SEMESTER WISE SYLLABUS
III Semester

TAS 301 : MATHEMATICS-III

L	T	P
3	1	0

Unit - I : Integral Transforms
8

Fourier integral, Fourier complex transform, Fourier sine and cosine transforms and applications to simple heat transfer equations.

Z – transform and its application to solve difference equations.

Unit - II : Functions of a Complex Variable - I
9

Analytic functions, C-R equations and harmonic functions, Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for derivatives of analytic functions, Liouvilles theorem, Fundamental theorem of algebra.

Unit - III : Functions of a Complex Variable - II
8

Representation of a function by power series, Taylor's and Laurent's series, Singularities, zeroes and poles, Residue theorem, evaluation of real integrals of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{+\infty} f(x)\, dx$, Conformal mapping and bilinear transformations.

Unit - IV : Statistics and Probability
8

Moments, Moment generating functions, Skewness, Kurtosis,Correlation and Regression, Binomial distribution, Poisson distribution, Normal distribution.

Unit - V : Curve Fitting and Solution of Equations
5

Method of least squares and curve fitting of straight line and parabola, Solution of cubic and bi-quadratic equations.

TCY 302: ORGANIC CHEMISTRY

Unit I

General Organic Chemistry

1. IUPAC nomenclature of bicyclic alkanes ,hetrocycles and carbohydrates .
2. Organomettalic compounds :Applications of Grignard Reagent and Lithium aluminium hydride in organic chemistry.
3. Conformational analysis : various terms , conformational analysis of cyclohexane and 1,2 – disubstituted cyclohexane . **[8]**

Unit II:

Aromaticity and Stereochemistry.

1. Concept of aromaticity in benzoid and non-benzoid compounds.antiaromatic qnd nonaromatic compounds .Directive influence of substitutions and orientations in aromatic compounds . Mechanism of Electrophilic substitution reactions (halogenation ,sulphonation and nitration)and nucleophilic substotition reactions by addition ,elimination and by elimination-addition
2. Stereochemistry :Stereoisomerism of cyclic compounds (cyclohexane),chiral drugs (ibuprofen),the relative and absolute configuration ,stereoselective and stereospecific reactions .

Unit III:

Organic reactions of Industrial Significance .

1. Alkenes and cycloalkenes (oxymercuration–demercuration ;hydroboration ,ozonolysis,oxidation, Diel's-Alder reaction)
2. Alkynes(oxidation,reduction ,ozonolysis &reactions with Hg++).
3. Alcohols, phenols &ethers :Reactions of alcohols with alkaline earth metals ,Iodoform reaction, oxidation, conversion of alcohols into Mesylates &Tosylates ;crown ethers &epoxides ;Reimer-Tiemann reaction , Kolbes-Schimidt reaction mechanisms
4. Aldehydes &Ketones : oxidation &reduction ,Perkin reaction ,Claison-Schmidt reaction, Benzoin condensation, Knovenagel reaction, reformatsky reaction,Wittig reaction.
5. carboxylic acids and their derivatives : Hell-VolhartdZelinsky reaction ,Hoffman bromamide reaction, Curtius and Lorsen Reaction
6. Nitrocompounds:Reduction of nitrobenzene under different conditions
7. Amines:reactions with nitrous acids ,diazotysation and reactions of arenedizonium salts **[8]**

Unit IV:

Biomolecules :

1. Carbohydrates:Reactions of monosaccharides with phenylhydrazene and periodic asset, kiliani-fischer synthesis and ruff degradation.Disaccharides:Hydrolysis of sucrose ,maltose and Lactose.anomers ,epimers ,Lobry-Devan-Ekstien rearrangement.
2. Fattyacids and triglycerols
3. Alpha aminoacids and Proteins **[8]**

Unit V:

1. Visible and Ultraviolet Spectroscopy and Infrared Spectroscopy (Excluding Instrumental details of that) as tools for the determination of Structure of oraganic molecules .
2. Mechanism &applications of the following rearrangement reactions :

4. Wagner-Meerwein rearrangements Claisen rearrangement ,Benzilidine rearrangement ,Fries rearrangement **[8]**

Text Books

1. **Finar, I.L**. "*Organic Chemistry : Vol. I & II*".
2. **Morrison & Boyd** "*Organic Chemistry*".
3. **March, J**. "*Organic Chemistry*".
4. **Soloman, T**. "*Organic Chemistry*".
5. **Srivastava, A.K**. "*Organic Chemistry made simple* ", New Age Publication, New Delhi.

