BMT101: CALCULUS
Credits: 4
LTP 400

Pre-Requisites: Knowledge about derivatives and Integration

Course Description:
This course provides the students with broad understanding of higher order derivatives and its applications, Curve Tracing and sketching of conics, Vector functions and its applications.

Course Learning Outcomes:

After doing this course students will be able to
CO1: Solve the problems related to Limit, Continuity,
CO2: Solve the problems related to Differentiability and integrability of functions
CO3: Learn the techniques to trace different types of curves which are highly applicable in different fields of study.

Contents:

Unit I

Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type e^{ax+b}sinx, e^{ax+b}cosx, $(ax+b)^n$sinx, $(ax+b)^n$cosx, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit II

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\, dx$, $\int \cos nx\, dx$ dx, $\int \tan nx\, dx$, $\int \sec nx\, dx$, $\int (\log x)^n\, dx$, $\int sin^n x\, sin^m x\, dx$, parametric equations, parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution.

Unit III

Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit IV

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer- Verlag, New York, Inc., 1989.
5. Liefhold, L 1997, *Calculus and Analytic Geometry*, 6th edn, Harper & Row.

Web Links:

1. https://nptel.ac.in/courses/111/104/111104085/
2. https://nptel.ac.in/courses/122/104/122104017/
3. https://nptel.ac.in/courses/111/103/111103021/
4. https://nptel.ac.in/content/storage2/courses/122101003/downloads/Lecture-9.pdf

BMT121: CALCULUS LAB

Credits: 2

LTP 004

Pre-Requisites: Knowledge about derivatives and Integration

Course Description:

This course provides the students with broad understanding of higher order derivatives and its applications, Curve Tracing and sketching of conics, Vector functions and its applications.

Course Learning Outcomes:

After doing this course students will be able to

CO1: Solve the problems related to Limit, Continuity,

CO2: Solve the problems related to Differentiability and integrability of functions

CO3: Learn the techniques to trace different types of curves which are highly applicable in different fields of study.

List of Practicals (using any software)

(i) Plotting of graphs of function e^{ax+b}, log (ax + b), 1/ (ax + b), sin (ax + b), cos (ax + b), |ax + b| and to illustrate the effect of a and b on the graph.

(ii) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.

(iii) Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).

(iv) Obtaining surface of revolution of curves.

(v) Tracing of conics in Cartesian coordinates/ polar coordinates.

(vi) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates.

(vii) Matrix operation (addition, multiplication, inverse, transpose).

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd.,Singapore, 2002.
4. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer- Verlag, New York, Inc., 1989.
5. Liefhold, L 1997, *Calculus and Analytic Geometry*, 6th edn, Harper & Row.

BMT202: DIFFERENTIAL EQUATIONS
Credits: 4
LTP 400

Pre-requisites: Nil

Course Description:
The objective of this course is to introduce the students to the theory of differential equations, to give a competence in solving differential equations by using analytical methods.

Course Learning Outcomes:

CO1: The topics included in the course provide the students with broad understanding and capability to solve different types of Differential equations.

Content:

Unit I

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation.

Unit II

Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit III

General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit IV

Mathematical Applications of differential equations in Engineering.

Books Recommended

1. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab,* 2nd Ed., Taylor and Francis group,London and New York, 2009.
2. C.H. Edwards and D.E. Penny, *Differential Equations and Boundary Value problems Computing and Modeling*, Pearson Education India, 2005.
3. S.L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, India, 2004.
4. Martha L Abell, James P Braselton, *Differential Equations with MATHEMATICA,* 3rd Ed., Elsevier Academic Press, 2004.

Web Links:

1. http://tutorial.math.lamar.edu/Classes/DE/DE.aspx
2. https://www.khanacademy.org/math/differential-equations
3. http://www.sosmath.com/diffeq/diffeq.html
4. https://nptel.ac.in/courses/111/106/111106100/
5. https://www.youtube.com/watch?v=Ty1sy-Mda_w
6. https://www.youtube.com/watch?v=TV4IHvDAg2A&list=PLhmzl7rZy2Ew4op7Fdpzxowx6ExZHIyvH&index=78

BMT222: LAB: DIFFERENTIAL EQUATIONS

Credits: 2

LTP 004

Pre-requisites: Nil

Course Description:

The objective of this course is to introduce the students to the theory of differential equations, to give a competence in solving differential equations by using analytical methods.

