NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics, Semester-I
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assesment	Practicals	Total Marks
BHM 111	Algebra	4 Hours/ week	60	15	-	75
BHM 112	Calculus	4 Hours/ week	60	15	-	75
BHM 113	Solid Geometry	4 Hours/ week	60	15	-	75
BHM 114	Discrete Mathematics-I	4 Hours/ week	60	15	-	75
BHM 115	Opt(i) : Descriptive Statistics	4 Hours/ week	60	15	-	75
	Opt(ii) : Chemistry -I	4 Hours/ week				
BHM 116	Opt(i) : Computer Fundamentals and MS-OFFICE	4 Hours/ week	60	15	-	75
	Opt(ii) : Physics -I	4 Hours/ week				
BHM 117	Practicals/ Computational work based on Paper BHM115	4 Hours/ week	-		25	25
BHM 118	Practicals/ Computational work based on Paper BHM116	4 Hours/ week	-		25	25
BHM 119	English-I	4 Hours/ week	60	15	-	75
Total marks of Semester-I						575

Note : The other conditions will remain the same as per relevant Ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Algebra

Code: BHM 111

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary Operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Section – II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Section – III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Section – IV

Nature of the roots of an equation Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Books Recommended :

1. H.S. Hall and S.R. Knight : Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan : A Text Books of Matrices.
3. Chandrika Prasad : Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.

(w.e.f. 2018-19)

Calculus

Code: BHM 112

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Section – II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Section – III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Section – IV

Quardrature (area)Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Books Recommended :

1. Differential and Integral Calculus : Shanti Narayan.
2. Murray R. Spiegel : Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov : Differential and integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad : Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad : Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

(w.e.f. 2018-19)

Solid Geometry

Code: BHM 113

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Section – II

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-oxal system of spheres
Cones. Right circular cone, enveloping cone and reciprocal cone.
Cylinder: Right circular cylinder and enveloping cylinder.

Section – III

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

Section – IV

Paraboloids: Circular section, Plane sections of conicoids.
Generating lines. Confocal conicoid. Reduction of second degree equations.

Books Recommended:

1. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
2. P.K. Jain and Khalil Ahmad : A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.

(w.e.f. 2018-19)

Discrete Mathematics-I

Code: BHM 114

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Sets, principle of inclusion and exclusion, relations, equivalence relations and partition, denumerable sets, partial order relations, Mathematical Induction, Pigeon Hole Principle and its applications.

Section – II

Propositions, logical operations, logical equivalence, conditional propositions, Tautologies and contradictions. Quantifier, Predicates and Validity.

Section – III

Permutations and combinations, probability, basic theory of Group and rings.

Section -IV

Discrete numeric functions, Generating functions, recurrence relations with constant coefficients. Homogeneous solution, particular relations, total rotation, Solution of recurrence relation by the method Generating function.

Books Recommended :

1. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.
2. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
3. Seymour Lipschutz, Finite Mathematics (International edition 1983), McGraw-Hill Book Company, New York.
4. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hilll Book Co.
5. Babu Ram, Discrete Mathematics, Vinayak Publishers and Distributors, Delhi, 2004.

(w.e.f. 2018-19)

Descriptive Statistics

Code: BHM 115 Opt(i)

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Introduction of Statistics, Basic knowledge of various types of data, Collection, classification and tabulation of data. Presentation of data: histograms, frequency polygon, frequency curve and ogives. Stem- and- Leaf and Box plots.

Section – II

Measures of Central Tendency and Location: Mean, median, mode, geometric mean, harmonic mean, partition values.
Measures of Dispersion: Absolute and relative measures of range, quartile deviation, mean deviation, standard deviation (σ), coefficient of variation.

Section – III

Moments, Skewness and Kurtosis: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks, Concepts of Skewness and Kurtosis.

Section – IV

Theory of Attributes: Symbolic notation, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule's coefficient of association and coefficient of colligation.
Correlation for Bivariate Data: Concept and types of correlation, Scatter diagram, Karl Pearson Coefficient (r) of correlation and rank correlation coefficient.

Books Suggested

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
3. Bernstein, S. & Bernstein, R. : Elements of Statistics, Schaum's outline series, McGraw-Hill.