TCH – 301: CHEMICAL ENGINEERING FLUID MECHANICS

Unit 1

Properties of fluids and their classification.

Fluid statics: Forces on fluids, pressure depth relationship for compressible and incompressible fluids.

Forces on submerged bodies.

Rigid body motion, pressure measurements, Euler's equation. 08

Unit 2

Kinematics of flow, Description of velocity field, Stream functions, Angular velocity, Fluids in circulation, Irrational flow. Dimensional analysis; Buckingham'sΠ.theorem ; Dimensionless numbers and their physical significance; Similitude criteria. Mixing and agitation of fluid, Types of mixers and their selection ; Power requirement. **08**

Unit 3

Fluid flow: Laminar and turbulent flows; Pressure drop in pipes and tubes, pipe fittings and pipe network and friction factor; Conservation of mass ,momentum and energy; Navier-Stokes equation; Mechanical energy balance and Bernoulli's Theorem.

08

Unit 4

Flow measuring devices for chemical plants: Orifice meter, nozzle and venturi meters, rotameter and pitot tube. **06**

Unit 5

Pumping and compressing of chemicals and gases, reciprocating pumps, rotary pumps, centrifugal pumps and
blowers. NPSH and calibration.

Mixing and agitation of fluids.

Compressible fluid flow and aerodynamics, Introductory concepts of two-phase flow.

10

Books Recommended

McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill

Fox, R.A. & McDonald, A.T. "Introduction to Fluid Mechanics, 5th ed: John Wiley (1998).

Reference Books

1. **Kumar D S** "*fluid Mechanics*", S.K, Katria and Sons, Delhi (1998.)
2. **Rajput R.K."***Text book of Fluid Mechanics*" , S.Chand and Co., New Delhi, (1998)
3. **Gupta, Vijay and SK Gupta**," *Fluid Mechanics and its Applications*"Wiley Eastern, NewDelhi, (1984)

TCH-302 : Fluid and Particle Operations

Unit 1

Introduction to unit operations and their role in Chemical Engineering industries. Types of Mechanical Operations.

Characteristics of particulate solids: sampling techniques, specification and screen analysis, particle size distribution, particle size measurement, Surface area measurements, statistical mean diameters, relevant equations and problems. 08

Unit 2

Principles of size reduction: Specific properties of solids for size reduction. Energy required for size reduction. Crushing and grinding efficiency. Laws of crushing, pulverization and ultrafine grinding.

Classification of crushing and grinding equipment. Construction and working principle of mostly used equipments, viz., Jaw crushers, gyratory crushers, hammer mill, crushing rolls, ball mills, and fluid energy mills. Mixing of solids, blending, kneading, etc.

Size enlargement: scope and applications, size enlargement techniques. 08

Unit 3

Conveying of bulk solids, classification of conveyors, selection of conveyors.

Storage of solids in bulk protected and unprotected piles, bines, silos, hoppers, mass flow and funnel flow bins. Flow assisting devices, feeders.

Weighing of bulk solids, batch and continuous weighing techniques. 06

Unit 4

Classification of separation methods for different types of mixtures like solid-solid, solid-gas, solid-liquid. Screening, classification of screening equipments.

Mechanical classification and classifiers.

Rare and dense medium separation, magnetic separation, electrostatic separation. Floatation and elutriation. Continuous thickeners, decantation.

Phase separation: Centrifugal separation, Electrostatic precipitators. Impingement separators.

Gas-solid separation: Gravity settling, Impingement separators. Cyclone separators, bag filters, scrubbers. 08

Unit 5

Introduction to flow of fluids in fluidized and packed bed columns. Fixed bed and fluidized bed operations. Pressure drop, loading and flooding in packed beds.