Course Learning Outcomes:

CO1: The topics included in the course provide the students with broad understanding and capability to solve different types of Differential equations.

List of Practicals (using any software)

1. Plotting of second order solution family of differential equation.
2. Plotting of third order solution family of differential equation.
3. Predatory-prey model (basic volterra model, with density dependence, effect of DDT, two prey one predator).
4. Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers).
5. Battle model (basic battle model, jungle warfare, long range weapons).

Books Recommended

1. Belinda Barnes and Glenn R. Fulford, *Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab*, 2nd Ed., Taylor and Francis group,London and New York, 2009.
2. C.H. Edwards and D.E. Penny, *Differential Equations and Boundary Value problems Computing and Modeling*, Pearson Education India, 2005.
3. S.L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, India, 2004.

BMT401: NUMERICAL METHODS
Credits: 4
LTP 400

Pre-requisites: Nil

Course Description:
The primary objective is to provide students with knowledge of numerical methods including root-finding, elementary numerical linear algebra, solving systems of linear equations and numerical solution to ordinary differential equations.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

Content: **(** Use of Scientific Calculator is allowed.)

Unit I

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit III

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Unit IV

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: The method of successive approximations, the Euler method, the modified
Euler method, The Runge-Kutta method. Euler's method. Runge-Kutta methods of orders two and four.

Books Recommended

1. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and EngineeringComputation*, 6th Ed., New age International Publisher, India, 2007.
3. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013.
5. John H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012.

Web Links:

1. https://en.wikipedia.org/wiki/Numerical_methods_for_ordinary_differential_equations
2. http://mathfaculty.fullerton.edu/mathews/numerical.html
3. http://www.codewithc.com/category/numerical-methods/
4. http://www.codeproject.com/Articles/17998/Some-simple-numerical-methods-in-C

BMT421: NUMERICAL METHODS LABORATORY

Credits: 2
LTP 004

Pre-requisites: Nil

Course Description:
The primary objective is to provide students with knowledge of numerical methods including root-finding, elementary numerical linear algebra, solving systems of linear equations and numerical solution to ordinary differential equations.

Course Outcomes:
Upon successful completion of the course, the student will be able to:
CO1: Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

List of Practicals (using any software)
(i) Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 + ----------+ 1/ N.
(ii) To find the absolute value of an integer.
(iii) Enter 100 integers into an array and sort them in an ascending order.
(iv) Bisection Method.
(v) Newton Raphson Method.
(vi) Secant Method.
(vii) Regulai Falsi Method.
(viii) LU decomposition Method.
(ix) Gauss-Jacobi Method.
(x) SOR Method or Gauss-Siedel Method.
(xi) Lagrange Interpolation or Newton Interpolation.
(xii) Simpson's rule.

Books Recommended
1. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and EngineeringComputation*, 6th Ed., New age International Publisher, India, 2007.
3. C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, Pearson Education, India, 2008.
4. Uri M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013.
5. John H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012.

BCH101: INORGANIC CHEMISTRY: ATOMIC STRUCTURE AND CHEMICAL BONDING-I

Credits: 4

LTP 400

Pre-Requisites: None

Course Description: This course is offered to the students as a fundamental course. The topics included in the course provide the students with broad understanding of Inorganic Chemistry and develop critical thinking.

Course Outcomes

Completion of this course will enable the students to:
CO1: understand periodic table
CO2: how compounds are formed.
CO3: understand about Chemical bonding
CO4: Understand the molecular structure.

Contents:

UNIT I

Atomic Structure: Review of: Bohr's theory and its limitations, dual behaviour of *matter and* radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom.

UNIT II

Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and
their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1*s* and 2*s* atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s, p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms.
Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

UNIT III

Chemical Bonding and Molecular Structure

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

UNIT IV

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s, s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and

2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches.

Reference Books:

- Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
- Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
- Douglas, B.E., McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry*, John Wiley & Sons.
- Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Education India, 2006.