(w.e.f. 2018-19)

Chemistry-I

Code: BHM 115 Opt(ii)

Max. Marks : 60
Time : 3 Hours

Note:- Examiner will set three questions from each section. The candidate will be required to attempt five questions in all, selecting not more than two questions from each section. All questions carry equal marks.

Section-I

Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge, Slater's rules.

Covalent Bond

Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7 SO_4^{2-}, ClO_4^-)Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2^- and H_2O. MO theory of heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Section-II

Gaseous States

Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path. Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Explanation of behaviour of real gases using Vander Waal's equation.

Critical Phenomenon: Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal"s constants. Critical compressibility factor. The Law of corresponding states. Lequifaction of gases.

Liquid States

Properties of liquids – surface tension, viscosity and their determination.

Solid State

Liquid crystals: Difference between solids, liquids and liquid crystals,types of liquid crystals. Applications of liquid crystals.

Section-III

Structure and Bonding

Localized and delocalized chemical bond, resonance effect and its applications,

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism.

Optical isomerism — elements of symmetry, molecular chirality, enantiomers, , optical activity, , chiral and achiral molecules with two stereogenic centres, diastereomers,

Relative and absolute configuration, sequence rules, R & S systems of nomenclature.

Geometric isomerism — determination of configuration of geometric isomers. E & Z system of nomenclature,

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions.
Reactive intermediates — carbocations, carbanions, free radicals,

Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, methods of formation (with special reference to Wurtz reaction, Kolbe reaction),.

Cycloalkanes — nomenclature, synthesis of cycloalkanes , dehalogenation of α,ω-dihalides.

(w.e.f. 2018-19)

Computer Fundamentals and MS-OFFICE

Code: BHM 116 Opt(i)

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section-I

Fundamentals of Computer: Model of a digital computer, Functioning of a digital computer, Historical evolution of computers, classification of computers, Human being vs computer, Input / Output devices, Storage devices, Memory and mass storage devices, characteristics of memory systems, types of memory, RAM, ROM, concepts of Virtual and Cache memory, Types of software, Application and system software and its functions, time sharing, multiprocessing, Applications of Computer.

Section-II

Introduction to Windows: Types of windows, windows as an operating system, windows explorer, using clipboard, using paintbrush, control panel, installing a printer.
MS Power Point: Introduction, Power point slide creation, Slide-show, Adding graphics, Formatting Customizing and Printing.

Section-III

MS-Word: Introduction to MS-Word, Standard Toolbar, Word Wrap, Text formatting, Indents, Tabs, Formatting paragraphs, Applying Effects to text, Applying animation to text.

Section-IV

MS Excel: Introduction to MS Excel, Working with Toolbars, Formatting, Formulas, Data management, Graphs and Charts, Macros and other additional functions.

Books Recommended:

1. Donald Sanders: Computers Today, McGraw-Hill Publishers.
2. Davis: Introduction to Computers, McGraw-Hill Publishers.
3. V. Rajaraman : Fundamental of Computers, Prentice-Hall India Ltd., New Delhi.

(w.e.f. 2018-19)

Physics - I

Code: BHM 116 Opt(ii)

Max. Marks : 60
Time : 3 Hours

NOTE : The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of ten marks will be compulsory having five parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section-I

Mechanics

Mechanics of single and system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy, Centre of mass and equation of motion, constrained motion, degrees of freedom.

Generalised coordinates, displacement, velocity, acceleration, momentum, force and potential. Hamilton's variational principle, Lagrange's equation of motion from Hamilton's Principle. Linear Harmonic oscillator, simple pendulum, Atwood's machine.

Section-II

Properties of Matter

Elasticity, Hooke's law, Elastic constants and their relations, Poisson's ratio, torsion of cylinder and twisting couple. Bending of beam (bending moment and its magnitude) cantilevers, Centrally loaded beam.

Theory of Relativity

Reference systems, inertial frames, Gallilean invariance and Conservation laws, Newtonian relativity principle, Michelson - Morley experiment : Search for ether. Lorentz transformations length contraction, time dilation, velocity addition theorem, variation of mass with velocity and mass energy equivalence.

Section-III

Electrostatic Field

Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations. Electric flux, Gauss's Law and its application to spherical shell, uniformly charged infinite plane and uniformily charged straight wire, mechanical force of charged surface, Energy per unit volume.