Fluidization and fluidized beds.

Filtration: classification of filters, theory of filtration, cake resistance. 10

Books Recommended

1. Coulson and Richardson: Chemical Engineering, Vol. 2.
2. Brown,G.G. and associates "Unit operations" Wiley ,New york,(1950).
3. Narayanan C.M.& Bhattacharya B.C. "Mechanical opeartions for chemical engineers", Khanna Publishers. 3 rd Ed.1999.

Reference Books

1. **Foust A. S. & associates ,** "*Principles of Unit Operations*" John Wiley and Sons (1980).
2. **McCabe Smith,** "*Unit Operation in Chemical Engineering*" 5th ed. Mc Graw Hill (1985).
3. **Perry R.H. & Chilton C.H.,** "*Chemical Engineers Hand Book"* , 7th ed.Mc graw hill.
4. **Bedger and Bencharo,** " *Introduction to Chemical Engineering*". Tata mc graw hill.
5. **S. K. Gupta,** "*Momentum Transfer Operation*". Tata Mc Graw Hill (1979)
6. **Davidson J.F. &Harrison D.***"Fluidisation"* Academic press (1985)
7. **Kunni & Levenspiel** " *Fluidization engineering* " Wiley (1962)

TCH 303 : PROCESS CALCUALTIONS

Unit I

Units their dimensions and conversions, Mass and volume relations, Stoichiometric and composition relations, Excess reactants, Degree of completion, Conversion, selectivity and yield.

Ideal gas law, Dalton's Law, Amagat's Law, and Average molecular weight of gaseous mixtures.

Effect of temperature on vapour pressure, Vapour pressure plot (Cox chart), Vapour pressures of miscible and immiscible liquids and solutions, Raoult's Law and Henry's Law.

Unit II

Humidity and saturation

Relative Humidity and percent saturation, Dew point, Dry and Wet bulb temperatures, Use of humidity charts for engineering calculations. **[6]**

Unit III

Stoichiometry & Material Balance

Material balances for systems with and without chemical reactions, species and elemental balance.Analysis of systems with by-pass, recycle and purge.

Unit IV

Energy Balance

Heat capacity of gases, liquids and solutions, Heat of fusion and vaporisation. Steady state energy balance for systems with and without chemical reactions. Calculations and application of heat of reaction, combustion, formation, neutralisation and solution. Enthalpy-concentration charts. Combustion of solids, liquids and gaseous fuels, Calculation of theoretical and actual flame temperatures. **[8]**

Unit V

Degrees of freedom in steady state processes, solution of simultaneous material and energy balance problems using flow sheeting codes, Unsteady state material and energy balance **[8]**

Text books

1. **Himmelblau, D.M.** *"Basic Principles and Calculations in Chemical Engineering",* 6th ed. prentice hall (1996).

2. **Felder, R.M.** & **Rousseau, R.W.** *"Elementary Principles of Chemical Processes ",* 3rd edition. John Wiley. (1999).

3. **Bhatt., B.I.** and **Vora S.M.** *"Stoichiomerty"* IInd edition, Tata McGraw Hill (1984)

Reference Books

Hougan D. A., Watson K.M. and Ragatz R. A. "*Chemical Process principles*" Vol. 1 Asia Publishing House (1962)

Luben W.L. and Wenzel, L.A. "*Chemical Process Analysis Mass and Energy Balance*" Prentice Hall (1988)

TCY 352:ORGANIC CHEMISTRY LAB

(L:T:P::0:0:3)

1. Identification of Organic Compounds in the mixture.
2. Preparation of p- Nitroaniline from acetanilide.
3. Estimation of Glucose.
4. Estimation of phenol.
5. Applications of TLC in the organic chemistry.
5. Recrystallization of organic compound (s).

