Bharti Vishwavidyalaya, Durg (C.G.)

Website - www.bhartiuniversity.org, Email–bhartiuniversity.in@gmail.com

SCHEME OF EXAMINATION

&

SYLLABUS

OF

BACHELOR OF SCIENCE (HONOURS)

IN

MATHEMATICS

UNDER

FACULTY OF SCIENCE

Session: 2021-2022

(Approved by Board of Studies)

EXAMINATION SCHEME

B. Sc. (Honours) Mathematics

B. Sc. (Honours) examination will be conducted in six semester

SEMESTER-I

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -101	Mathematics-I	4	70	30	100
BSHM -102	Mathematics-I	4	70	30	100
BSHM -103	Mathematics-I	4	70	30	100
GE-I	A. Physics-I B. Chemistry-I C. Comp. Sc.-I	4	35	15	50
ECA	Bio-Mathematics	2	35	15	50
AECC	English Communication	2	35	15	50

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
GEL-I	Generic Elective - Practical-I	2	35	15	50

B. Sc. (Honours) Mathematics

SEMESTER–II

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -201	Mathematics-I	4	70	30	100
BSHM -202	Mathematics-II	4	70	30	100
BSHM -203	Mathematics-III	4	70	30	100
GE-I	A. Physics-II B. Chemistry-II C. Comp. Sc.-II	4	35	15	50
ECA	Tour, Industrial Training/ Field Visit, NSS/ Swachhta/ Sports/ others	2	35	15	50
AECC	Environmental Science	2	35	15	50

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
GEL-II	Generic Elective - Practical-II	2	35	15	50

B. Sc. (Honours) Mathematics

SEMESTER–III

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -301	Mathematics-I	4	70	30	100
BSHM -302	Mathematics-II	4	70	30	100
BSHM -303	Mathematics-III	4	70	30	100
BSHM -304	Mathematics-IV	4	70	30	100
GE-III	A. Physics-III B. Chemistry-III C. Comp. Sc.-III	4	35	15	50
SEC-I	Select one from the pool of sec courses offered by different department	4	70	30	100

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
GEL-III	Generic Elective - Practical-III	2	35	15	50

B. Sc. (Honours) Mathematics

SEMESTER–IV

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -401	Mathematics-I	4	70	30	100
BSHM -402	Mathematics-II	4	70	30	100
BSHM -403	Mathematics-III	4	70	30	100
BSHM -404	Mathematics-IV	4	70	30	100
GE-IV	A. Physics-IV B. Chemistry-IV C. Comp. Sc.-IV	4	35	15	50
SEC-II	Select one from the pool of sec courses offered by different department	4	70	30	100

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
GEL-IV	Generic Elective - Practical-IV	2	35	15	50

B. Sc. (Honours) Mathematics

SEMESTER–V

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -501	Mathematics-I	4	70	30	100
BSHM -502	Mathematics-II	4	70	30	100
BSHM -503	Mathematics-III	4	70	30	100
DSE-I	DSE-I-Theory	4	70	30	100
DSE-II	DSE-II-Theory	4	70	30	100

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
DSEL-I	DSE-I-Lab	2	35	15	50
DSEL-II	DSE-II-Lab	2	35	15	50

B. Sc. (Honours) Mathematics

SEMESTER–VI

THEORY

PAPER CODE	SUBJECT	CREDIT	THEORY MARKS	TEACHER ASSESSMENT	TOTAL MARKS
BSHM -601	Mathematics-I	4	70	30	100
BSHM -602	Mathematics-II	4	70	30	100
BSHM -603	Mathematics-III	4	70	30	100
DSE-III	DSE-III-Theory	4	70	30	100
DSE-IV	DSE-IV-Theory	4	70	30	100

PRACTICAL

PAPER CODE	SUBJECT	CREDIT	PRACTICAL MARKS	TEACHER ASSESSMENT	TOTAL MARKS
DSEL-III	DSE-III-Lab	2	35	15	50
DSEL-IV	DSE-IV-Lab	2	35	15	50

* As per UGC CBCS guidelines, University / departments have liberty to offer GE and SEC courses offered by one department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each.

Minimum One Skill Enhancement course shall be proposed by each department (4 credits) [4 L or 2 L+ 2 P or l L+3 P or 3L+ l T] 1P = 2 hours.

***Credit= L+T+P/2**

Where, **L**-Lecture**, T**-Tutorial and **P-** Practical

Total Credits=144

SCHEME FOR PRACTICAL EXAMINATION

EXPERIMENT	MARKS
EXPERIMENT	25
VIVA-VOCE	10
TEACHER ASSESSMENT	15
TOTAL MARKS	50

MATHEMATICS –DSE I-IV (DISCIPLINE SPECIFIC ELECTIVE)

MATHEMATICS -DSE-I: **PROBABILITY AND STATISTICS**

MATHEMATICS -DSE.II: **ECONOMETRICS**

MATHEMATICS -DSE-III: **CRYPTOGRAPHY & NETWORK SECURITY**

MATHEMATICS -DSE-IV: **INFORMATION SECURITY**

SKILL ENHANCEMENT COURSE

SEC-I: **BOOLEAN ALGEBRA**

SEC-II: **AUTOMETA THEORY**

NAME OF THE GENERIC ELECTIVE SUBJECTS OFFERED BY YOUR DEPARTMENT

1. SEMESTER I MATHEMATICS-I
2. SEMESTER II MATHEMATICS-II
3. SEMESTER III MATHEMATICS-III
4. SEMESTER IV MATHEMATICS-IV

B.Sc. (Honours) SEMESTER- I
MATHEMATICS- I
Algebra and Trigonometry part- I (BSHM-101)

CREDITS: 4

UNIT-I Elementary operations on matrices, Inverse of a matrix. Linear independence of row and column matrices, Row rank, column rank and rank of a matrix. Equivalence of column and row ranks.

UNIT-II Application of matrices to a system of linear (both homogeneous and nonhomogeneous) equations. Theorems on consistency of a system of linear equations.

UNIT-III Solutions of cubic equations (Cardons method), Biquadratic equation. Mappings, Equivalence relations and partitions.

UNIT-IV Lagrange's theorem and its consequences. Fermat's and Euler's theorems. Normal subgroups. Quo tient group, Permutation groups. Even and odd permutations. The alternating groups An. Cayley's theorem.

TRIGONOMETRY :

UNIT- V De-Moivre's theorem and its applications. Direct and inverse circular and hyperbolic functions.

TEXT BOOK :

1. I.N. Herstein, Topies in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
3. Chandrika Prasad, Text-Book on Algebra and Theory of equations, Pothishala Private Ltd., Allahabad.
4. S. L. Loney, Plane Trigonometry Part II, Macmillan and Company, London.

REFERENCES :

1. P.B. Bhattacharya, S.K. Jain and S. R. Nagpaul, First Course in linear Algebra, Wiley Eastern, New Delhi, 1983.
2. P.B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra (2 edition), Cambridge University Press, Indian Edition, 1997.
3. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.
4. H.S. Hall and S. R. Knight, Higher Algebra, H. M. Publications, 1994.
5. R. S. Verma and K. S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahabad.

B.Sc. (Honours) SEMESTER- I

MATHEMATICS- II

Calculus-I (BSHM-102)

CREDITS: 4

Differential Calculus

UNIT- I Definition of the limit of a function. Basic properties of limits. Continuous functions and classification of discontinuties.

UNIT- II Asymptotes. Curvature. Tests for concavity and convexity. Points of inflexion.Multiple points.

Integral Calculus

UNIT- III Integration of transcendental functions. Reduction formulae. Definite integrals.

Ordinary Differential Equations

UNIT- IV Degree and order of a differential equation. Equations reducible to the linear form. Exact differential equations. First order higher degree equations solvable for x, y, p. Clairaut's form and singular solutions.

UNIT- V Linear differential equations of second order. Transformation of the equation by changing the dependent variable/the independent variable.

Text Book

1. Gorakh Prasad, Differential Calculaus, Pothishala Private Ltd. Allahabad.
2. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. All ahabad.
3. D. A. Murray Introductory Course in Differential Equations, Orient Longman (India), 1976.

References

1. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
3. P.K. Jain and S. K. Kaushik, An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
4. E. A. Codington, An Introduction to Ordinary Differential Equa tions, Prentics Hall of India, 1961.
5. H.T.H. Piaggio, Elementary Treatise on Differential Equations and their Applications, C.B.S. Publishe & Distributors, Dehli, 1985.
6. W.E. Boyce and P.O. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 1986.

B.Sc. (Honours) SEMESTER- I

MATHEMATICS- III

Vector analysis and Geometry - I (BSHM-103)

CREDITS: 4

Vector Analysis

UNIT- I Scalar and vector product of three vectors. Product of four vectors. Reciprocal Vectors.

UNIT- II Vector integration.

UNIT- III General equation of second degree. Tracing of conics.

Geometry

UNIT- IV Sphere. Cone. Cylinder.

UNIT- V Central Conicoids. Paraboloids. Plane sections of conicoids. Genera ting lines.

Text Books

1. N. Saran and S.N. Nigam, Introduction to vector Analysis, Pothishala Pvt. Ltd. Allahabad.
2. Gorakh Prasad and H. C. Gupta, Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.
3. R.J.T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Machmillan India Ltd. 1994.

References

1. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
3. Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Co., New Delhi.
4. S. L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, london.
5. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of two Dimensions, Wiley Eastern Ltd., 1994.
6. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of three Dimensions, Wiley Eastern Ltd., 1999.
7. N. Saran and R.S. Gupta, Analytical Geometry of three Dimensions, Pothishala Pvt. Ltd.Allahabad.

B.Sc. (Honours) SEMESTER – I

GE-I PHYSICS: MATHEMATICAL PHYSICS-I (BSHP-101)

CREDITS: 4

UNIT-I Calculus-I

Recapitulation: Introduction to Cartesian spherical and cylindrical coordinate system, Intuitive ideas of plotting of curves with example of different curves. Elementary ideas of differentiation of function and Integration of function, multiple integrals (line,surface,volume) and its application with simple curves Approximation: Taylor theorems of single variable.