Web Links:

(a) http://nptel.ac.in/courses.php?disciplineId=104
(b) http://www.slideshare.net/bherren/periodic-table-ppt

BCH121: INORGANIC CHEMISTRY: ATOMIC STRUCTURE AND CHEMICAL BONDING-I – LAB

Credits: 2

LTP 004

Pre-Requisites: None

Course Description: This course is offered to the students as a fundamental course. The topics included in the course provide the students with broad understanding of Inorganic Chemistry and develop critical thinking.

Course Outcomes

CO1: Student will be able to have complete understanding of periodic table, how compound formed.

CO2: Student will be able to have knowledge about basic of organic chemistry , mechanism basic and stereochemistry involved in it.

List of experiments:-

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with $KMnO_4$.
3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.
4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

BCH201: ORGANIC CHEMISTRY: ORGANIC BASIC AND HYDROCARBON

Credits: 4

LTP 400

Pre-Requisites: Nil

Course Objectives: The objective of this course is to predict and explain patterns in shape, structure, bonding, formal charge, stability, acidity, basicity, solubility and reactivity for hydrocarbons, halocarbons, alkenes, dienes by understanding and applying concepts of organic chemical structure and bonding and stability.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO1: Identify, classify, organize, analyze, and draw structures of organic molecules.

CO2: Apply the basic rules of organic nomenclature to convert between structures and names.

CO3: Draw organic structures consistent with the results of specific chemical tests.

Contents:

UNIT –I

Fundamentals of Organic Chemistry

Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

UNIT-II

Stereochemistry

Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis - trans* nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

UNIT -III

Aliphatic Hydrocarbons

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

UNIT IV

Alkenes: (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes(Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cisaddition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Alkynes: (Upto 5 Carbons) *Preparation:* Acetylene from CaC2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. KMnO4.

Books Recommended:

- Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- Eliel, E.L. *Stereochemistry of Carbon Compounds*, Tata McGraw Hill education, 2000.
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010.
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.

BCH221: ORGANIC CHEMISTRY: ORGANIC BASIC AND HYDROCARBON-LAB

Credits: 2

LTP 004

Pre-Requisites: Nil

Course Description:

The objective of this course is to predict and explain patterns in shape, structure, bonding, formal charge, stability, acidity, basicity, solubility and reactivity for hydrocarbons, halocarbons, alkenes, dienes by understanding and applying concepts of organic chemical structure and bonding and stability.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

CO1: Identify, classify, organize, analyze, and draw structures of organic molecules.

CO2: Apply the basic rules of organic nomenclature to convert between structures and names.

CO3: Draw organic structures consistent with the results of specific chemical tests.

List of experiments:

1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)
   (a) Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography
   (b) Identify and separate the sugars present in the given mixture by paper chromatography.

BCH303: PHYSICAL CHEMISTRY: PHASE EQUILIBRIA AND CHEMICAL KINETICS

Credits: 4

LTP 400

Course Description:
To enable the students to understand phase equilibrium, chemical kinetic, catalysis and surface chemistry

Course Outcomes

CO1: Student will be able to have knowledge about catalysis and how it effect reaction.

CO2: *Student will be able to have knowledge about phase equilibrium, colligative properties and chemical kinetics*

UNIT-I

Phase Equilibria:

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions.

UNIT-II

Three component systems, water-chloroform-acetic acid system, triangular plots. *Binary solutions:* Gibbs-Duhem -Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non ideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

UNIT-III

Chemical Kinetics

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

UNIT-IV

Catalysis:

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Surface chemistry:

Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state.

Reference Books:

• Peter Atkins & Julio De Paula, *Physical Chemistry 9th Ed.*, Oxford University Press (2010).
• Castellan, G. W. *Physical Chemistry*, 4th Ed., Narosa (2004).
• McQuarrie, D. A. & Simon, J. D., *Molecular Thermodynamics*, Viva Books Pvt. Ltd.: New Delhi (2004).
• Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.,* Prentice-Hall (2012).
• Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S.
Commonly Asked Questions in Thermodynamics. CRC Press: NY (2011).
• Zundhal, S.S. *Chemistry concepts and applications* Cengage India (2011).
• Ball, D. W. *Physical Chemistry* Cengage India (2012).
• Mortimer, R. G. *Physical Chemistry 3rd Ed.,* Elsevier: NOIDA, UP (2009).
• Levine, I. N. *Physical Chemistry 6th Ed.,* Tata McGraw-Hill (2011).
• Metz, C. R. *Physical Chemistry 2nd Ed.,* Tata McGraw-Hill (2009).