TCH 351: CHEMICAL ENGG. FLUID MECHANICS LAB

1. To calibrate the venturimeter and to find out its discharge coefficient. Also, to plot a graph between Reynolds number and discharge coefficient.
2. To calibrate the orifice meter and to find out its discharge coefficient. Also, to plot a graph between Reynolds number and discharge coefficient.
3. To calibrate the V-notch and to determine its discharge coefficient.
4. To find out the equivalent length of various pipe fittings (i) Gate valve, fully open (ii) Globe valve, fully open (iii) Elbow (iv) Reducer (v) Socket and (vi) Bend.
5. To verify Bernoulli's theorem.
6. To study the characteristics of a centrifugal pump (UPSH / NPSH) / compressor
7. To calibrate the Rotameter..
8. To study the flow characteristics using Reynolds' apparatus.
9. To study the flow curves of fluid's for Newtonian and Non-Newtonian fluids flow conditions.
10. To calibrate and tofind out discharge coefficient using Nozzle flow meter.
11. To find out the viscosity of a given Liquid sample using Falling Ball Viscometer.
12. To calculate the power requirement of mixing

TCH 352: Fluid and Particle Operations Lab

1. To study the performance of Ball Mill and find out it's crushing efficiency.
2. To study the performance of Jaw Crusher and find out it's crushing efficiency.
3. To study the performance of Crushing Rolls and find out it's crushing efficiency.

4. To study the settling characteristics.(Free & Hindered settling) of a given suspension of particles.
5. To study the filtration characteristics of rotary vacuum filter.
6. To study the filtration characteristics of Plate and frame filter press.
7. To study the filtration characteristics of Leaf and sparkle filter.
8. To carry out differential and cumulative screen analysis of given sample of solid particles.
9. To study the pressure drop characteristics through packed beds.
10. To study the pressure drop and porosity in Air fluidized bed.
11. To study the pressure drop and porosity in Liquid fluidized bed.

TAS-401: COMPUTER BASED NUMERICAL METHODS

Unit 1

Problem solving on computer. Algorithms and flow charts.

Introduction to numerical computing, approximations and errors in numerical computations. Truncation and round off errors, propagation of errors.

Root finding: bisection method, regula falsi method, iteration method, Newton Raphson method, Secant method, systems of nonlinear equations. 08

Unit 2

Matrix algebra, Solution of simultaneous linear algebraic equations: Gauss elimination, Gauss Jordan method, LU decomposition, Jacobi method, Gauss Seidel method, SOR method, convergence of iterative methods. Tridiagonal systems and Thomas algorithm, Condition of a system and stability issues. 06

Unit 3

Interpolation and Extrapolation: Newton's forward and backward interpolation formula, Lagrange interpolation formula. Divided differences and Newton's general formula.

Numerical differentiation, Numerical integration : Trapezoidal and Simpson's rules. Newton-Cotes integration formulas, Romberg integration, Gaussian Quadrature. 10

Unit 4

Numerical solution of O.D.E.: Taylor series method, Euler's method, Runge Kutta methods. Multistep methods: Milne's method, Adams method, accuracy, Convergence criteria, stiffness, systems of equations. 08

Unit 5

Boundary Value problems: Finite difference method, solving eigenvalue problems, polynomial method, power method.

Numerical solution of Partial Differential equations. Elliptic, Parabolic and hyperbolic PDEs. 08

Books Recommended

E. Balagurusamy: Numerical Methods, Tata McGraw hill.

Reference Books

1. **Sastry, S. S.** "*Introductory Methods of Numerical Analysis*", 3rd ed. Prentice- Hall of India, New Delhi (2002).
2. "*Schaum's Outlines: Numerical Analysis*", 2nd ed. Tata Mc Graw Hill Publishing Co. Limited (1968)
3. **Kandasamy, P. Thialagawathy, K. & Gumawathy, K.** "*Numerical Methods*", S. Chand & Company Ltd., New Delhi (1999).
4. **Balaguruswamy, E.** "*Numerical Methods*. Tata Mc Graw Hill Publishing Company Limited, New Delhi (2001).

5. **V. K. Singh** *"Numerical and Statistical Methods in Computer"* (2005), Paragon International Publishers, New Delhi.
6. **Jain, Iyengar and Jain**, *"Numerical Methods for Scientific and Engineering Computation*" (2003), New Age International, New Delhi.
7. **Grewal B.S.,** *"Numerical Methods in Engineering and Science",* Khanna Publishers, Delhi.