UNIT-II Calculus-II

First order and Second Order Differential equations, First Order Differential equations and integrating factor. Homogeneous Equations with constant coefficients, Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor with simple illustration.

UNIT-III Vector Calculus-I

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations.Vector product, Scalar triple product and their interpretation in terms of area and volume respectively.Scalar and Vector fields.Vector Differentiation: Directional derivatives and normal derivative.Gradient of a scalar field and its geometrical interpretation.Divergence and curl of a vector field.Del and Laplacian operators.Vector identities.

UNIT-IV Vector Calculus-II

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian.Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

UNIT-V Dirac Delta function and its properties:

Definition of Dirac delta function.Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.

References:

1. Higher engineering Mathematics, B.S.Grewal(Khanna Publishers)
2. Theory and Problems of vector analysis, M.R.Spiegel(Schaum's Outline series)

3. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Ed., Elsevier.
4. An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
5. Differential Equations, George F. Simmons, 2007, McGraw Hill.
6. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
7. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
8. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning

B.Sc. (Honours) SEMESTER - I

MATHEMATICAL PHYSICS-I- LAB-I (BSHP-L-101)

CREDITS: 2

Topics (Description with Applications):

Introduction and Overview Computer architecture and organization, memory and Input/output devices Basics of scientific computing Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow emphasize the importance of making equations in terms of dimensionless variables, Iterative methods Errors and error Analysis Truncation and round off errors, Absolute and relative errors, Floating point computations. Review of C & C++ Programming fundamentals Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (*If---statement. If---else Statement. Nested if Structure. Else---if Statement. Ternary Operator.Goto Statement. Switch Statement. Unconditional and Conditional Looping.While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops*), Arrays (*1D & 2D*) and strings, user defined functions, Structures and Unions, Idea of classes and objects Programs: Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search Random number generation Area of circle, area of square, volume of sphere, value of $\boldsymbol{\pi}$ Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$; $I = \text{Io}\,[(\sin\alpha)/\alpha]2$ in optics Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation Evaluation of trigonometric functions e.g. *sin θ, cos θ, tan θ, etc.* Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop

Also attempt some problems on differential equations like:

1. Solve the coupled first order differential equations for four initial conditions. Plot x vs y for each of the four initial conditions on the same screen for $0 \leq t \leq 15$.

2. The ordinary differential equation describing the motion of a pendulum. The pendulum is released from rest at an angular displacement α. Use the RK4 method to solve the equation for $\alpha = 0.1, 0.5$ and 1.0 and plotP as a function of time in the range $0 \leq t \leq 8\pi$. Also, plot the analytic solution valid in the small P ($sinP \approx P$).

Solve differential equation with the boundary conditions and plot y and dy/dx against x in the given range. Both should appear on the same graph.

References:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn. , 2012, PHI Learning Pvt. Ltd.
2. Schaum's Outline of Programming with C^{++}. J. Hubbard, 2000, McGraw-Hill Pub.
3. Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd Edn. , 2007, Cambridge University Press.
4. A first course in Numerical Methods, U.M. Ascher& C. Greif, 2012, PHI Learning.
5. Elementary Numerical Analysis, K.E. Atkinson, 3 r d Edn. , 2 0 0 7 , Wiley India Edition.
6. Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
7. An Introduction to computational Physics, T.Pang, 2nd Edn. , 2006,Cambridge Univ. Press

B.Sc. (Honours) SEMESTER - I
GE-I INORGANIC CHEMISTRY-I (BSHCY-101)

CREDITS: 4

UNIT –I : Atomic Structure

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s, p, d* and *f* orbitals. Contour boundary and probability diagrams.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

UNIT –II: Periodicity of Elements

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s &p-block'

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(f) Electron gain enthalpy, trends of electron gain enthalpy.

(g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-JafIe's electronegativity scales. Variation of electronegativity with bond order, pa(ial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

UNIT –III: Chemical Bonding

Ionic bond- General characteristics, types of *ions,* size effects, radius ratio rule and its limitations. Packing of ions in crystals. Bonn-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Bonn-Haber cycle and its application, Solvation energy.

Covalent bond- Lewis structure, Valence Bond theory (HeitIer-London approach). Energetics

of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCI, BeF_2, CO_2, (idea of *s-p* mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (o and z bond approach) and bond lengths.

UNIT –IV: Chemical Bonding-II

Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.

Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electro-negativity difference.

Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

Weak Chemical Forces. van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

UNIT- V: Oxidation-Reduction

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.

B.Sc. (Honours) SEMESTER - I
GE-I INORGANIC CHEMISTRY-I PRACTICAL (BSHCY-L101)

CREDITS: 2

1. **Titrimetric Analysis**
   - (i) Calibration and use of apparatus
   - (ii) Preparation of solutions of different Polarity/Normality of titrants
2. **Acid-Base Titrations**
   - (iii) Estimation of carbonate and hydroxide present together in a mixture.
   - (iv) Estimation of carbonate and bicarbonate present together in a mixture.
   - (v) Estimation of free alkali present in different soaps/detergents
3. **Oxidation-Reduction Titrimetry**
   - (vi) Estimation of Fe (II) and oxalic acid using standardized $KMnO_4$ solution.
   - (vii) Estimation of oxalic acid and sodium oxalate in a given mixture.
   - (viii) Estimation of Fe (II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

Reference text:

l. Vogegl, A.l. A Textbook of Quantitatlve I norgganic Analysis, ELBS.

B.Sc. (Honours) SEMESTER- I
GE-I-COMPUTER SCIENCE (C-I): Programming Fundamentals using C^{++} (BSHCS-101)

CREDITS: 4

UNIT-I:

Introduction to C and C^{++}: History of C and C^{++}, Overview of Procedural Programming and Object-Orientation Programming, Using main () function, Compiling and Executing Simple Programs in C^{++}.

Data Types, Variables, Constants, Operators and Basic I/O: Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putcharetc), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.hetc).

Expressions, Conditional Statements and Iterative Statements: Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch- case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

UNIT-II:

Functions and Arrays: Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments.

Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Two-dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

Derived Data Types (Structures and Unions): Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with

structures as members.

UNIT-III:

Pointers and References in C^{++}: Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values

UNIT-IV:

Memory Allocation in C++: Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators, storage of variables in static and dynamic memory allocation

File I/O, Preprocessor Directives: Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

Using Classes in C++: Principles of Object-Oriented Programming, Defining & Using Classes, Class Constructors, Constructor Overloading, Function overloading in classes, Class Variables &Functions, Objects as parameters, Specifying the Protected and Private Access, Copy Constructors,Overview of Template classes and their use.

UNIT-V:

Overview of Function Overloading and Operator Overloading: Need of Overloading functions and operators, Overloading functions by number and type of arguments, Looking at an operator as a function call, Overloading Operators (including assignment operators, unary operators)

Inheritance, Polymorphism and Exception Handling: Introduction to Inheritance (Multi-Level Inheritance, Multiple Inheritance), Polymorphism (Virtual Functions, Pure Virtual Functions), Basics Exceptional Handling (using catch and throw, multiple catch statements), Catching all exceptions, Restricting exceptions, Rethrowing exceptions.

Reference Books

1. HerbtzSchildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill.

2. BjarneStroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley , 2013.

3. BjarneStroustroup, "Programming -- Principles and Practice using C++", 2nd Edition, Addison-Wesley 2014.

4. E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education,2008.

5. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011.

6. John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.

7. Andrew Koeni, Barbara, E. Moo, "Accelerated C++", Published by Addison-Wesley , 2000.

8. Scott Meyers, "Effective C++", 3rd Edition, Published by Addison-Wesley, 2005.

9. Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", FirstCreate space Inc, O-D Publishing, LLC USA.

10. Walter Savitch, "Problem Solving with C++", Pearson Education, 2007.

11. Stanley B. Lippman, JoseeLajoie, Barbara E. Moo, "C++ Primer", Published by Addison-Wesley, 5th Edition, 2012

B.Sc. (Honours) SEMESTER- I

GEL-I-PROGRAMMING FUNDAMENTALS USING C^{++}

PRACTICAL (BSHCS-L-101)