BCH323: PHASE EQUILIBRIA AND CHEMICAL KINETICS LAB

LTP: 004

CREDITS: 02

Course Description:

To enable the students to understand phase equilibrium, chemical kinetic, catalysis and surface chemistry

Course Outcomes

CO1: Student will be able to have knowledge about catalysis and how it effect reaction.

CO2: *Student will be able to have knowledge about phase equilibrium, colligative properties and chemical kinetics*

I. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
   a. simple eutectic and
   b. congruently melting systems.

III. Distribution of acetic/ benzoic acid between water and cyclohexane.

IV. Study the equilibrium of at least one of the following reactions by the distribution method:
   (a) $I_2(aq) + I^- \rightarrow I_3^-(aq)_{2+}$
   (b) $Cu_{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)n$

V. Study the kinetics of the following reactions.
   a) Initial rate method: Iodide-persulphate reaction
   b) Integrated rate method:
      i. Acid hydrolysis of methyl acetate with hydrochloric acid.
      ii. Saponification of ethyl acetate.
   c) Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methyl acetate.

VI. Adsorption
   Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Reference Books:

• Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R.Chand & Co.: New Delhi (2011). 25

• Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).

• Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

Web Links:

(a) www.**youtube**.com/watch?v=zumZL9lWKGM

(b) www.**youtube**.com/watch?v=zumZL9lWKGM

BMT104: **Computer Fundamentals & Office Automation**
Credits: 4
LTP 400

Course Description: The course aims to equip the students with various Office Automation Tools such as Word processor, Spread sheet program & Presentation program.

The course includes Crafting professional word documents; excel spread sheets, power point presentations using the Microsoft suite of office tools.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Use various Office Automation Tools like Word processor, Spread sheet software & Presentation software.
CO2: Learn the fundamental of processing unit and operating system.
CO3: Various peripheral devices like Input and Output devices of Computer systems, online storage devices.
CO4: Perform documentation, accounting operations, presentation skills.

Course Content

UNIT I

Introduction to Computers: Introduction, Characteristics of Computers, Block diagram of computer. Types of computers and features, Minicomputers, Micro Computers, Mainframe Computers, Super Computers. Types of Programming Languages (Machine Languages, Assembly Languages, High Level Languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary and Secondary) RAM, ROM, PROM, EPROM, Secondary Storage Devices (FD, CD, HD, Pen drive) I/O Devices (Scanners, Plotters, LCD, Plasma Display)Number Systems: Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition, Subtraction, Multiplication.

UNIT II

Algorithm: Definition, Characteristics, Advantages and disadvantages, Examples. Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples. Operating System and Services in O.S., Types of O.S.DOS: History, Files and Directories, Internal and External Commands, Batch Files.

UNIT III

Word Processing: Typing, Editing, Proofing & Reviewing, Formatting Text & Paragraphs, Automatic Formatting and Styles, Working with Tables, Graphics and Frames, Mail Merge, Automating Your Work & printing Documents.

Excel Spreadsheet: Working & Editing in Workbooks, Creating Formats & Links, formatting a Worksheet& creating graphic objects, Creating Charts (Graphs), formatting and analyzing data, Organizing Data in a List (Data Management), Sharing & Importing Data, Printing.

UNIT IV

PowerPoint Presentations: Getting started in PowerPoint, creating a presentation, Creating & editing slides, previewing a slide show, Adding picture & graph, adding sound & video, adding auto shape, Animating objects. Spreadsheets and Database packages: Purpose, usage, command, MS-Excel, Creation of files in MS-Access, Switching between applications.

Recommended Books / Suggested Readings:

1. "Computers Today", D. H. Sanders, Fourth Edition, McGraw Hill, 1988.
2. Fundamental of Computers – By V. Rajaraman B.P.B. Publications.
3. "Fundamental of Computers – By P.K. Sinha.
4. MS-Office 2000(For Windows) – By Steve Sagman.
5. "Information Technology Inside and Outside", David Cyganski, John A. Orr, Paperback Edition, Pearson Education 2002.