TCY 402: PHYSICAL AND ANALYTICAL CHEMISTRY

UNIT – I

Chemical Kinetics : Kinetics of fast reactions (relaxation and flow technique) , chain reactions , reactions between ions , salt effect **[8]**

UNIT – II

Catalysis : Acid base catalyzed reaction, enzyme catalyzed reaction and Heterogeneous catalyzed reaction

Surface chemistry: Adsorption , adsorption Isotherms-Freundich and Langmuir , Surface Tension-Determination and Applications **[8]**

UNIT – III

Colloids: General methods of preparation and properties, hydrophilic and hydrophobic sols ,

Electrical Properties of colloids

Colligative Propperties :Lowering of Vapor Pressure , Elevation in boiling point , lowering in melting point , Osmotic Pressure and their relation with molecular weight
[8]

UNIT – IV

Electrochemistry : Cells , Classifications , Liquid junction Potential , E.M.F. of Cell and Thermodynamic functions K , ΔF, ΔA,ΔS. Applications of E.M.F. Measurement to Equilibrium constant , Solubility Product , Concept of Activity and activity coefficient **[8]**

UNIT – V

General Analytical methods : A brief Introduction to Conductometry , Potentiometry

Polarography , GLC,HPLC and TGA/DTA . **[8]**

Text Books

1- Glasstone, S. "*Physical Chemistry***"**
2- Rakshit, P. C. "*Physical Chemistry***"**
3- Atkin, P. W. "*Physical Chemistry***"**
4- Laidler, K. J. *"Kinetics and Mechanism"*
5- Frost & Pearson, *"Chemical Kinetics"*
6- Banwell, C. N. *"Fundamentals of Molecular Spectroscopy"*
7- Willard Merit & Dean *"Instrumental Methods of Chemical Analysis"*
8- Skoog & West *"Instrumental Methods of Chemical Analysis"*

TCH 401: HEAT TRANSFER OPERATIONS (L:T:P::3:1:0)

Unit 1

Introduction to heat transfer and general concepts of heat transfer by conduction, convection and radiation.

Conduction: Basic concepts of conduction in solids, liquids and gases, steady state temperature fields and one dimensional conduction without heat generation, e.g., through plane walls, cylindrical and spherical surfaces, composite layers, etc.

Insulation materials, critical and optimum insulation thickness.

Extended surfaces, fins and their practical applications. Introduction to unsteady state heat transfer. **07**

Unit 2

Convection: Fundamentals of convection, Basic concepts and definitions, natural and forced convection, hydrodynamic and thermal boundary layers,

laminar and turbulent heat transfer inside and outside tubes. Dimensional analysis, determination of individual and overall heat transfer coefficients and their temperature dependence, heat transfer in molten metals. **09**

Unit 3

Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, view factors, Kirchoff's law, solar radiations, combined heat transfer coefficients by convection and radiation. **04**

Unit 4

Heat Transfer with Phase Change: Condensation of pure and mixed vapors, film wise and drop wise condensation, loading in condensers and basic calculation on condensers,

heat transfer in boiling liquids, boiling heat transfer coefficients.

Evaporation: Elementary principles, types of evaporators. Single and multiple effect evaporators and their calculation, thermocompression. **10**

Unit 5

Heat Transfer Equipment: Classification, principles and design criteria, types of exchangers, viz., double pipe, shell and tube, plate type, extended surface,

Furnaces and their classification and application. **10**

Books Recommended

Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).

Reference Books

1. Coulson, J.M. & Richardson, J.F. "*Chemical Engineering :Vol-1*", 6th ed. Butterworth-Heinemann(1999)

2. **McAdams W.H.** "*Heat Transmission*", 3rd ed., McGraw-Hill, (1954)

3. **Kern D.Q**. "*Process Heat Transfer*" McGraw Hill Book (1950)

4. **Badger W.L. & Bancharo J.T**. ,"*Introduction to chemical engineering*" Tata McGraw Hill .