Magnetostatistics

Magnetic Induction, magetic flux, solenoidal nature of Vector field of induction. Properties of B (i) $\nabla .B = 0$ (ii) $\nabla \times B = \mu_o J$. Electronic theory of dia and para magnetism (Langevin's theory). Domain theory of ferromagnetism. Cycle of Magnetisation - Hysteresis (Energy dissipation, Hysteresis loss and importance of Hysteresis curve). Maxwell's Equations and their derivation.

References

1. Electricity and Magnetism by A.S.Mahajan and A.A. Rangwala (Tata MC Graw Hill)
2. Classical Mechanics by H. Goldstein (2nd Edition)
3. Berkeley Physics Course, Vol. I, Mechanics by E.M. Purchell
4. Properties of Matter by D.S. Mathur.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 117

(Based on paper BHM115 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

Practical/ Computational Work

Code: BHM 117

(Based on paper BHM115 Opt(ii))

Time:3 Hours

Max. Marks: 25

Section-I (Inorganic)

Volumetric Analysis

1. **Redox titrations**: Determination of Fe^{2+}, $C_2O_4^{2-}$ (using $KMnO_4$, $K_2Cr_2O_7$)
2. **Iodometic titrations:** Determination of Cu^{2+} (using standard hypo solution).

Section-II (Physical)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetatecatalyzed by hydrogen ions at room temperature.
2. To determine the specific refractivity of a given liquid

Section-III (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point

(i) Iodoform from ethanol (or acetone)

2. To study the process of) sublimation of camphor and phthalic acid

Distribution of marks

1.	Section I	5 marks
2.	Section II	5 marks
3.	Section III	5 marks
4.	Viva-voce	5 marks
5.	Lab Record	5 marks

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 118

(Based on paper BHM116 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 118

(Based on paper BHM116 Opt(ii))

Time:3 Hours

Max. Marks: 25

SPECIAL NOTES

1. Do any eight experiments.
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 10 marks
Viva Voce :	= 10 marks
Lab Record :	= 5 marks
Total	= 25 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. Moment of Inertia of a fly-wheel
2. M.I. of an irregular body using a torsion pendulum.
3. Surface Tension by Jeager's method.
4. Young's modulus by bending of beam.
5. Modulus of rigidity by Maxwell's needle.
6. Elastic constants by Searle's method.
7. Viscosity of water by its flow through a uniform capillary tube.
8. Thermal conductivity of a good conductor by Searle's method.
9. Mechanical equivalent of Heat by Callendao and Barne's method.
10. 'g' by Bar pendulum.
11. Surface tension by capillary method.

(w.e.f. 2018-19)

English - I

Code: BHM 119

Max. Marks : 60
Time : 3 Hours

Part-A Poetry

The following poems from **The Chronicles of Time edited by Asha Kadyan (Oxford University Press)**

a) "Let Me Not to the Marriage of True Minds" by William Shakespeare
b) "Death Be not Proud" by John Donne
c) "On His Blindness" by John Milton
d) "Shadwell" by John Dryden
e) "Know then Thyself" by Alexander Pope
f) "The Little Black Boy" By William Blake
g) "Three Years She Grew in Sun and Shower" by William Wordsworth

Part-B Phonetics and Grammar

i) **Phonetics**: Introduction to the Sound system of English: Phonetics Symbols, Organs of Speech, Transcription of Words (Oxford Advance Learners' Dictionary by Hornby to be followed).

ii) **Grammar:** Parts of Speech, Types of Sentences, Common Errors, Technical Writing (application writing, business letter).

Instruction for the paper-setter and the students

Q. No.1 Explanation with reference to the context. The students will be required to attempt two passages out of the given four from the book of poems. **(6x2=12)**

Q. No. 2 Two questions (with internal choice) will be asked based on theme, central idea, message and narrative technique of the poem. **(6x2=12)**

Q. No. 3 The question will be based on the Sound System of English language having internal choice. **(12)**

Q. No. 4 The question will be based on grammar. There will be internal choice with 12 sentences out of 20 to be attempted. **(12)**

Q. No. 5 The question will be based on technical writing. There will be internal choice. **(12)**

Total=60

Suggested Reading:

High School Grammar by Wren and Martin.
Remedial English Grammar for Foreign Students by F.T. Wood.
Essentials of Communication by D.G. Sexena, Kuntal Tamang (Top Quark)

NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics, Semester-II
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assessment	Practicals	Total Marks
BHM 121	Number Theory and Trigonometry	4 Hours/ week	60	15	-	75
BHM 122	Ordinary Differential Equations	4 Hours/ week	60	15	-	75
BHM 123	Vector Calculus	4 Hours/ week	60	15	-	75
BHM 124	Discrete Mathematics-II	4 Hours/ week	60	15	-	75
BHM 125	Opt(i) : Regression Analysis and Probability	4 Hours/ week	60	15	-	75
	Opt(ii) : Chemistry - II	4 Hours/ week				
BHM 126	Opt(i) : Programming in Visual Basic	4 Hours/ week	60	15	-	75
	Opt(ii) : Physics - II	4 Hours/ week				
BHM 127	Practicals / Computational work based on Paper BHM 125	4 Hours/ week	-		25	25
BHM 128	Practicals / Computational work based on Paper BHM 126	4 Hours/ week	-		25	25
BHM 129	English - II	4 Hours/ week	60	15	-	75
Total marks of Semester-II						575

Note: The other conditions will remain the same as per relevant Ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Number Theory and Trigonometry

Code: BHM 121

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Divisibility, G.C.D.(greatest common divisors), L.C.M.(least common multiple) Primes, Fundamental Theorem of Arithemetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophanatine equations in two variables

Section – II

Complete residue system and reduced residue system modulo m. Euler's ø function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and $\sigma(n)$). Moebius function and Moebius inversion formula.

Section - III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Section – IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Books Recommended :

1. S.L. Loney : Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla : Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Ivan Ninen and H.S. Zuckerman. An Introduction to the Theory of Numbers.

(w.e.f. 2018-19)

Ordinary Differential Equations

Code: BHM 122

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x,y,p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Section – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves.. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous

Section – III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Section – IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators x (d/dx) or t (d/dt) etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray : Introductory Course in Differential Equations. Orient Longaman (India) . 1967
2. A.R.Forsyth : A Treatise on Differential Equations, Machmillan and Co. Ltd. London
3. E.A. Codington : Introduction to Differential Equations.
4. S.L.Ross: Differential Equations, John Wiley & Sons
5. B.Rai & D.P. Chaudhary : Ordinary Differential Equations; Narosa, Publishing House Pvt. Ltd.

(w.e.f. 2018-19)

Vector Calculus

Code: BHM 123

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives

Section – II

Gradient of a scalar point function, geometrical interpretation of grad Φ , character of gradient as a point function. Divergence and curl of vector point function, characters of Div $\vec{f}$ and Curl $\vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Section – III

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Section – IV

Vector integration; Line integral, Surface integral, Volume integral.
Theorems of Gauss, Green & Stokes and problems based on these theorms.

Books Recommended:

1. Murrary R. Spiegal : Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2. Murrary R. Spiegal : Vector Analysis, Schaum Publisghing Company, New York.
3. N. Saran and S.N. NIgam. Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayna : A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

(w.e.f. 2018-19)

Discrete Mathematics-II

Code: BHM 124

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section -I

Lattices and their properties, lattice as algebraic system, Bounded, Complement and distributive lattices.

Section -II

Boolean algebra, definition and examples, properties, duality, distributive and complmented Calculus. Design and implementation of digital networks, switching circuits, Karnaugh map.

Section -III

Graph, definition, exemplary types of graphs, paths and circuits. Eulearian and Hermitian circuits. Seven bridges machine, shortest path traveling salesman problems. Planar graph. Matrix of graph.

Section -IV

Directed Graphs, Trees, Isomorphism of Trees, Representation of Algebraic Expressions by Binary Trees, Spanning Tree of a Graph, Shortest Path Problem, Minimal spanning Trees, Cut Sets, Tree Searching..

Books Recommended:

1. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.
2. J.L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
3. Seymour Lipschutz, Finite Mathematics (International edition 1983), McGraw-Hill Book Company, New York.
4. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hilll Book Co.
5. Babu Ram, Discrete Mathematics, Vinayak Publishers and Distributors, Delhi, 2004.