BMT124: Computer Fundamentals & Office Automation Lab

Credits: 2
LTP 004

Course Description: The course aims to equip the students with various Office Automation Tools such as Word processor, Spread sheet program & Presentation program.

The course includes Crafting professional word documents; excel spread sheets, power point presentations using the Microsoft suite of office tools.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Recognize when to use each of the Microsoft Office programs to create professional business documents and professional presentation.

CO2: Use Microsoft Office programs to create personal and/or business documents following current professional and/or industry standards.

List of Practical:

1. Demonstration of various parts of a Computer System.
2. Starting the Windows, starting a program, running a program, running multiple programs and switching between windows, customizing the Task bar, recycle bin, restoring the deleted files.
3. Creating and removing folders, Making the taskbar wider, arranging icons on the Desktop, Displaying and hiding the taskbar clock, controlling the size of start menu options, Creating Shortcuts.
4. Expanding and collapsing a folder, Recognizing File types using icons, running a program from explorer, renaming a file or folder, Sorting a folder
5. MS Word Basic, Formatting and Miscellaneous Operations using MS Word, Using the special features of word.
6. Printing envelopes and mail merge.
7. To print envelopes with from addresses and to addresses.
8. To use mail merge facility for sending a circular letter to many persons.
9. To use mail merge facility for printing mailing labels.
10. Preparing a Govt. Order / Official Letter / Business Letter / Circular Letter.
11. Covering formatting commands - font size and styles - bold, underline, upper case, lower, case, superscript, subscript, indenting paragraphs, spacing between lines and characters, tab settings etc.
12. Preparing a newsletter: To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
13. Create an advertisement for your university.
14. Prepare a resume.
15. MS Excel Basics, Using MS Excel, performing various calculations and analyzing data availing, Formulas and Functions, Preparing Charts, Pivot table.
16. Using formulas and functions:

17. To prepare a Worksheet showing the monthly sales of a company in different branch offices (Showing Total Sales, Average Sales).
18. Prepare a Statement for preparing Result of 10 students in 5 subjects (using formula to get Distinction, I Class, II Class and Fail under Result column against each student).
19. MS Presentation Basics, creating a new Presentation based on a template: using Auto content wizard, design template and Plain blank presentation.
20. Creating a Presentation with Slide Transition: Automatic and Manual with different effects.
21. Creating a Presentation applying Custom Animation effects: Applying multiple effects to the same object and changing to a different effect and removing effects.
22. Creating and Printing handouts.

BMT204: Data Structures & Algorithms
Credits: 4
LTP 310

Course Description: The course aims to equip the students with the knowledge of data structures and algorithms.

The course includes arrays, stacks & queues, recursion, linked lists, graphs, trees.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

Course Content

Unit I

Basic Concepts: Data objects and Structures, Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction, Performance analysis-time complexity and space complexity, Examples, Introduction to Linear and Non-Linear data structures.

Array: Array, using one dimensional array, implementing one dimensional array, two-dimensional array, multi-dimensional array.

Unit II

Stacks and Queues: Introduction and primitive operations on stack; Stack application; Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion between prefix, infix and postfix, recursion-tower of Hanoi, introduction and primitive operation on queues, D- queues and priority queues.

Recursion: Introduction, Recursion Properties, Applications of Recursion (Factorial, Addition of Two Number, Power of A Number, Fibonacci Series, Multiplication of Two Number, Tower of Hanoi.) Advantages and Disadvantages of Recursion.

Unit III

Linked List: Linear list ADT-array representation and linked representation, Singly Linked Lists- Operations-Insertion, Deletion, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion.

Tree: definition, terminology, Binary trees-definition, Properties of Binary Trees, Binary Tree ADT, representation of Binary Trees-array and linked representations, Binary Tree traversals, Threaded binary trees

Unit IV

Graphs: Definitions, Terminology, Applications and more definitions, Properties, Graph Representations-Adjacency matrix, Adjacency lists, Graph Search methods - DFS and BFS, Complexity analysis.
Searching: Linear Search, Binary Search, Hashing.
Sorting: Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Merge sort.

