

THIRD SEMESTER

MAU201 MATHEMATICS III

L	T	P	Cr.
3	1	0	3

Module 1 (11 hours)
Probability distributions - random variables, Binomial distribution, hyper-geometric distribution, mean and variance of a probability distribution, Chebyshev's theorem, Poisson distribution, geometric distribution, normal distribution, uniform distribution, gamma distribution, beta distribution, Weibull distribution, joint distribution of two random variables.

Module 2 (10 hours)
Sampling distributions and inference concerning means- population and samples, the sampling distribution of the mean (σ known and σ unknown), sampling distribution of the variance, maximum likelihood estimation, point estimation and interval estimation, point estimation and interval estimation of mean and variance, tests of hypothesis, hypothesis concerning one mean, Inference concerning two means.

Module 3 (10 hours)
Inference concerning variances proportions - estimation of variances, hypothesis concerning one variance, hypothesis concerning two variances, estimation of proportions, hypothesis concerning one proportion, hypothesis concerning several proportions, analysis of $r \times c$ tables, chi- square test for goodness of fit.

Module 4 (10 hours)
Regression analysis - bi-variate normal distribution-joint, marginal and conditional distributions, curve fitting, method of least squares, estimation of simple regression models and hypothesis concerning regression coefficients, correlation coefficient-estimation of correlation coefficient, hypothesis concerning correlation coefficient, estimation of curvilinear regression models. Analysis of variance - general principles, completely randomised designs, randomised block diagram, latin square designs, analysis of covariance.

TEXT BOOK

Johnson, R.A., Miller and Freund's Probability and Statistics for Engineers, 6th Edn., Prentice Hall India, 2004.

REFERENCE BOOKS

1. Levin R.I. & Rubin D.S., Statistics for Management, 7th Edn., PHI, New Delhi, 2000.
2. Ross S.M., Introduction to Probability and statistics for Engineers, 3rd Edn., Academic Press (Elsevier), Delhi, 2005.

SHG201 PHYSICAL CHEMISTRY

L	T	P	Cr.
3	1	0	3

Module 1 (10 hours)
Colligative properties - meaning and types, lowering of vapour pressure, Raoult's law - statement and limitation, determination of molecular weight by lowering of vapour pressure, problems, Ostwald's and Walker's method, elevation in boiling point of a solvent – derivation, experimental determination of molecular weight by ebullioscopy method, problems, isotonic solutions - abnormal molecular weight, osmosis and osmotic pressure - explanation of the terms, effect of temperature and concentration and simultaneous effect of both, derivation of molecular weight, Berkley and Hartley's method and problems

Module 2 (10 hours)
Characteristics of chemical equilibrium, introduction to heterogeneous equilibria, law of mass action from kinetic considerations, Van't Hoff reaction isotherm, De Donder's concept of degree of advancement of a reaction, hydrogen-iodine equilibrium, combination of nitrogen and oxygen, dissociation of phosphorus penta chloride, degree of dissociation from density measurements, dissociation of calcium carbonate, dissociation of ammoniates of silver chloride.

Module 3 (11 hours)
Chemical kinetics and catalysis - review of basic concepts, differential and integral forms of rate equations, third order reactions, determination of order, effect of temperature on reaction rates, theories of gas phase reactions, Lindemann's theory, steady state approximation, kinetics of complex reactions, opposing, consecutive and parallel reactions, chain reactions exemplified by acetaldehyde decomposition, and hydrogen-bromine reaction, explosive reactions, reaction kinetics in solutions, solvent and salt effect. Enzyme catalysis (Michelis Menten model), influence of pH and temperature on catalytic activity, inhibition of enzyme catalysed reactions.

Module 4 (11 hours)
Electrochemistry - electrolytic conductance and transference, ionic strength, Debye limiting law of activity coefficients, electrochemical cells, determination of enthalpy, entropy and free energy changes from EMF of cells, concentration cells with and without transference, fuel cells (methanol fuel cell, molten carbonate fuel cell), structure of electrical double layer (Helmholtz-Perrin) Guoy-Chapman and Stern models), electrokinetic potential, Butler-Volmer and Tafel equations, polarography, half wave potential, diffusion current, dropping mercury electrode, Ilkovic equation, applications of polarography.