CREDITS: 2

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series S = 1+1/2+1/3+1/4+……
4. WAP to compute the sum of the first n terms of the following series S =1-2+3-4+5…….
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```
*
***
*****
*******
*********
```

10. WAP to perform following actions on an array entered by the user:

i) Print the even-valued elements

ii) Print the odd-valued elements

iii) Calculate and print the sum and average of the elements of array

iv) Print the maximum and minimum element of array

v) Remove the duplicates from the array

vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu shouldalso include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text

enteredas command line arguments.

12. Write a program that swaps two numbers using pointers.

13. Write a program in which a function is passed address of two variables and then alter itscontents.

14. Write a program which takes the radius of a circle as input from the user, passes it to anotherfunction that computes the area and the circumference of the circle and displays the value ofarea and circumference from the main() function.

15. Write a program to find sum of n elements entered by the user. To write this program, allocatememory dynamically using malloc() / calloc() functions or new operator.

16. Write a menu driven program to perform following operations on strings:

a) Show address of each character in string

b) Concatenate two strings without using strcat function.

c) Concatenate two strings using strcat function.

d) Compare two strings

e) Calculate length of the string (use pointers)

f) Convert all lowercase characters to uppercase

g) Convert all uppercase characters to lowercase

h) Calculate number of vowels

i) Reverse the string

17. Given two ordered arrays of integers, write a program to merge the two-arrays to getan ordered array.

18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration

19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration

20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.

21. Create Matrix class using templates. Write a menu-driven program to perform following Matrixoperations (2-D array implementation):

a) Sum b) Difference c) Product d) Transpose

22. Create the Person class. Create some objects of this class (by taking information from the user). Inherit the class Person to create two classes Teacher and Student class. Maintain the respectiveinformation in the classes and create, display and delete objects of these two classes (Use Runtime Polymorphism).

23. Create a class Triangle. Include overloaded functions for calculating area. Overload

assignmentoperator and equality operator.

24. Create a class Box containing length, breath and height. Include following methods in it:
    a) Calculate surface Area
    b) Calculate Volume
    c) Increment, Overload ++ operator (both prefix & postfix)
    d) Decrement, Overload -- operator (both prefix & postfix)
    e) Overload operator == (to check equality of two boxes), as a friend function
    f) Overload Assignment operator
    g) Check if it is a Cube or cuboid

    Write a program which takes input from the user for length, breath and height to test the aboveclass.
25. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks.Create 10 students and store them in a file.
26. Write a program to retrieve the student information from file created in previous question andprint it in following format:

    Roll No. Name Marks
27. Copy the contents of one text file to another file, after removing all whitespaces.
28. Write a function that reverses the elements of an array in place. The function must accept onlyone pointer value and return void.
29. Write a program that will read 10 integers from user and store them in an array. Implement arrayusing pointers. The program will print the array elements in ascending and descending order.

Reference Books

1. HerbtzSchildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill.
2. BjarneStroustrup, "The C++ Programming Language", 4th Edition, Addison-Wesley , 2013.
3. BjarneStroustroup, "Programming -- Principles and Practice using C++", 2nd Edition, Addison-Wesley 2014.
4. E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education,2008.

B.Sc. (Honours) SEMESTER - I

ECA- BIO-MATHEMATICS

CREDITS: 2

UNIT- I Mathematical Biology and the modeling process: an overview, Continuous models, Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling type growth, Bacterial growth in a Chemostat, Harvesting a single natural population.

UNIT- II Prey predator systems and Lotka Volterra equations, Populations in competitions, Epidemic Models (SI, SIR, SIRS, SIC), Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numerical solution of the models and its graphical representation.

UNIT- III Qualitative analysis of continuous models: Steady state solutions, stability and linearization, multiple species communities and Routh-Hurwitz Criteria, Phase plane methods and qualitative solutions, bifurcations and limit cycles with examples in the context of biological scenario. Spatial Models: One species model with diffusion, Two species model with diffusion, Conditions for diffusive nstability, Spreading colonies of microorganisms, Blood flow in circulatory system, Travelling wave solutions.

UNIT- IV Spread of genes in a population. Discrete Models: Overview of difference equations, steady state solution and linear stability analysis, Introduction to Discrete Models, Linear Models, Growth models, Decay models, Drug Delivery Problem, Discrete Prey-Predator models, Density

UNIT-V Density dependent growth models with harvesting, Host-Parasitoid systems (Nicholson-Bailey model), Numerical solution of the models and its graphical representation. Case Studies: Optimal Exploitation models, Models in Genetics, Stage Structure Models, Age Structure Models.

Books Recommended:

1. L.E. Keshet, *Mathematical Models in Biology*, SIAM, 1988.

2. J. D. Murray, *Mathematical Biology*, Springer, 1993.

3. Y.C. Fung, *Biomechanics*, Springer-Verlag, 1990.

4. F. Brauer, P.V.D. Driessche and J. Wu, *Mathematical Epidemiology*, Springer, 2008.

5. M. Kot, *Elements of Mathematical Ecology*, Cambridge University Press, 2001.

B.Sc. (Honours) SEMESTER - I
AECC- ENGLISH LANGUAGE

CREDITS: 2

UNIT I COMMUNICATION THEORY AND TYPES

Theory of Communication, Types and modes of Communication Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal,Inter-personal and Group communication

UNIT II SPEAKING SKILLS

Monologue Dialogue Group Discussion Effective Communication/ Mis-Communication,Interview Public Speech.

UNIT III READING AND UNDERSTANDING

Close Reading Comprehension Summary Paraphrasing Analysis and Interpretation Translation (from Indian language to English and vice-versa) Literary/Knowledge Texts.

UNIT IV WRITING SKILLS

Documenting Report Writing Making notes Letter writing .

UNIT-V FUNCTIOANL GRAMMAR

Parts of Speech, Word order / Types of Sentences, Questions (Affirmative and Negative), Present Perfect – Simple & Continuous, Present Perfect and Past Simple, Future Tense, Articles, Prepositions, Modals, Conjunctions, Quantifiers and Voice.

REFERENCE BOOKS:

1. English Language and Indian Culture - Published by M.P. Hindi Grant Academy Bhopal.

B.Sc. (Honours) SEMESTER- II
MATHEMATICS- I
Algebra and Trigonometry-II (BSHM-201)

CREDITS: 4

Algebra

UNIT- I Eigenvalues, eigenvectors and the characteristic equations of a matrix. Cayley Hamilton theorem and its use in finding inverse of a matrix.

UNIT- II Relation between the roots and coefficients of general polynomial equations in one variable. Transformation of equations. Descarte's rule of signs.

UNIT- III Congruence modulo n. Definition of a group with examples and simple properties. Subgroups, generation of groups, cyclic groups coset decomposition.

UNIT- IV Homomorphism and Isomorphism of groups. The fundamental theorems of homomorphism. Introduction, properties and examples of rings, Subrings, Integral domain and fields Characteristic of a ring and Field.

Trigonometry

UNIT- V Logarithm of a complex quantity. Expansion of trigonometrical functions. Gregory's series. Summation of series.

Text Book

1. I. N. Herstein, Topies in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. K. B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.
3. Chandrika Prasad, Text-Book on Algebra and Theory of equations, Pothishala Private Ltd., Allahabad.
4. S. L. Loney, Plane Trigonometry Part II, Macmillan and Company, London.

References

1. P.B. Bhattacharya, S.K. Jain and S. R. Nagpaul, First Course in linear Algebra, Wiley Eastern, New Delhi, 1983.
2. P.B. Bhattacharya, S. K. Jain and S. R. Nagpaul, Basic Abstract Algebra (2 edition), Cambridge University Press, Indian Edition, 1997.
3. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic linear Algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.
4. H.S. Hall and S. R. Knight, Higher Algebra, H. M. Publications, 1994.
5. R. S. Verma and K. S. Shukla, Text Book on Trigonometry, Pothishala Pvt. Ltd., Allahabad.

B.Sc. (Honours) SEMESTER- II

MATHEMATICS- II

Calculus- II (BSHM-202)

CREDITS: 4

Differential Calculus

UNIT- I Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

UNIT- II Tracing of curves in cartesian and polar coordinates.

Integral calculus

UNIT- III Quadrature. Rectification. Volumes and surfaces of solids of revolution.

Ordinary Differential Equations

UNIT- IV Geometrical meaning of a differential equation. Orthogonal trajectories. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations.

UNIT- V Method of variation of parameters. Ordinary simultaneous differential equations.

Text Book

1. Gorakh Prasad, Differential Calculaus, Pothishala Private Ltd. Allahabad.
2. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. All ahabad.
3. D. A. Murray Introductory Course in Differential Equations, Orient Longman (India), 1976.

References

1. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus , Schaum's outline series, Schaum Publishing Co. New York.
3. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
4. P.K. Jain and S. K. Kaushik, An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
5. G.F. Simmons, Differential Equations, Tata Mc Graw Hill, 1972.
6. E. A. Codington, An Introduction to Ordinary Differential Equa tions, Prentics Hall of India, 1961.
7. H.T.H. Piaggio, Elementary Treatise on Differential Equations and their Applications, C.B.S. Publishe & Distributors, Dehli, 1985.
8. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley and Son s, 1999.

B.Sc. (Honours) SEMESTER - II

MATHEMATICS - III

Vector Analysis and Geometry-II (BSHM-203)

CREDITS: 4

Vector Analysis

UNIT- I Vector differentiation. Gradient, divergence and curl.

UNIT- II Theorems of Gauss, Green, Stokes and problems based on these.

Geometry

UNIT- III System of conics. Confocal conics. Polar equation of a conic.

UNIT- IV Sphere. Cone. Cylinder.

UNIT- V Confocal Conicoids. Reduction of second degree equations.

Text Books

1. N. Saran and S.N. Nigam, Introduction to vector Analysis, Pothishala Pvt. Ltd. Allahabad.
2. Gorakh Prasad and H. C. Gupta, Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.
3. R.J.T. Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Machmillan India Ltd. 1994.

References

1. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
2. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley & Sons, 1999. 4. Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Co., New Delhi.
3. S. L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, london.
4. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of two Dimensions, Wiley Eastern Ltd., 1994.
5. P.K. Jain and Khalil Ahmad, A Text Book of Analytical Geometry of three Dimensions, Wiley Eastern Ltd., 1999.
6. N. Saran and R.S. Gupta, Analytical Geometry of three Dimensions, Pothishala Pvt. Ltd.Allahabad.

B.Sc. (Honours) SEMESTER - II