Recommended Books / Suggested Readings:

1. E.Horowiz and S.Sahani, " Fundamentals of Data structures", Galgotia Book source Pvt. Ltd.,
2. 2003.
3. R.S.Salaria, "Data Structures & Algorithms" Khanna Book Publishing Co. (P) Ltd., 2002.
4. Y.Langsam et. Al., "Data Structures using C and C++", PHI, 1999.

BMT224: Data Structures & Algorithms Lab

Credits: 2

LTP 004

Course Description: The course aims to equip the students with the knowledge of data structures and algorithms.

The course includes arrays, stacks & queues, recursion, linked lists, graphs, trees.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

List of Practical:

1. To delete an element from Kth position of Array.
2. To insert an element ITEM at Kth position of Array.
3. To insert an element Item in Sorted Array.
4. To implement the operation of Push, Pop and to know the status of stack.
5. An implement to check the status of stack.
6. To find factorial of a number using Recursion.
7. To find multiplication of two number using Recursion.
8. To simulation the game of Tower of Hanoi using recursion.
9. To implement the operation of insertion and deletion on Queue.
10. A menu driven program to implement the operation of addition, deletion, searching, traversing, reversion, sorting, counting number of nodes and at the end erasing the link list.
11. Implementation of stack using linked list.
12. Implementation of Queue using linked list.
13. To create binary search tree, traverse it and find number of leaves and total nodes in the Tree.
14. To arrange the list of number in a Sorted order using Merge Sort.
15. To arrange the list of number in the Sorted order using Quick sort.
16. To checks all the element of list is in sorted order or not.
17. To search an element using sequential or linear search. At the end display time required to search an element including number of comparisons.
18. Write a program in C to find the location of the first node containing ITEM and find the location of an edge in the graph G.
19. Write a program in C to insert new nodes to a graph G and delete a node from a graph G.

BMT305: R Programming
LTP: 400
CREDIT: 04

Pre – Requisite: Basics of Communication System

Course Description: This course provides the knowledge to install and use R for simple programming tasks, extended R libraries and packages which helps to develop R Programs using looping constructs and R mathematical functions that can be used for data exploration in R.

Course Outcomes: After successful completion of the course students should be able to

CO1: Understand the basics in R programming in terms of constructs, control statements, string functions
CO2: Understand the use of R for Big Data analytics
CO3: Learn to apply R programming for Text processing
CO4: Able to appreciate and apply the R programming from a statistical perspective

UNIT – I

Introduction: Introducing to R – R Data Structures – Help functions in R – Vectors – Scalars – Declarations – recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NULL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

UNIT – II

Matrices, Arrays And Lists: Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists

UNIT – III

Data Frames: Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – functions are objects - Recursion– Math and Simulations in R

UNIT – IV

Interfacing: Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering 9 Practical content Based on Theory Concepts.

Text Books

1) Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2) Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series, 2013.

Reference Books

1) Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2) Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

BMT325: R Programming LAB
LTP: 004
Credit : 02

Course Description: This course provides the knowledge to install and use R for simple programming tasks, extended R libraries and packages which helps to develop R Programs using looping constructs and R mathematical functions that can be used for data exploration in R.

Course Outcomes: After successful completion of the course students should be able to

CO1: Master the use of the R interactive environment.
CO2: Expand R by installing R packages.
CO3: Develop Loop constructs in R.
CO4: Use R for descriptive statistics.
CO5: Use R for inferential statistics.

List of practicals.

1. History of R
2. Installing R and packages in R
3. Programs on data types in R.
4. Built in Functions in R
5. Creating and manipulating a vector in R.
6. Creating and operations on factors in R.
7. Operations on Data Frames in R
8. Operations on lists in R.
9. Programs on Operations in R.
10. Comparison of Matrices & vectors in R.
11. Programs on If – else statements in R.
12. Programs on For Loops in R.
13. Programs on While Loops in R.

Text Book:

1. The Art of R Programming, Norman Matloff, Cengage Learning.
2. R for everyone, Lander, Pearson

Reference Books:

1. R cookbook, Paul Teetor, Oreilly.
2. R in Action, Rob Kabacoff, Manning.