TEXT BOOKS

1. Peter Atkins and Julio de Paula, Physical Chemistry, 7th Edn., Oxford University Press, New York, 2002.
2. Robert J. Silbey and Robert A Alberty, Physical Chemistry, 3rd Edn., John-Wiley and Sons, Singapore, 2002.
3. Puri, L.R. and Sharma, B.R., Physical Chemistry, 14th Edn, Chand S & Co., New Delhi, 1998.

REFERENCE BOOKS

1. Dogra, S.K. and Dogra, S., Physical Chemistry through Problems, Wiley Eastern Ltd., Hyderabad, 1994.
2. Koltz, I.M. and Rosenberg, R.M., Physical Thermodynamics, Wiley Interscience, New York, 2000.
3. Hillert, M., Phase Equilibria, Phase Diagrams and Phase Transformations: A Thermodynamic Basis, Cambridge University Press, UK, 1998.

SHG202 ORGANIC CHEMISTRY

L	T	P	Cr.
3	0	0	3

Module 1

(10 hours)

Introduction to organic reaction mechanisms - cleavage of a covalent bond, classification of reagents, reaction intermediates, free radicals, electrophiles and nucleophiles, types of organic reactions with one example for each, electronic displacements in covalent bond, inductive effect, inductometric effect, mesomerism, resonance and hyperconjugation.

Module 2

(12 hours)

Benzene and aromatic character, uses of benzene, common aromatic reactions, nomenclature of benzenes, derivatives and orientation of aromatic substitution. Halogen compounds - preparation, properties and uses of aliphatic and aromatic halides. Hydroxy compounds - industrial preparation of alcohols and phenols, properties of hydroxy compounds, polyhydric alcohols and their uses. Carbonyl compounds - preparation and properties of aldehydes, ketones and their uses. Aromatic carbonyl compounds - preparation and properties. Carboxylic acids - preparation and properties of aliphatic and aromatic monocarboxylic acids and their uses. Esters - nomenclature, preparation and properties of esters - acetoacetic ester, malonic ester and their uses. Nitrogen compounds - nitro compounds (aliphatic and aromatic)- preparation, properties and uses, amines - nomenclature, method of preparation of aliphatic and aromatic amines, properties and uses.

Module 3

(10 hours)

Amino acids and proteins - classification, synthesis of amino acids, reactions of carboxyl group and amino group, peptide linkage, end group analysis, colour reaction of proteins, denaturation, DNA, RNA. Drugs - chemotherapy, classification of drugs, structure and application of penicillin, streptomycin and chloramphenicol, sulphadiazine like sulphadiazine, sulphathiazole, sulphadiazine and prothionamide

Module 4

(10 hours)

Dyes - colours and constitution, chromophores and auxochromes, Quinone theory and electron theory of dyes - preparation, colour and application of azodyes, acidic, basic, mordant and direct azodyes, triphenylmethane dyes - malachite green, crystal violet, rosaniline, prosoaniline mordant dyes - application, vat dyes - indigo, synthesis and application

TEXT BOOKS

1. Jain, M.K., Modern Organic Chemistry, Shobhan Lal Nagi Chand and Co., Jalandhar, 1986.
2. Morrison and Boyd, Organic Chemistry, Prentice Hall of India, New Delhi, 1992.
3. Sony, P.L., Organic Chemistry, S.Chand Co., New Delhi, 2003
4. Finar, I.L., Organic Chemistry, (Vol. I & II) 5th Edn., ELBS, London 1975

REFERENCE BOOKS

1. Hendrickson Cram and Hammond, Organic Chemistry, Mc Graw Hill, New York, 1990.
2. Solomons, Organic Chemistry, John Wiley, Singapore, 1992.
3. Francis A Carey, Organic Chemistry, Tata McGraw Hill, New York, 2003.