GE-II PHYSICS: ELECTRICITY AND MAGNETISM (BSHP-201)

CREDITS: 4

UNIT-I Electric Field and Electric Potential

Electric field: Electric field lines. Electric flux.Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.

Conservative nature of Electrostatic Field.Electrostatic Potential.Laplace's and Poisson equations.The Uniqueness Theorem.Potential and Electric Field of a dipole. Force andTorque on a dipole.

Electrostatic energy of system of charges.Electrostatic energy of a charged sphere.Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors.Parallel-plate capacitor.Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

UNIT-II Dielectric Properties of Matter

Electric Field in matter.Polarization, Polarization Charges.Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics.

UNIT-III Magnetic Field

Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge(2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.

Magnetic Properties of Matter: Magnetization vector (**M).** Magnetic Intensity(**H).** Magnetic Susceptibility and permeability.Relation between **B, H, M**. Ferromagnetism.B-H curve and hysteresis.

UNIT-IV Electromagnetic Induction

Faraday's Law.Lenz's Law.Self Inductance and Mutual Inductance.Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge

Conservation and Displacement current.

UNIT-V Electrical Circuits

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

Network theorems: Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem.Applications to dc circuits.

References:

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
4. Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education
5. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
6. Electricity and Magnetism, J.H.Fewkes&J.Yarwood. Vol.I, 1991, Oxford Univ. Press.

B.Sc. (Honours) SEMESTER - II
GE-II ELECTRICITY AND MAGNETISM LAB-I (BSHP-L-201)

CREDITS: 2

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
4. To verify the Thevenin Theorem.
5. To verify the Norton theorem.
6. To verify the Superposition, and Maximum power transfer theorems.
7. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
8. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
9. To determine self-inductance of a coil by Rayleigh's method.
10. To determine the mutual inductance of two coils by Absolute method.
11. To determine the frequency of AC Mains using Sonometer.

References:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.
5. Engineering Practical physics S.Panigrihi and B.Mallick, 2015, Cengage Learning.

B.Sc. (Honours) SEMESTER - II
GE-II ORGANIC CHEMISTRY- I (BSHCY-201)

CREDITS: 4

UNIT- I: Structure and Bonding

Classification, *nomenclature* and general structure *of* organic compounds. Hybridization. orbital representation of methane, ethane, ethylene, acetylene and benzene. Bond energy, bond length and bond angels. Polarity of covalent bonds-Inductive, resonance, hyper-conjugation and steric inhibition in resonance and its influence on acidity and basicity of organic compounds.

UNIT- II: Mechanism of Organic reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double headed arrows. Homoljsis and heterolysis of carbon-carbon bonds; Reactive species e.g. Carbocations, carbanions, free radicals and their stability. Nucleophiles and electrophiles.

UNIT- III: Alkanes and cycloalkanes

Preparation and general reactions of alkanes and cycloalkanes, Bayer Strain theory of strain less ring; Conformation of ethane, *n*-butane and cyclohexane, chlorination of methane and side chain chlorination of toluene.

UNIT-IV: Alkenes

General methods for preparation of alkenes, Reactions of alkenes: Addition reactions (Electrophilic and free radical), Halogenation, Hydrohalogenation, Hydration, Hydroxylation, Hydroboration-oxidation, Mercuration-demercuration, Epoxidation and Ozonoloysis.

Dienes: Conjugated and isolated Dienes; 1,2- versus 1,4-addition. Diels-Alder reaction of dienes: Mechanism.

UNIT-V: Alkynes

Preparation of alkynes, acidity and metal acetylides, Electrophilic addition reactions viz.,Halogenation, Hydrohalogenation, Hydration. Hydroboration-oxidation, Mercuration-demercuration and Ozonoloysis.

Reference Books:

- *"Organic Chemistry*", R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P)Ltd., New Delhi.
- *"Organic Chemistry",* S. M. Mukherjee, S. P. Singh, and R. P. Kapoor, I st Edition (1985), New Age International (P) Ltd. Publishers, New Delhi.

- *"Organic Chemistry", I.* L. Finar, [Vol. 1, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in 1996], ELBS and Longman Ltd., New Delhi.
- *'Organic Chemistry - Structure and Reactivity", Seyhan N' Ege, 3rd Edition (1998), AITBS Publishers and Distributtors, Delhi'*
- *-Organic Chemistry", Paula Y. Bruice, 2nd Edition, Prentice-Hall, lntemational Edition* (1998).
- "Organic Chemistry", G. Solomon, W illey India, Paper Back, 9" Edition.
- *"Modern Organic Chemistry",* M. K. Jain and S. C. Sharma, V ishal Publishing CO. Jalandhar, India. 4^{h} Edition (2012).

B.Sc. (Honours) SEMESTER - II
GE-II ORGANIC CHEMISTRY-I LAB (BSHCY-L201)

CREDITS: 2

1. Calibration of the thermometer
2. Purification *of organic* compounds by crystallization using the following solvents: a. Water b. Alcohol, c. Alcohol-Water
3. Determination of the melting points of unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point-mixed melting point of two unknown organic compounds.
5. Detection of special elements (N, S, C1. Br, I).

Reference Books:

- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
- Furniss, B.S.; Hannaford, A.J.: Smith, P.W.G.: Tatchell, A.R. *Practical Organic Chemistry, 5th Ed., Pearson (2012)*

B.Sc. (Honours) SEMESTER – II
GE-II-PROGRAMMING IN JAVA (BSHCS-201)

CREDITS: 4

UNIT I: Introduction to Java

Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods),

UNIT II: Arrays, Strings and I/O

Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System.out and the Scanner class, Byte and Character streams, Reading/Writing from console and files.

UNIT III: Object-Oriented Programming Overview

Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection.

Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing,Enumerations and Metadata.

UNIT IV: Exception Handling, Threading, Networking and Database Connectivity

Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulatingdatabases using JDBC.

UNIT V: Applets and Event Handling

Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms,Listener Interfaces, Adapter and Inner Classes. Thedesign and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts. Overview of servlets.

Reference Books

1. Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition,2005.
2. James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3. Joshua Bloch, "Effective Java" 2nd Edition,Publisher: Addison-Wesley, 2008.
4. Cay S. Horstmann, Gary Corness, "Core Java 2 Volume 1 - Fundamentals)", 9th Edition, PrinticeHall.
5. Cay S. Horstmann, Gary Corness, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition,Printice Hall.
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.
8. Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.
9. "Head First Java", Orielly Media Inc. 2nd Edition, 2005.
10. David J. Eck, "Introduction to Programming Using Java", Published by Create Space Independent Publishing Platform, 2009.
11. John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.

B.Sc. (Honours) SEMESTER – II

GE-II-PROGRAMMING IN JAVA PRACTICAL (BSHCS-L-102)

CREDITS: 2

1. To find the sum of any number of integers entered as command line arguments
2. To find the factorial of a given number
3. To learn use of single dimensional array by defining the array dynamically.
4. To learn use of in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
8. Write a program that show working of different functions of String and String Buffer classs likeset CharAt(, setLength(), append(), insert(), concat() and equals().
9. Write a program to create a "distance" class with methods where distance is computed in termsof feet and inches, how to create objects of a class and to see the use of this pointer
10. Modify the "distance" class by creating constructor for assigning values (feet and inches) to thedistance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
11. Write a program to show that during function overloading, if no matching argument is found,then java will apply automatic type conversions(from lower to higher data type)
12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passedby reference and to learn use of final keyword
13. Write a program to show the use of static functions and to pass variable length arguments in afunction.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the userand the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to

generate Fibonacci series, where the function to generate Fibonacii series is given in a different file belonging to the same package.

17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program "DivideByZero" that takes two numbers a and b as input, computes a/b, andinvokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronizationamong threads (Hint: you can implement a simple producer and consumer problem).
23. Write a program to create URL object, create a URL Connection using the openConnection() method and then use it examine the different components of the URLand content.
24. Write a program that creates a Banner and then creates a thread to scrolls the message in thebanner from left to right across the applet's window.
25. Write a program to get the URL/location of code (i.e. java code) and document (html file).
26. Write a program to demonstrate different mouse handling events like mouse Clicked(), mouse Entered(), mouse Exited(), mouse Pressed, mouse Released() and mouse Dragged().
27. Write a program to demonstrate different keyboard handling events.
28. Write a program to generate a window without an applet window using main () function.
29. Write a program to demonstrate the use of push buttons.

Reference Books

1. Ken Arnold, James Gosling, David Homes, "The Java Programming Language", 4th Edition,2005.
2. James Gosling, Bill Joy, Guy L Steele Jr, GiladBracha, Alex Buckley"The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3. Joshua Bloch, "Effective Java" 2nd Edition,Publisher: Addison-Wesley, 2008.

B.Sc. (Honours) SEMESTER - II
AECC- ENVIRONMENTAL SCIENCE

CREDITS: 2

UNIT – I

General: Environmental segments, environmental degradation, environmental impact assessment. Concept of Ecosystem: Fundamental of Ecology and Ecosystem, components of ecosystem, food-chain, foodweb, trophic levels, energy flow, cycling of nutrients, major ecosystem types (forest, grass land and aquatic ecosystem).

UNIT – II

Air Pollution: Atmospheric composition, energy balance, classification of air pollutants, source and effect of pollutants – Primary (CO, SOx, NOx, particulates, hydrocarbons), Secondary [photochemical smog, acid rain, ozone, PAN (Peroxy Acetyl Nitrate)], green house effect, ozone depletion, atmospheric stability and temperature inversion, Techniques used to control gaseous and particulate pollution, ambient air quality standards.

UNIT – III

Water Pollution: Hydrosphere, natural water, classification of water pollutants, trace element contamination of water, sources and effect of water pollution, types of pollutants, determination and significance of D.O., B.O.D., C.O.D. in waste water, Eutrophication, methods and equipment used in waste water treatment preliminary, secondary and tertiary.

UNIT – IV

Land Pollution & Noise Pollution: Lithosphere, pollutants (agricultural, industrial, urban waste, hazardous waste), their origin and effect, collection of solid waste, solid waste management, recycling and reuse of solid waste and their disposal techniques (open dumping, sanitary land filling, thermal, composting). Noise Pollution: Sources, effect, standards and control.

UNIT – V

