolgu, Electric Machinery and Transformers, Oxford University Press
5. Kothari D.P., and Nagrath, I.J., 'Electrical Machines', Tata McGraw Hill
6. Electrical Measurements and Measuring Instruments – A.K. Shawney (Dhanpat Rai)

CH 384: Fundamentals of Chemical Engineering

L – T – P

3 – 1 – 0

Theory : 100 marks

Sessional : 50 marks

Time : 3 Hrs

Introduction to Chemical Engineering: Definition, Origins and Development of the Chemical Process Industry. The Present Day Chemical Industry. The systematic Analysis of Chemical processes. Representation of a Chemical Process in terms of Flow sheet. Functions of a Chemical Engineer. Professional and General Aspects of. Chemical Engineering. Brief description of important Chemical Industries in terms of Unit Operations and Unit Processes. Measuring Techniques, Devices and Control in Process Industries. Pollution and its Abatement.

Numerical Methods: Different types of graph papers, statistical analysis of data, curve fitting, sorting of data, interpolation, Numerical integration, numerical differentiation

STOICHIOMETRY: Introduction- Units and Dimensions - stoichiometric principles- composition relations, density and specific gravity.

IDEAL GASES AND VAPOR PRESSURE: Behaviors of Ideal gases -kinetic theory of gases - application of ideal gas law- gaseous mixtures - volume changes with change in composition. Vapor pressure- effect of Temperature on vapor pressure-vapor pressure plots-vapor pressure of immiscible liquids-solutions.

HUMIDITY AND SOLUBILITY: Humidity - saturation - vaporization - condensation - wet and dry bulb thermometry Solubility and Crystallization-Dissolution -solubility of gases.

TEXTBOOKS:

1. O.A.Hougen, K. M. Watson and R. A. Ragatz,"Chemical Process Principles", Vol-I,CBS Publishers and Distributors, New Delhi, 1995.
2. D. Himmelblau, ""Basic Principles and Calculations in Chemical Engineering", 5th Edn.,Prentice Hall of India Ltd.,N.Delhi,1994.
3. K V Narayanan and B Lakshmikutty, Stoichiometry and Process Calculations, , PHI
4. B.I.Bhatt and S.M.Vora, "Stoichiometry", Tata McGraw Hill Publishers Ltd., New Delhi, 1996.
5. V.Venkataramani and N.Anantharaman,"Process Calculations",Prentice Hall of India Ltd.,N.Delhi,2003.
6. Pallb Ghosh , Numerical methods with Computer Programs in C++, , PHI

CH386: CHEMICAL PROCESS INDUSTRIES

L – T – P
3 – 1 – 2

Time : 3 Hrs
Theory : 100 marks
Sessional : 50 marks
Practical : 50 marks

1. Chlor-alkali Industries: Manufacture of Soda ash, Manufacture of caustic soda and chlorine - common salt. Sulphur and Sulphuric acid, manufacture of hydrochloric acid .
2. Types and Manufacture of Portland cement, manufacture of glasses and special glasses, Ceramics, Refractories.
3. Nitrogen Fertilizers, Phosphetic Fertilizers, Potassium Fertilizers
4. Production and processing of Pulp, production of different papers.
5. Oils and fats of vegetable and animal origin, processing of oils and fats, fatty acid and fatty alcohol production, hydrogenation. Essential oils. Manufacture of soaps, glycerin and detergents.
6. Functionality concept of polymerization. Types and methods of polymerization, production of polyolefines, polystyrene, polyvinyl esters, acrylic plastic, p-f, u-f, m-f, resins epoxy resins, alkyd resins, brief idea on moulding, and properties of plastic. Different types of rubber, Vulcanizations products of SBR. Nylon, polyester, acrylic cellulose fibres (Rayon & cellulose acetate)

PRACTICALS

1. Oil analysis :-
 - (a) Determination of iodine value.
 - (b) Determination of saponification value.
 - (c) Determination of fatty acid.
2. Soap analysis :-
 - (a) Moisture content determination.
 - (b) Free fatty acid determination.
3. Analysis of Water and Cement.

BOOKS

1. Outlines of Chemical Technology by Dryden.
2. Chemical Technology by Sukla & Pandey.
3. Chemical Process Industries by Shreve.
4. Polymer Science and Technology, Fried, 2nd Ed, Prentice Hall

CH 385: Material Science & Corrosion Engineering

L – T – P
3 – 1 – 0

Time : 3 Hrs
Theory : 100 marks
Sessional : 50 marks

1. ATOMIC BONDING: Class of engineering materials - engineering requirement of materials - selection of materials - level of structure - structure of atoms and molecules - bonding in solids - types of bonds and their energies.

2. STRUCTURE AND IMPERFECTIONS IN MATERIALS: Crystal structure: Crystal geometry, structure of solids, methods of determining structures. Imperfections in crystals - types of imperfection. Point imperfection, diffusion in solids - Fick's law, self diffusion.

3. PROPERTIES AND CORROSION OF MATERIAL: Electrical and magnetic properties of materials- Chemical, thermal and technological properties of materials - corrosion, theories of corrosion - control and prevention of corrosion.

4. METALS: Engineering materials - ferrous metals - Iron and steel, Iron-carbon equilibrium diagram. Non ferrous metals and alloys - Aluminium, copper, zinc, lead, nickel and their alloys with special reference to the application in chemical industries.

5. NON METALS: Inorganic materials : Ceramics, glass and refractories - organic materials : wood, plastics and rubber with special reference to the application in chemical industries.

TEXT BOOKS:

1. Montana, Corrosion engineering, McGraw Hill
2. V Raghavan, Materials Science and Engineering, 5th ed, Prentice Hall India
3. Lawrence H. Van Vlack, "Elements of Material Science and Engineering", 1971.
4. S.K. Hajra Choudhury, "Material Science and Processes", 1st Edn., 1977. India Book Distribution Co., Calcutta.

REFERENCE:

1. Manas Chanda, "Science of Engineering Materials", Vol. 1st Edn., 1979, McMillan Co., India Ltd.
2. A K Bhargava, Engineering Materials-Polymers, ceramics and composites,
Prentice Hall India

CH 387 : CHEMICAL ENGINEERING DRAWING (SESSIONAL)

L – T – P

0 – 0 – 3

Sessional : 50 marks.
Total Practicals : 42 Hrs.

Fastenings and other simple parts such as Bolts, Nuts, Rivets, Rivetted joints, Screw Threads, Locking Devices, Couplings.

Assembly and detailed drawing of simple machine parts such as stuffing box, glands, pipe fittings – such as gate valves, globe valves, plugcock, relief valves etc.

Constructional details and free hand sketching of various Chemical Engg. Equipments such as valves, pipe fitting, pumps, reaction vessels, evaporator body, distillation columns, jacketed vessels, heat exchangers etc.

NOTE : Half of the sessional marks (25) will be based on the class work including attendance and the other half (25) will be based on an examination held internally at the end of the session.