CHU201 PROCESS CALCULATIONS

L	T	P	Cr.
3	1	0	3

Module 1 (10 hours)

Introduction - conversion of units, dimensional consistency, number of significant figures, precision and accuracy, conversion of units, mole concept and mole fraction, weight fraction and volume fraction, concentration of liquid solutions, molarity, molality, normality, ppm, density and specific gravity, composition relationships, stoichiometric principles.

Module 2 (10 hours)

General material balance equation for steady and unsteady state, simplifications for steady-state processes without chemical reaction, element balance, material balance problems involving multiple subsystems, recycle, bypass and purge calculations

Module 3 (11 hours)

Material balance problems with chemical reactions, concept of limiting, excess reactants, fractional conversion and percentage of conversion, percentage yield, Orsat analysis, ultimate and proximate analysis of fuels, excess air, air-fuel ratio calculations, material balance problems involving simultaneous equations.

Module 4 (11 hours)

Energy balance - heat capacity, estimation of heat capacities, calculation of enthalpy changes (without phase change), enthalpy change for phase transitions, general energy balance, thermochemistry - Hess's law of summation- heat of formation, reaction, combustion, solution and mixing, theoretical flame temperature

TEXT BOOKS

1. Narayanan K.V, and Lakshmikuttyamma, B., Stoichiometry & Process Calculations, Prentice Hall Publishing, Delhi, 2006.
2. Himmelblau, D.H, Basic Principles and Calculations in Chemical Engineering, 5th Edn., Prentice Hall, New York, 1990.
3. Bhatt B.I, and Vora S.M, Stoichiometry, 4th Edn., Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001.

REFERENCE BOOKS

1. Hougen, O.A, Watson, K.M and Ragatz R.A, Chemical Processes Principles (Part-1): Material and Energy Balances, 2nd Edn., Asia Publication House, New Delhi, 2001.
2. Felder, R.M. and Rousseau, R.W., Elementary Principle and Chemical Processes, 3rd Edn., John Wiley & Sons Inc., 2000.

CHU202 FLUID AND PARTICLE MECHANICS

L	T	P	Cr.
3	1	0	3

Module 1 (10 hours)

Introduction - nature of fluids, physical properties of fluids, fluid statics - pressure-density-height relationships, pressure measurement, units and dimensions, dimensional analysis, dimensional number, forces arising out of physical similarity.

Module 2 (11 hours)

Kinematics of fluid flow - stream line, stream tube, velocity potential, Newtonian and non-Newtonian fluids, time dependent fluids, Reynold's number - experiment and significance, momentum balance - forces acting on stream tubes, potential flow, Bernoulli's equation, correction for fluid friction, correction for pump work. Flow of incompressible fluids in pipes, laminar and turbulent flow through closed conduits, velocity profile and friction factor for smooth and rough pipes, head loss due to friction in pipes, fittings etc.

Module 3 (11 hours)

Introduction to compressible flow, isentropic flow through convergent and divergent nozzles and sonic velocity. Flow of fluids through solids - form drag, skin drag, drag coefficient, flow around solids and packed beds, friction factor for packed beds, Ergun's equation, motion of particles through fluids, motion under gravitational and centrifugal fields, terminal settling velocity, fluidization - mechanism, types, general properties, applications

Module 4 (10 hours)

Measurement of fluid flow - orifice meter, venturimeter, pilot tube, rotameter, weirs and notches, wet gas meter and dry gas meter, hot wire and hot film anemometers, transportation of fluids, fluid moving machinery performance, selection and specification, airlift and diaphragm pump, positive displacement pumps, rotary and reciprocating pumps, centrifugal pumps and characteristics.

TEXT BOOK

Warren L. McCabe, Jullian Smith C. and Peter Harriott, Unit Operations of Chemical Engineering, 6th edition, Mc Graw-Hill, New York, 2001.

REFERENCE BOOKS

1. Coulson J M and Richardson J F, Chemical Engineering, Vol. I and II, Pergamon Press, NY, 1990.
2. De Nevers N H, Fluid Mechanics for Chemical Engineers, McGraw Hill, NY, 1991.