Environmental Biotechnology: Definition, current status of biotechnology in environmental protection, bio-fuels, bio-fertilize, bio-surfactants, bio-sensor, bio-chips, bio-reactors. Pollution Prevention through Biotechnology: Tannery industry, paper and pulp industry, pesticide industry, food and allied industry.

TEXT BOOKS

1. Environment and Ecology by Piyush Kant Pandey and Dipti Gupta (Sum India Publication)

2. A Textbook of Environmental Chemistry and Pollution Control by S.S. Dara (S. Chand and Company)

REFERENCE BOOKS:

1. Masters, G.M. Introduction to Environment Engineering and Science (Prentice Hall of India).

2. Environmental Chemistry by A.K. Dey (Eastern Ltd.).

3. Environmental Chemistry by B.K. Sharma (Krishna Prakashan).

4. Nebel B.J. Environmental Science (Prentice Hall of India-1987).

5. Environmental Biotechnology by S.N. Jogdand (Himalaya Publishing House).

6. Introduction to Environmental Biotechnology by A.K. Chatterji (Prentice Hall of India).

B.Sc. (Honours) SEMESTER- III
MATHEMATICS- I

Advanced Calculus- I (BSHM-301)

CREDITS: 4

UNIT-I Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion. Series of non-negative terms. Comparison tests, Cauchy's integral test, Ratio tests, Raabe's test.

UNIT-II Logarithmic, De Morgan and Bertrand's tests. Alternating series, Leibnitz's theorem. Absolute and conditional convergence.

UNIT-III Continuity, Sequential continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems and their geometrical interpretations.

UNIT-IV Darboux's intermediate value theorem for derivatives, Taylor's theorem with various forms of remainders.

UNIT-V Limit and continuity of functions of two variables. Partial differentiation. Change of variables.

References

1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. R.R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
4. D. Soma Sundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
6. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
7. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
8. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
9. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
10. O.E. Stanaitis, An Introduction to Sequences, Series and Improper Integrals, Holden-Dey, Inc., San Francisco, California.

B.Sc. (Honours) SEMESTER- III
MATHEMATICS- II

Differential Equations (BSHM-302)

CREDITS: 4

UNIT-I Series solutions of differential equations- Power series method, Bessel and Legendre functions and their properties-convergence, recurrence and generating relations

UNIT-II Orthogonality of functions, Sturm-Liouville problem, Orthogonality of eigen- functions, Reality of eigen values, Orthogonality of Bessel functions and Legendre polynomials.

UNIT-III Laplace Transformation- Linearity of the Laplace transformation, Existence theorem for Laplace transforms, Laplace transforms of derivatives and integrals, Shifting theorems. Differentiation and integration of transforms.

UNIT-IV Convolution theorem. Solution of integral equations and systems of differential equations using the Laplace transformation.

UNIT-V Partial differential equations of the first order. Lagrange's solution.

References

1. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967.
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London.
4. Lan N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
5. Francis B. Hilderbrand, Advanced Calculus for Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin, Differential equations, Marcel Dekkar, 1994.
7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Company, 1972.
8. Richard Bronson, Theory and Problems of Differential Equations, McGraw-Hill, Inc., 1973.
9. A.S. Gupta, Calculus of variations with-Applications, Prentice-Hall of India, 1997.
10. R. Courant and D. Hilbert, Methods of Mathematical Physics, Vots. I & II, Wil

B.Sc. (Honours) SEMESTER-III

MATHEMATICS- III

Statics & Dynamics (BSHM-303)

CREDITS: 4

Statics

UNIT-I Analytical conditions of Equilibrium, Stable and unstable equilibrium, Catenary.

UNIT-II Virtual work.

UNIT-III Forces in three dimensions, Poinsot's central axis, Null lines and planes.

Dynamics

UNIT-IV Simple harmonic motion. Elastic strings. Velocities and accelerations along radial and transverse directions.

UNIT-V Projectile, Central orbits.

References

1. S.L. Loney, Statics, Macmillan and Company, London.
2. R.S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S.L. Loney, An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956

B. Sc. (Honours) SEMESTER- III

MATHEMATICS- IV

Theory of Equations (BSHM-304)

CREDITS: 4

UNIT- I General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations.

UNIT- II Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations, Symmetric functions, Applications of symmetric function of the roots.

UNIT- III Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

UNIT- IV Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations, Separation of the roots of equations.

UNIT- V Strums theorem, Applications of Strum's theorem, Conditions for reality of the roots of an equation and biquadratic. Solution of numerical equations.

Books Recommended:

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.

2. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

B. Sc. (Honours) SEMESTER- III
GE-III PHYSICS: MATHEMATICAL PHYSICS-II (BSHP-301)

CREDITS: 4

UNIT-I Fourier Series

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients.Complex representation of Fourier series.Expansion of functions with arbitrary period.Expansion of non-periodic functions over an interval.Even and odd functions and their Fourier expansions.Application.Summing of Infinite Series.

UNIT-II Frobenius Method and Special Functions

Singular Points of Second Order Linear Differential Equations and their importance.Frobenius method and its applications to differential equations.Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Bessel Functions of the First Kind: Generating Function, simple recurrence relations.

UNIT-III Some Special Integrals

Beta and Gamma Functions and Relation between them.Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral).

UNIT-IV Partial Differential Equations

Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.

UNIT-V Special Theory of Relativity

Non-inertial frames and fictitious forces.Uniformly rotating frame.Laws of Physics in rotating coordinate systems.Centrifugal force.Coriolis force and its applications. Michelson-Morley Experiment and its outcome.Postulates of Special Theory of

Relativity.Lorentz Transformations.Simultaneity and order of events.Lorentz contraction.Time dilation.Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities.Variation of mass with velocity.Massless Particles.Mass-energy Equivalence.

References:

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
5. Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
6. Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

B. Sc. (Honours) SEMESTER- III
GE-III MATHEMATICAL PHYSICS-II LAB-I (BSHP-L-301)

CREDITS: 2

The aim of this Lab is to use the computational methods to solve physical problems. Course will consist of lectures (both theory and practical) in the Lab. Evaluation done not on the programming but on the basis of formulating the problem

Topics	**Description with Applications**
Introduction to Numerical computation software Scilab	Introduction to Scilab, Advantages and disadvantages,Scilab environment, Command window, Figurewindow, Edit window, Variables and arrays, Initialisingvariables in Scilab, Multidimensional arrays, Subarray,Special values, Displaying output data, data file, Scalarand array operations, Hierarchy of operations, Built inScilab functions, Introduction to plotting, 2D and 3Dplotting (2), Branching Statements and program design,Relational & logical operators, the while loop, for loop,details of loop operations, break & continue statements,nested loops, logical arrays and vectorization (2) Userdefined functions, Introduction to Scilab functions,Variable passing in Scilab, optional arguments,preserving data between calls to a function, Complexand Character data, string function, Multidimensionalarrays (2) an introduction to Scilab file processing, fileopening and closing, Binary I/o functions, comparingbinary and formatted functions.

Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate springConstant
Solution of Linear system of equations by Gauss elimination method and Gauss Seidal method. Diagonalization of matrices, Inverse of a matrix, Eigenvectors, eigen values problems	Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)
Solution of ODE First order Differential equation Euler, modified Euler and Runge-Kutta second order methods Second order differential equation Fixed difference method	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Second order Differential Equation • Harmonic oscillator (no friction) • Damped Harmonic oscillator • Over damped • Critical damped • Oscillatory • Forced Harmonic oscillator
Using Scicos / xcos	Generating square wave, sine wave, saw tooth wave Solution to harmonic oscillator Study of beat phenomenon Phase space plots

References:

1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press.
2. Complex Variables, A.S. Fokas&M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press.

3. First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett.
4. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer.
5. Scilab by example: M. Affouf 2012, ISBN: 978-1479203444.
6. Scilab(A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand& Company.
7. Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing.

B. Sc. (Honours) SEMESTER- III

GE-III PHYSICAL CHEMISTRY-I (BSHCY-102)

CREDITS: 4

UNIT –I : Gaseous state

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, Causes of deviation from ideal behaviour. Van der Waals equal *ion of state*, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

UNIT –II: Liquid state

Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of' mater.

UNIT –III: Solid state

Nature of the solid state, law of constancy où interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry. symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal sj stems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaC1, CsC1 and KCl etc.

UNIT –IV: lonic equilibria-I

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).

UNIT –V: lonic equilibria-II

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry .

Solubility and solubility product of sparingly soluble salts-applications of solubility product principle. Qualitative treatment of acid-base titration curves (calculation of pH at various stages). Theory of acid-base indicators; selection of indicators and their limitations.

Reference Books:

- Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
- Ball, D. W. Physical Chemistry Thomson Press, lndia (2007).
- Castellan, G. W. Physical Chemist 4th Ed. Narosa (2004).
- Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

B. Sc. (Honours) SEMESTER- III

GE-III PHYSICAL CHEMISTRY-I LAB (BSHCY-L-102)

CREDITS: 2

1. To Calibration of thermometer
2. To Determine the Melting point of Organic Compound
3. To Determine the Boiling Point of Water
4. Preparation of solutions of various concentrations, NaOH, HCl and H_2SO_4
5. To Determine the percentage composition of given Organic mixture (glycerol & water) using stalgmometer by surface tension method.
6. To Determine the percentage composition of Acetone and Methyl Ethyl Ketone given mixture by surface tension method.
7. To Determine the viscosity/ percentage composition of given Amyl alcohol with respect to water by viscometer method.
8. To Determine the viscosity/ percentage composition of given binary mixture(Glycerol & Water) by viscometer method
9. To determine the velocity constant(specific reaction rate) of the hydrolysis of methyl acetate catalyzed by hydrogen ions at room temperature.