TCH 402: TRANSPORT PHENOMENA

Unit I

Introduction to Transport Phenomena

Similarity between momentum, heat and mass transfer, The continuum hypothesis, Basic laws of fluid motion, Newton's second law of motion, principle of balance between momentum, heat and mass transfer, Principles of conservation of momentum, mass and energy.

Unit II

Momentum Transport Phenomena

Momentum transport in laminar flow: Newton's law of viscosity, Science of rheology, Prediction of viscosity and its dependence on temperature, pressure and composition, Boundary conditions, Shell balance approach for stress distribution and velocity profiles.

Introduction to time derivatives and vector analysis, Equation of continuity and equation of motion and their applications in fluid flow problems.

Unit III

Unsteady state momentum transport, Flow near a wall suddenly set in motion,

Momentum transport phenomena in turbulent flow. Definitions of friction factors, friction factor for flow in tubes, for flow around spheres, for packed bed column.

Unit IV

Energy Transport Phenomena

Energy transport in laminar flow: Fourier's law of heat conduction, Prediction of thermal conductivities and its dependence on temperature, pressure and composition, Boundary conditions, shell balance approach. Types of heat sources, Principle of extended surfaces, types of cooling fans, free and forced convection.

Unsteady state heat transport, Unsteady state heat conduction in solids, heating of semi-infinite slab, heating of finite slab.

Unit V

Mass Transport Phenomena

Definitions of concentration, velocities and mass fluxes, Fick's law of diffusion, Prediction of diffusivity and its dependence on temperature, pressure and composition, Boundary conditions, Shell balance approach for mass transfer problems, Problems of diffusion with homogeneous and heterogeneous chemical reaction, Diffusion and chemical reaction in porous catalyst – the effectiveness factor. The equation of continuity for multicomponent mixtures.

Text Books

1. **Bird, R. B., Stewart, W. E. and Lightfoot, E. N.,** "*Transport Phenomena*", 2nd edition John Wiley (1960).

2. **Bannet, C. O. and Myers J. E**., "*Momentum Heat and Mass Transfer*" Tata McGraw Hill, (1973)..

3. **RS Broadkey dan HC Hersey,** "*Transport Phenomena:AUnified approach*", McGraw-Hill Book, (1988).

Reference Books

1. **Beck, W. J. and Muttzall, K.M.K**., "*Transport Phenomena*", John Wiley, (1975).

2. **Loddha, G. S. and Degaleesan T. E**. "*Transport Phenomena in Liquid Extraction*", Tata McGraw Hill, (1975).

3. **Slattery, J**. "*Momentum, Energy and Mass Transfer in Continua*", McGraw Hill, (1972).

4. **Scissom, L. E. and Pitts, D. R.,** "*Elements of Transport Phenomena*", McGraw Hill, (1972).

5. **Theodere, L**. "*Transport Phenomena for Engineers*", International Textbook Co.,(1971).

TCH 403: CHEMICAL ENGINEERING THERMODYNAMICS -I

Unit I

Basic concepts and first law of Thermodynamics

Introduction: Scope of thermodynamics, force, temperature, pressure, work, energy, heat, First law of thermodynamics for closed & open system, Internal energy, application of first law to open system for steady and unsteady state e.g. nozzles, turbines, Throttling valves, heat exchanger and filling and evacuation of Tank.

Unit II

Volumetric properties of pure fluids : P.V.T. behaviour of pure substance, Compressibility factor, laws of corresponding states, rec

Unit III

Second and Third Laws of thermodynamics

Statements, heat engines, heat pumps, Thermodynamic temperature scales, Entropy, entropy changes of an ideal gas, entropy balance for open and closed systems, Calculation of ideal work, Lost work and third law of thermodynamics, Entropy change for reacting systems.