MEU204 MACHINE DRAWING

Prerequisite: ZZU 103

L	T	D	Cr.
0	0	3	2

Module 1

(9 hours)

Introduction to machine drawing: principles of orthographic projections applied to machine drawing – first angle and third angle projections, methods of dimensioning and conversion of pictorial projections into orthographic projections. Sectional views - rules and conventions of sectioning, full sectional, half sectional, partial sectional and revolved sectional views of simple machine parts. Welded joints - types of welds, nomenclature of welds, welding symbols, drawing of welded machine parts with details of welding. Screwed fastenings - screw thread forms, V and square threads, nomenclature of threads, conventional representation of threads, hexagonal and square headed bolts and nuts, locking arrangements of nuts, various types of machine screws and set screws, foundation bolts.

Module 2

(12 hours)

Pipe joints - coupler joint, nipple joint, union joint, socket and spigot joint, integral and screwed flanged joints, hydraulic joint and expansion joint. Shaft joints - cotter and pin joints, socket and spigot joint, Gib and cotter joint, sleeve and cotter joint and knuckle joint. Couplings and keys - Muff couplings, flanged couplings, flexible coupling, Oldham's coupling and universal coupling, parallel and tapered sunk keys, hollow and flat saddle keys, feather key and pin key. Bearings - solid journal bearings, bush bearings, plummer block, foot step bearing and pedestal bearing.

Module 3

(15 hours)

Assembly drawings - types, accepted norms. Engine parts - piston, connecting rod, eccentric, stuffing box and crosshead.. Parts of a lathe - tail stock, head stock assembly, tool post and carriage. Valves - stop valves, safety valves, check valves, pressure relief valves and flow and direction control valves. Miscellaneous assemblies - vices, screw jack.

Module 4

(10 hours)

Surface texture - nomenclature of surface texture, designation of surface texture, selection of surface characteristics. Limits, fits and tolerances - nomenclature, classification of fits, systems of fits and tolerances, designation, selection of fits and tolerances. Working/Production drawings - working drawings of simple machine elements. Computer aided drafting - elements of computer aided drafting, simple exercises using graphics packages.

TEXT BOOK

Bhatt N.D., and Panchal V.M., Machine Drawing, Charotar Publishing House, 2006.

REFERENCE BOOKS

1. Narayana K.L., Kannaiah P., and Reddy K.V., Machine Drawing, Wiley Eastern.
2. John K.C., and Varghese P.I., Machine Drawing, VIP Publication
3. Gill P.S., A Text Book of Machine Drawing, Karlson Publication
4. Pippenger J., and Hicks T., Industrial Hydraulics, McGraw Hill
5. Sidheswar N., Kannaiah P., and Sastry V. V. S., Machine Drawing, Tata McGraw Hill

SHG291 PHYSICAL CHEMISTRY LABORATORY

L	T	P	Cr.
0	0	3	2

1. Determination of critical solution temperature of phenol – water system
2. Study of the influence of impurity on the critical solution temperature of phenol – water system
3. Determination of phase diagram of a simple eutectic system - naphthalene-biphenyl system
4. Potentiometric titration – Fe^{2+} vs $\text{K}_2\text{Cr}_2\text{O}_7$
5. Conductometric titration – titration of a weak acid against strong base
6. Conductometric titration - mixture of acids against strong base
7. Polarimetry - determination of concentration of sucrose solution
8. Determination of dissociation constant of weak acid using pH meter
9. Determination of partition coefficient of I_2 between water and CCl_4
10. Determination of equilibrium constant by partition method
11. Determination of concentration of KI solution by partition method

CHU291 FLUID AND PARTICLE MECHANICS LABORATORY

L	T	P	Cr.
0	0	3	2

1. Measurement of viscosity and surface tension of liquids
2. Reynolds experiment to demonstrate laminar and turbulent flow
3. Verification of Bernoulli's principle
4. Flow through orifice and mouthpiece
5. Losses due to friction in pipe lines
6. Losses in pipe fittings, expansion and contraction
7. Terminal settling velocities in viscous medium
8. Flow through packed bed
9. Flow through fluidized bed
10. Orificemeter
11. Venturimeter
12. Flow through weirs and notches
13. Characteristics of centrifugal pump
14. Efflux times and velocities in tanks
15. Pitot static tube set-up