10. To determine the specific rate of hydrolysis of ethyl acetate catalyzed by hydrogen ions at room temperature.

Note: *Any other experiment carried out in the class.*

Reference Books

- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senion Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
- Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8 th Ed.* McGraw-Hill: New York (2003).
- Halpem, A. *M.* & McBane, G. C. *Experimental Physical ChemistryEd.;* W.H. Freeman & Co.: New *Work* (2003).

B.Sc. (Honours) SEMESTER – III
GE-III-DATA STRUCTURES (BSHCS-301)

CREDITS: 4

UNIT–I

Arrays

Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)

Stacks

Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack

UNIT–II

Linked Lists

Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists

UNIT–III

Queues

Array and Linked representation of Queue, De-queue, Priority Queues

Recursion

Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)

UNIT–IV

Trees

Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion, Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).

Searching and Sorting

Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques

UNIT–V

Hashing

Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function

Reference Books:

1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning,2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C andC++:, Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
5. D.S Malik, Data Structure using C++,Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rdedition, 2011
7. Aaron M. Tenenbaum, Moshe J. Augenstein, Yedidyah Langsam, "Data Structures Using Java,2003.
8. Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan ComputerPub,2003
9. John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2edition, 2009
10. Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition,Wiley
11. Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata McGraw Hill, 2014.
12. D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003.

B.Sc. (Honours) SEMESTER – III

GEL-III-DATA STRUCTURES PRACTICAL (BSHCS-L301)

CREDITS: 2

1. Write a program to search an element from a list. Give user the option to perform Linear orBinary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting usingInsertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overloadoperator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion andsearch of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion andsearch of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked Listimplementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii)using iteration
12. (ii) WAP to display fibonacci series (i)using recursion, (ii) using iteration
13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion
14. WAP to create a Binary Search Tree and include following operations in tree:
    (a) Insertion (Recursive and Iterative Implementation)
    (b) Deletion by copying
    (c) Deletion by Merging
    (d) Search a no. in BST
    (e) Display its preorder, postorder and inorder traversals Recursively
    (f) Display its preorder, postorder and inorder traversals Iteratively
    (g) Display its level-by-level traversals
    (h) Count the non-leaf nodes and leaf nodes

(i) Display height of tree

(j) Create a mirror image of tree

(k) Check whether two BSTs are equal or not

15. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
16. WAP to reverse the order of the elements in the stack using additional stack.
17. WAP to reverse the order of the elements in the stack using additional Queue.
18. WAP to implement Diagonal Matrix using one-dimensional array.
19. WAP to implement Lower Triangular Matrix using one-dimensional array.
20. WAP to implement Upper Triangular Matrix using one-dimensional array.
21. WAP to implement Symmetric Matrix using one-dimensional array.
22. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
23. WAP to implement various operations on AVL Tree.

Reference Books:

1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning,2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C andC++:, Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
5. D.S Malik, Data Structure using C++, Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rdedition, 2011
7. Aaron M. Tenenbaum, Moshe J. Augenstein, Yedidyah Langsam, "Data Structures Using Java,2003.

B.Sc. (Honours) SEMESTER- III

SEC-I- BOOLEAN ALGEBRA

CREDITS: 2

UNIT-I Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle.

UNIT-II Lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms.

UNIT-III Definition, examples and properties of modular and distributive lattices, Boolean algebras.

UNIT-IV Boolean polynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method.

UNIT-V Karnaugh diagrams, switching circuits and applications of switching circuits.

Books Recommended

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge UniversityPress, Cambridge, 1990.

2. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*,(2nd Ed.), Pearson Education (Singapore) P.Ltd., Indian Reprint 2003.

3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts inMathematics, Springer (SIE), Indian reprint, 2004.

B.Sc. (Honours) SEMESTER- IV

MATHEMATICS- I

Advanced Calculus-II (BSHM-401)

CREDITS: 4

UNIT-I Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Jacobians.

UNIT-II Envelopes, evolutes. Maxima, minima and saddle points of functions of two variables.

UNIT-III Maxima, minima using Lagrange's multiplier method.

UNIT-IV Beta and Gamma functions, Double and triple integrals, Dirichlet's integrals

UNIT-V Change of order of integration in double integrals.

References

1. Gabriel Klaumber, Mathematical Analysis, Marcel Dekkar, Inc. New York, 1975.
2. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. R.R. Goldberg, Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970.
4. D. Soma Sundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
6. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad.
7. Murray R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
8. Gorakh Prasad, Integral Calculus, Pothishala Pvt. Ltd., Allahabad.
9. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
10. O.E. Stanaitis, An Introduction to Sequences, Series and Improper Integrals, Holden-Dey, Inc., San Francisco, California.
11. Earl D. Rainville, Infinite Series, The Macmillan Company, New York.
12. Chandrika Prasad, Text Book on Algebra and Theory of Equations, Pothishala Pvt. Ltd., Allahabad
13. N. Piskunov, Differential and Integral Calculus, Peace Publishers, Moscow.
14. Shanti Narayan, A Course of Mathematical Analysis, S.Chand and Company, New Delhi.

B.Sc. (Honours) SEMESTER- IV
MATHEMATICS- II
Differential and Partial Differential Equations (BSHM-402)

CREDITS: 4

UNIT-I Some special types of equations which can be solved easily by methods other than the general method, Charpit's general method of solution.

UNIT-II Partial differential equations of second and higher orders, Classification of linear partial differential equations of second order, Homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients

UNIT-III Non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Monge's methods.

UNIT-IV Calculus of Variations- Variational problems with fixed boundaries- Euler's equation for functionals containing first order derivative and one independent variable, Extemals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form, invariance of Euler's equation under coordinates transformation.

UNIT-V Variational Problems with Moving Boundaries- Functionals dependent on one and two functions, One sided variations.Sufficient conditions for an Extremum- Jacobi and Legendre conditions, Second Variation. Variational principle of least action.

References

1. Erwin Kreysizig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967.
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London.
4. Lan N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.
5. Francis B. Hilderbrand, Advanced Calculus for Applications, Prentice Hall of India Pvt. Ltd., New Delhi, 1977.
6. Jane Cronin, Differential equations, Marcel Dekkar, 1994.
7. Frank Ayres, Theory and Problems of Differential Equations, McGraw-Hill Book Company, 1972.

B.Sc. (Honours) SEMESTER- IV

MATHEMATICS- III

Dynamics (BSHM-403)

CREDITS: 4

UNIT-I Kepler's laws of motion, velocities and acceleration in tangential and normal directions,

UNIT-II Motion on smooth and rough plane curves.

UNIT-III Motion in a resisting medium,

UNIT- IV Motion of particles of varying mass.

UNIT-V Motion of a particle in three dimensions, acceleration in terms of different co-ordinate systems.

References

1. S.L. Loney, Dynamics, Macmillan and Company, London.
2. R.S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
3. S.L. Loney, An Elementary Treatise on the Dynamics of a particle and of rigid bodies, Cambridge University Press, 1956.

B.Sc. (Honours) SEMESTER- IV

MATHEMATICS-IV

Operating System: Linux (BSHM-404)

CREDITS: 4

UNIT-I Linux – The Operating System: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux architecture,

UNIT-II Installation, Start up scripts, system processes (an overview), Linux Security, The Ext2 and Ext3 File systems: General Characteristics of, The Ext3 File system, file permissions.

UNIT-III User Management: Types of users, the powers of Root, managing users (adding and deleting): using the command line and GUI tools.

UNIT-IV Resource Management in Linux: file and directory management, system calls for files Process Management, Signals, IPC: Pipes,

UNIT-V FIFOs, System V IPC, Message Queues, system calls for processes, Memory Management, library and system calls for memory.

Books Recommended:

1. Arnold Robbins, *Linux Programming by Examples The Fundamentals*, 2nd Ed., PearsonEducation, 2008.

2. Cox K, *Red Hat Linux Administrator's Guide*, PHI, 2009.

3. R. Stevens, *UNIX Network Programming*, 3rd Ed., PHI, 2008.

4. Sumitabha Das, *Unix Concepts and Applications*, 4th Ed., TMH, 2009.

5. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, *Linux in a Nutshell*, 6th Ed.,O'Reilly Media, 2009.

6. Neil Matthew, Richard Stones, Alan Cox, *Beginning Linux Programming*, 3rd Ed., 2004.

B.Sc. (Honours) SEMESTER- IV
GE-IV PHYSICS: MATHEMATICAL PHYSICS-III (BSHP-401)

CREDITS: 4

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

UNIT-I Complex Analysis

Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables.Analyticity and Cauchy-Riemann Conditions.Examples of analytic functions.

UNIT-II

Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable.Cauchy's Inequality.Cauchy's Integral formula.Simply and multiply connected region.Laurent and Taylor's expansion.Residues and Residue Theorem.Application in solving Definite Integrals.

UNIT-III Integrals Transforms:

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples.Fourier transform of trigonometric,Gaussian, finite wave train & other functions.Representation of Dirac delta function as a Fourier Integral.

UNIT-IV

Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.

UNIT-V

Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits.

References:

1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
2. Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications
3. Complex Variables, A.S.Fokas & M.J.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
4. Complex Variables and Applications, J.W. Brown &R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
5. First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

B.Sc. (Honours) SEMESTER- IV

GE-IV MATHEMATICAL PHYSICS-III LAB-I (BSHP-L-401)

CREDITS: 2

Scilab based simulations experiments based on Mathematical Physics problems like

1. Solve differential equations: $dy/dx = e^{-x}$ with y = 0 for x = 0 $dy/dx + e^{-x}y = x2$ $d^2y/dt^2 + 2\ dy/dt = -y$ $d^2y/dt^2 + e^{-t}dy/dt = -y$
2. Dirac Delta Function: Evaluate complex integrals .
3. Fourier Series: Program to sum (0.2)^n

Evaluate the Fourier coefficients of a given periodic function (square wave)