Unit IV

Thermodynamic properties of fluids and Application of thermodynamics

Property relations for homogeneous phases (Maxwell's relation, Relations for internal energy, enthalpy, entropy, Cp and Cv in terms of P, V, T and S), Residual and Excess properties, Residual properties by equation of state, Two-phase system, Thermodynamic diagram, Generalized properties, Correlation for gases. Multistage compression process, Duct flow of compressible fluids, Thermodynamic efficiency of turbines, compressor and heat exchangers

Unit V

Power and Refrigeration cycles

Otto Cycle, Diesel Cycle, Bryton cycle, Sterling cycle, Eriction cycle, Steam power Plant, Rankine cycle, Jet engines, Cogeneration system for chemical process plants, Carnot refrigeration, Vapor compression cycle, Absorption refrigeration, Choice and designation of refrigeration, Eco Friendly refrigerants, Heat pumps, Liquefaction processes.

Text Books

1. **Smith, J.M., Van Ness, H.C. & Abbot, M.M.**. Intro to Chemical Engineering Thermodynamics, 6th edition. New York: Mc-Graw Hill, (1996).

2. **Cengel and Boles** " Thermodynamics: An Engineering Approach",Mc graw Hill (2001).

Reference Books

1. **Y.V.C.Rao**," *Chemical Engineering Thermodynamics*" University press(1997).

TAS : 451 NUMERICAL TECHNIQUES LAB (L:T:P::0:0:3)

Use of following Techniques in C/C++ Language

1. Solution of single non-linear algebraic equations by Newton Raphson method.
2. Solution of single non-linear equations by Regulafalsi method.
3. Solution of system of linear simultaneous by Gauss Elimination method.
4. Solution of system of linear simultaneous equation by gauss seidel method and successive over relaxation method.
5. Solution of single first order ordinary differential equations by fourth order Runge-Kutta method.
6. Solution of Heat equations (Parabolic equations) by finite difference method.
7. Solution of Laplace equations (elliptic equation) by finite difference method.
8. Solution of wave equations (Hyperbolic equation) by finite difference method.
9. Finding Newton's interpolatory polynomial for n points.
10. Finding Newton's interpolatory polynomial based on finite difference table for n points.
11. Simpson's 3/8-rule.

TCY 452: PHYSICAL AND ANALYTICAL CHEMISTRY LAB (L:T:P::0:0:3)

1. Determination of percentage composition of mixture with the help of viscosity measurements.
2. Freundlich adsorption isotherm verification.
3. Distribution of solute between two immiscible solvents (I_2 / water + organic solvent). Distribution law.
4. Kinetics: Rate of hydrolysis of ester in presence of acid.
5. Conductivity: (i) Conductivity titration strength of strong acid vs. strong base, (ii) Dissociation constant of a weak acid (CH_3COOH).
6. Colligative properties: Determination of molecular weight of a non volatile substance by (i) elevation in boiling point (ii) depression in freezing point.
7. Specrophotometer: (i) verification of Beer's law, (ii) determination of $\lambda_{max.}$
8. Potentiometric titration.

TCH 451: HEAT TRANSFER OPERATIONS LAB (L:T:P::0:0:4)

1. To find the thermal conductivity of metallic rod at different temperature and draw the temperature profile for steady and un-steady state conduction.
2. To find out the thermal conductivity of insulating powder.
3. To find the thermal conductivity of liquid / gases.
4. To find the emissivity of grey plate with respect to black plate
5. To study the critical heat flux behaviour of a liquid
6. To find the heat transfer coefficient for parallel and counter current flow condition for a Double pipe heat exchanger

7. To study the shell & Tube heat exchanger and find the heat duty and Over all heat transfer coefficient for parallel flow condition.
8. To study the shell & Tube heat exchanger and find the heat duty and Over all heat transfer coefficient for counter flow condition.
9. Compare the heat duty for parallel &Counter flow And find the energy saving.
10. To study the Plate heat exchanger and find the Over all heat transfer coefficient
11. To study the performance of heat pipe.
12. To find the heat transfer coefficient for open pan evaporator for steady and unsteady state condition.
13. To study Single/Double/Tripple effect Evaporator and find its Steam economy.

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U.P. TECHNICAL UNIVERSITY
LUCKNOW

Syllabus

of

B.Tech. Chemical Engineering

[2nd year 3rd & 4th Semester]

B.TECH. COURSES