4. Frobenius method and Special functions. Plot Pn(x) , jv(x) and show recursion relation
5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).
6. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.
7. Evaluation of trigonometric functions e.g. *sin θ,* Given Bessel's function at N points find its value at an intermediate point. Complex analysis: Integrate 1/(x2+2) numerically and check with computer integration.
8. Integral transform: FFT of $^{(-x2)}$

References:

1. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
2. Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
3. Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. VandeWouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
4. Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
5. Scilab(A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand& Company.
6. Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

B.Sc. (Honours) SEMESTER- IV
GE-IV PHYSICAL CHEMISTRY-V (BSHCY-502)

CREDITS: 4

UNIT- I: Quantum Chemistry

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.
Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component. Qualitative treatment of hydrogen atom and hydrogen-like ions.

UNIT- II: Molecular Spectroscopy

Interaction of electromagnetic radiation with molecules and various types of spectra; Bom-Oppenheimer approximation.
Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear tri atomic molecules, isotopic substitution.
Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

UNIT- III: Raman spectroscopy
Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectr4 Stokes and anti-stokes lines; their intensity difference, rule of mutual exclusion.

UNIT- IV: Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre-dissociation, calculation of electronic transitions of polyenes using free electron model. Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

UNIT- V: Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Reference Books:

- Banwell, C. N. & Mccash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw- Hill: New Delhi (2006).
- Chandra A. K. lntroductory Quantum Chemistry Tata Mccraw-Hill (2001).
- House, J. E. Fundamentals ofQuantum Chemistry 2no Ed. Elsevier: USA (2004).
- Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
- Kakkar, R. Atomic & Molecular Spectroscopy, Cambridge University Press (2015).

B.Sc. (Honours) SEMESTER- IV
GE-IV PHYSICAL CHEMISTRY V LAB (BSHCY-L502)

CREDITS: 2

UV/ Visible spectroscopy

I. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).
II. Study the pH dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.
III. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2- propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry

I. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration.
II. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
III. Study the kinetics of iodination of propanone in acidic medium.
IV. Determine the amount of iron present in a sample using l, 10-phenathroline.
V. Determine the dissociation constant of an indicator (phenolphthalein).
VI. Study the kinetics of interaction of crystal violet phenolphthalein with sodium hydroxide.
VII. Analysis of the given vibration-rotation spectrum of HCI(g)

Reference Books:

- Khosla, B. D.; Garg, V. C. & Gulati, A' Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (201l).
- Garland C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed,' McGraw-Hill: New York (2003).
- Halpem, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W-H. Freeman & Co.: New York (2003).

B.Sc. (Honours) SEMESTER – IV

GE-IV-DESIGN AND ANALYSIS OF ALGORITHMS (BSHCS-401)

CREDITS: 4

UNIT–I:

Introduction: Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.

Algorithm Design Techniques: Iterative techniques, Divide and Conquer, DynamicProgramming, Greedy Algorithms.

UNIT–II:

Sorting and Searching Techniques

Elementary sorting techniques–Bubble Sort, InsertionSort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, complexity analysis;

UNIT–III:

Lower Bounding Techniques

Decision Trees

Balanced Trees

Red-Black Trees

UNIT–IV:

Advanced Analysis Technique

Amortized analysis

UNIT–V: Graphs

Graph Algorithms–Breadth First Search, Depth First Search and its Applications,Minimum Spanning Trees.

String Processing

String Matching, KMP Technique

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction toAlgorithms, PHI, 3rd Edition 2009
2. Sarabasse& A.V. Gelder Computer Algorithm – Introduction to Design and Analysis,Publisher – Pearson 3rd Edition 1999

B.Sc. (Honours) SEMESTER – IV

GEL-IV-DESIGN AND ANALYSIS OF ALGORITHMS PRACTICAL

(BSHCS-L401)

CREDITS: 2

1. i. Implement Insertion Sort (The program should report the number of comparisons)
   ii. Implement Merge Sort (The program should report the number of comparisons)
2. Implement Heap Sort(The program should report the number of comparisons)
3. Implement Randomized Quick sort (The program should report the number of comparisons)
4. Implement Radix Sort
5. Create a Red-Black Tree and perform following operations on it:
   i. Insert a node
   ii. Delete a node
   iii. Search for a number & also report the color of the node containing this number.
6. Write a program to determine the LCS of two given sequences
7. Implement Breadth-First Search in a graph
8. Implement Depth-First Search in a graph
9. Write a program to determine the minimum spanning tree of a graph

For the algorithms at S.No 1 to 3 test run the algorithm on 100 different inputs of sizes varying from30 to 1000. Count the number of comparisons and draw the graph. Compare it with a graph of nlogn.

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction toAlgorithms, PHI, 3rd Edition 2009

2. Sarabasse& A.V. Gelder Computer Algorithm – Introduction to Design and Analysis, Publisher – Pearson 3rd Edition 1999.

B.Sc. (Honours) SEMESTER- IV

SEC-II- AUTOMATA THEORY

CREDITS: 2

UNIT-I Introduction: Alphabets, strings, and languages. Finite Automata and Regular Languages: deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata,

UNIT-II Pumping lemma and closure properties of regular languages, Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages,

UNIT-III Pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

UNIT-IV Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence.

UNIT-V Undecidability: Recursively enumerable and recursive languages, undecidable problems about Turing machines: halting problem, Post Correspondence Problem, and undecidability problemsAbout CFGs.

Books Recommended:

1. J. E. Hopcroft, R. Motwani and J. D. Ullman, *Introduction to Automata Theory, Languages,and Computation*, 2nd Ed., Addison-Wesley, 2001.

2. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*,2nd Ed., Prentice-Hall, NJ, 1997.

3. J.A. Anderson, *Automata Theory with Modern Applications*, Cambridge University Press,2006.

B.Sc. (Honours) SEMESTER- V
MATHEMATICS- I

Analysis (BSHM-501)

CREDITS: 4

Metric Space

UNIT-I Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and Closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness,

UNIT-II Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity, isometry and homeomorphism. Equivalent metrics.

Complex Analysis

UNIT-III Complex numbers as ordered pairs. Geometrical representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy-Riemann equations. Harmonic functions.

Real Analysis

UNIT-IV Series of arbitrary terms. Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables.

UNIT-V Riemann integral. Intergrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence.

References

1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.

2. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.

3. D. Somasundaram and B. Choudhary, A First Coarse in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.

4. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co. New Delhi.

5. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw- Hill, NewYork, 1990.

B.Sc. (Honours) SEMESTER- V
MATHEMATICS- II
Abstract Algebra (BSHM-502)

CREDIT-4

UNIT-I Group- Automorphisms, inner automorphism. Automorphism of groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group.

UNIT-II Ring theory-Ring homomorphism. Ideals and quotient rings. Field of quotients of an integral domain, Euclidean rings, polynomial rings, Polynomials over the rational field.

UNIT-III Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span, Linear dependence, independence and their basic properties.

UNIT-IV Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism.

UNIT-V Inner Product Spaces-Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases.

References

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jacobson, Basic Algebra, Vols. I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
3. Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.
4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2"" Edition) Cambridge University Press, Indian Edition, 1997.
6. K. Hoffman and R. Kunze, Linear Algebra, (2nd Edition), Prentice Hall. Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.
8. S. Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.
9. Vivek Sahai and Vikas Bist, Algebra, Norosa Publishing House, 1997.

B.Sc. (Honours) SEMESTER- V

MATHEMATICS- III

Logic and Sets (BSHM-503)

CREDITS: 4

UNIT-I Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

UNIT-II Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

UNIT-III Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations.

UNIT-IV Classes of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections.

UNIT-V Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, n-ary relations.

Books Recommended:

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education, 1998.

2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.

3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.

B.Sc. (Honours) SEMESTER- V
DSE-I- PROBABILITY AND STATISTICS

CREDITS: 4

UNIT- I Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, Probability mass/density function.

UNIT- II Mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

UNIT- III Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables.

UNIT- IV Conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables. Chebyshev's inequality.

UNIT- V Statement and interpretation of (weak) law of large numbers and strong law of large numbers, Central Limit theorem for independent and identically distributed random variables with finite variance, Markov Chains, Chapman-Kolmogorov equations, classification of states.

Books Recommended:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to MathematicalStatistics*, Pearson Education, Asia, 2007.

2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Applications*,7th Ed., Pearson Education, Asia, 2006.

3. Sheldon Ross, *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint,2007.

4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, *Introduction to the Theory ofStatistics*, 3rd Ed., Tata McGraw- Hill, Reprint 2007.

B.Sc. (Honours) SEMESTER- V

DSE-I: PROBABILITY AND STATISTICS LAB (DSEL-I)

CREDITS: 2

1. Sample space, probability axioms
2. Real random variables (discrete and continuous)
3. Cumulative distribution function
4. Probability mass/density function.
5. Mathematical expectation
6. Moments, moment generating function
7. Characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential
8. Correlation coefficient, joint moment generating function and calculation of covariance
9. Linear regression for two variables

Books Recommended:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to MathematicalStatistics*, Pearson Education, Asia, 2007.

2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Applications*,7th Ed., Pearson Education, Asia, 2006.

3. Sheldon Ross, *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint,2007.

4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw- Hill, Reprint 2007.

OR

PROJECT

PRESENTATION-I

PRESENTATION-II

B.Sc. (Honours) SEMESTER- V

DSE-II- ECONOMETRICS

CREDITS: 4

UNIT-I Statistical Concepts Normal distribution; chi-square, t and F-distributions; estimation of parameters; properties of estimators; testing of hypotheses: defining statistical hypotheses; distributions of test statistics;

UNIT-II Testing hypotheses related to population parameters; Type I and Type II errors; power of a test; tests for comparing parameters from two samples. Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares.

UNIT-III Properties of estimators; goodness of fit; tests of hypotheses; scaling and units of measurement; confidence intervals; Gauss-Markov theorem; forecasting. Multiple Linear Regression Model Estimation of parameters; properties of OLS estimators;

UNIT-IV Goodness of fit - R2 and adjusted R2 ; partial regression coefficients; testing hypotheses – individual and joint; functional forms of regression models; qualitative (dummy) independent variables.

UNIT-V Violations of Classical Assumptions: Consequences, Detection and Remedies Multicollinearity; heteroscedasticity; serial correlation.Specification Analysis Omission of a relevant variable; inclusion of irrelevant variable; tests of specification errors.

Books Recommended:

1. Jay L. Devore, *Probability and Statistics for Engineers*, Cengage Learning, 2010.

2. John E. Freund, *Mathematical Statistics*, Prentice Hall, 1992.

3. Richard J. Larsen and Morris L. Marx, *An Introduction to Mathematical Statistics and itsApplications*, Prentice Hall, 2011.

4. D. N. Gujarati and D.C. Porter, *Essentials of Econometrics*, McGraw Hill, 4th Ed., International Edition, 2009.

5. Christopher Dougherty, *Introduction to Econometrics*, Oxford University Press, 3rd Ed.,Indian edition, 2007.

B.Sc. (Honours) SEMESTER- V
DSE-II: ECONOMETRICS LAB (DSEL-II)

CREDITS-2

1. Statistical Concepts Normal distribution; chi-square, t and F-distributions

2. Estimation of parameters; testing of hypotheses: defining statistical hypotheses

3. Testing hypotheses related to population parameters; Type I and Type II errors

4. Power of a test; tests for comparing parameters from two samples

5. Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares.

6 Gauss-Markov theorem; forecasting. Multiple Linear Regression Model Estimation of parameters properties of OLS estimators;

7. Goodness of fit - R2 and adjusted R2 ; partial regression coefficients

8. Testing hypotheses – individual and joint; functional forms of regression models; qualitative (dummy) independent variables.

9. Consequences, Detection and Remedies Multicollinearity

10. Inclusion of irrelevant variable; tests of specification errors.

Books Recommended:

1. Jay L. Devore, *Probability and Statistics for Engineers*, Cengage Learning, 2010.

2. John E. Freund, *Mathematical Statistics*, Prentice Hall, 1992.

3. Richard J. Larsen and Morris L. Marx, *An Introduction to Mathematical Statistics and itsApplications*, Prentice Hall, 2011.

4. D. N. Gujarati and D.C. Porter, *Essentials of Econometrics*, McGraw Hill, 4th Ed., International Edition, 2009.

5. Christopher Dougherty, *Introduction to Econometrics*, Oxford University Press, 3rd Ed.,Indian edition, 2007.

OR

PROJECT

PRESENTATION-I

PRESENTATION-II

B.Sc. (Honours) SEMESTER-VI

MATHEMATICS -I

Analysis (BSHM-601)

Metric Space **CREDITS-4**

UNIT –I Cantor's intersection theorem. Contraction principle, construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field.

UNIT-II Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and Compact sets, Connectedness, Components, Continuous functions and Connected sets.

Complex Analysis

UNIT-III Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, Cross ratio. Inverse points and critical mappings. Conformal mappings.

Real Analysis

UNIT-IV Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions.

UNIT-V Comparison tests. Abel's and Dirichlet' tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

References

1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. R.R. Goldberg, Real Analysis, Oxford & IBH publishing Co., New Delhi, 1970.
3. D. Somasundaram and B. Choudhary, A First Coarse in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
4. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co. New Delhi.
5. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw- Hill, NewYork, 1990.
6. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

B.Sc. (Honours) SEMESTER- VI

MATHEMATICS –II

Abstract Algebra (BSHM- 602)

CREDITS-4

UNIT-I Center for Group of prime-order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups.

UNIT-II The Eisenstien criterion, polynomial rings over commutative rings, Unique factorization domain in R, Unique factorisation domain R, Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.

UNIT-III Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.

UNIT-IV Adjoint of a linear transformation. Eigenvalues and eigenvectors of a linear transformation. Diagonalisation, Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms.

UNIT-V Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

REFERENCES :

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

2. N. Jacobson, Basic Algebra, Vols. I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company).

3. Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.

4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.

5. K. Hoffman and R. Kunze, Linear Algebra, (2nd Edition), Prentice Hall. Englewood Cliffs, New Jersey, 1971.

6. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.

7. S. Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.

8. Vivek Sahai and Vikas Bist, Algebra, Norosa Publishing House, 1997.

B.Sc. (Honours) SEMESTER- VI
MATHEMATICS- III
Numerical Analysis (BSHM- 603)

CREDITS: 4

Numerical Analysis:

UNIT-I Interpolation: Lagrange and Hermite Interpolation, Divided Differences, Difference Schemes, Interpolation Formulas using Differences.

UNIT-II Linear Equations: Direct Methods for Solving Systems of Linear Equations (Guass Elimination, LU Decomposition, Cholesky Decomposition), Iterative Methods (Jacobi, GaussSeidel, Relaxation Methods).

UNIT-III Ordinary Differential Equations: Euler Method, Single-step Methods, Runge-Kutta's Method, Multi- step Methods, Milne-Simpson Method.

UNIT-IV Approximation: Different Types of Approximation, Least Square Polynomial Approximation, Polynomial Approximation using Orthogonal Polynomials,

UNIT-V Random number generation, congruential generators, statistical tests of pseudo-random numbers. Random variate generation, inverse transform method, composition method, acceptance rejection method, generation of exponential, normal variates, binomial and Poisson variates.

References

1. Henry Mullish and Herbert L. Cooper, Spirit of C: An Introduction to Modern Programming, Jaico Publishers, Bombay.
2. B.W. Kernighan and D.M. Ritchie. The C Programming Language 2nd Edition, (ANSI features) Prentice Hall, 1989.
3. Peter A Darnel and Philip E. Margolis, C : A Software Engineering Approach, Narosa Publishing House, 1993.
4. Robert C. Hutehisonand Steven B. Just, Programming using C Language, McGraw Hill, 1988.
5. Les Hancock and Morris Krieger, The C Primer, McGraw Hill, 1988.
6. V. Rajaraman, Programming in C, Prentice Hall of India, 1994.
   Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998.

B.Sc. (Honours) SEMESTER- VI
DSE-III- CRYPTOGRAPHY AND NETWORK SECURITY

CREDIT-4

UNIT-I Public Key Cryptography Principles & Applications, Algorithms: RSA, Message Authentication: One way Hash Functions: Message Digest, MD5, SHA1. Public Key Infrastructure: Digital Signatures, Digital Certificates, Certificate Authorities.

UNIT-II Network Attacks: Buffer Overflow, IP Spoofing, TCP Session Hijacking, Sequence Guessing, Network Scanning: ICMP, TCP sweeps,

UNIT-III Basic Port Scans; Denial of Service Attacks: SYN Flood, Teardrop attacks, land, Smurf Attacks.IP security Architecture: Overview, Authentication header, Encapsulating Security Pay Load,

UNIT-IV combining Security Associations, Key Management. Virtual Private Network Technology: Tunneling using IPSEC. Requirements, Secure Socket Layer, and Secure Electronic Transactions,

UNIT-V Network Management Security: Overview of SNMP Architecture- SNMPV1, SNMPV3.Firewall Characteristics &Design Principles, Types of Firewalls: Packet Filtering Router, Application Level Gateway or Proxy, Content Filters, Bastion Host.

Books Recommended:

1. W. Stallings, *Networks Security Essentials: Application & Standards*, Pearson Education,2000.

2.TCP/IP Protocol Suite , Behrouz A. Forouzan, *Data Communication and Networking*, Tata McGraw Hill.

3.W. Stallings, *Cryptography and Network Security, Principles and Practice*, Pearson Education, 2000.

B. Sc. (Honours) SEMESTER- VI

DSE-III- CRYPTOGRAPHY AND NETWORK SECURITY LAB (DSEL-III)

CREDITS: 2

1. Public Key Cryptography Principles & Applications
2. Algorithms: RSA, Message Authentication
3. One way Hash Functions
4. Message Digest, MD5, SHA1. Public Key Infrastructure: Digital Signatures, Digital Certificates, Certificate Authorities.
5. Network Attacks: Buffer Overflow
6. IP Spoofing, TCP Session Hijacking, Sequence Guessing
7. Network Scanning: ICMP, TCP sweeps
8. Basic Port Scans; Denial of Service Attacks: SYN Flood
9. Teardrop attacks, land
10. Smurf Attacks.IP security Architecture: Overview, Authentication header, Encapsulating Security Pay Load,

Books Recommended:

1. W. Stallings, *Networks Security Essentials: Application & Standards,* Pearson Education,2000.
2. TCP/IP Protocol Suite , Behrouz A. Forouzan, *Data Communication and Networking*, Tata McGraw Hill.
3. W. Stallings, *Cryptography and Network Security, Principles and Practice*, Pearson Education, 2000.

OR

PROJECT

PRESENTATION-I

PRESENTATION-II

B. Sc. (Honours) SEMESTER- VI
DSE-IV- INFORMATION SECURITY

CREDITS- 4

UNIT-I Overview of Security: Protection versus security; aspects of security–data integrity, data availability, privacy; security problems, user authentication, Orange Book.

UNIT-II Security Threats: Program threats, worms, viruses, Trojan horse, trap door, stack and buffer over flow; system threats- intruders; communication threats- tapping and piracy.

UNIT-III Cryptography: Substitution, transposition ciphers, symmetric-key algorithms-Data Encryption Standard, advanced encryption standards, public key encryption - RSA; Diffie-Hellman key exchange, ECC cryptography, Message Authentication- MAC, hash functions.

UNIT-IV Digital signatures: Symmetric key signatures, public key signatures, message digests, public key infrastructures.

UNIT-V Security Mechanisms: Intrusion detection, auditing and logging, tripwire, system-call monitoring.

Books Recommended:

1. W. Stallings, *Cryptography and Network Security Principles and Practices*, 4th Ed., Prentice- Hall of India, 2006.

2. C. Pfleeger and S.L. Pfleeger, *Security in Computing* , 3rd Ed., Prentice-Hall of India, 2007.

3. D. Gollmann, *Computer Security*, John Wiley and Sons, NY, 2002.

4. J. Piwprzyk, T. Hardjono and J. Seberry, *Fundamentals of Computer Security*, Springer- Verlag Berlin, 2003.

5. J.M. Kizza, *Computer Network Security*, Springer, 2007.

6. M. Merkow and J. Breithaupt, *Information Security: Principles and Practices*, Pearson Education, 2006.

B. Sc. (Hon.) SEMESTER- VI
DSE-IV- LAB (DSEL-IV)

CREDITS: 2

MAJOR PROJECT/ PRESENTATION

* As per UGC CBCS guidelines, University / departments have liberty to offer GE and SEC courses offered by one department to students of other departments. The No. of GE course is four. One GE course is compulsory in first 4 semesters each.

Minimum One Skill Enhancement course shall be proposed by each department (4 credits) [4 L or 2 L+ 2 P or l L+3 P or 3L+ l T] 1P = 2 hours.

*Credit= L+T+P/2 Where, **L-**Lecture**, T-**Tutorial and **P-** Practical

Total Credits = 144

Reference:

1. **Pt. Ravi Shankar Shukla University**
2. **Guru Ghasidas Vishwavidyalaya**