(w.e.f. 2018-19)

Regression Analysis and Probability

Code: BHM 125 Opt(i)

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections ***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section -I

Linear Regression: Concept of regression, principle of least squares and fitting of straight line, derivation of two lines of regression, properties of regression coefficients, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values. Angle between two lines of regression. Difference between correlation and regression.

Curvilinear Regression: Fitting of second degree parabola, power curve of the type $Y=ax^b$, exponential curves of the types $Y=ab^x$ and $Y=ae^{bx}$.

Section –II

Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely and independent events, Definition of probability—classical, relative frequency, statistical and axiomatic approach, Addition and multiplication laws of probability, Boole's inequality.

Section -III

Bayes' theorem and its applications.

Random Variable and Probability Functions: Definition and properties of random variables, discrete and continuous random variable, probability mass and density functions, distribution function.

Section –IV

Concepts of bivariate random variable: joint, marginal and conditional distributions.

Mathematical Expectation: Definition and its properties –moments, measures of location, dispersion, skewness and kurtosis.

Books Suggested:

1. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2. Baisnab and M. Jas, Element of Probability and statistics, Tata McGraw Hill.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
4 P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.

(w.e.f. 2018-19)

Chemistry - II

Code: BHM 125 Opt(ii)

Max. Marks : 60
Time : 3 Hours

Note: Examiner will set three questions from each section. The candidate will be required to attempt five questions in all, selecting not more than two questions from each section. All questions carry equal marks.

Section-I

Periodic Properties

Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, trends in periodic table (in s & p block elements).

s-Block Elements

Comparative study of the elements including, diagonal relationships and salient features of hydrides (methods of preparation excluded).

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th gp):-

Diborane – properties and structure (as an example of electron – deficient compound and multicentre bonding), Borazene – chemical properties and structure.

Carbon Family (14th group)

Allotropy of carbon, Catenation, pπ– dπ bonding (an idea), carbides, fluorocarbons– general methods of preparations, properties and uses.

Nitrogen Family (15th group)

Oxides – structures of oxides of N,P. oxyacids – structure and relative acid strengths of oxyacids of Nitrogen and phosphorus. .

Oxygen Family (16th group)

Oxyacids of sulphur – structures and acidic strength

Halogen Family (17th group)

Basic properties of halogen, hydro and oxyacids of chlorine – structure and comparison of acid strength.

Section-II

Kinetics

Rate of reaction, rate equation, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst. Order of a reaction, integrated rate expression for zero order, first order, Half life period of a reaction. Methods of determination of order of reaction, effect of temperature on the rate of reaction – Arrhenius equation.

Electrochemistry

Electrolytic conduction, factors affecting electrolytic conduction, specific, conductance, molar conductance,equivalent conductance and relation among them, their vartion with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law. Debye- Huckel – Onsager's equation for strong electrolytes (elementary treatment only), Kohlarausch's Law, calculation of molar ionic conductance and effect of viscosity temperature & pressure on it. Application of Kohlarausch's Law in calculation of conductance of weak electrolytes at infinite diloution. Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids determination of solubility product of sparingly soluble salts, conductometric titrations. Definition of pH and pK_a, Buffer solution, Buffer action, (elementary idea only).

Section-III

Alkenes

Nomenclature of alkenes, , mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides,. The Saytzeff rule, Chemical reactions of alkenes — mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule,

Arenes and Aromaticity

Nomenclature of benzene derivatives:. Aromatic nucleus and side chain.

Aromaticity: the Huckel rule, aromatic ions, aromatic, anti - aromatic and non - aromatic compounds.

Dienes and Alkynes

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes.,. Chemical reactions — 1,2 and 1,4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes., acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions,

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions of aryl halides.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

(w.e.f. 2018-19)

Programming in Visual Basic

Code: BHM 126 Opt(i)

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections ***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section - I

Visual Basic: Introduction, Analyzing, Data types, Variables, Constants, Controls and Properties.
Control Structures: Conditional Statements, Loop Statements, Exit statement, Stop statement Arrays

Section - II

Text Boxes, Command Buttons, Labels, Additional Controls – List Box, ComboBox, Difference between ListBox and Combo Box, Option Buttons, Check Boxes, Frames, Scroll Bars, Timer Control
Control Arrays, Procedures and Functions, SDI and MDI Applications

Section - III

Menus: Menu Editor, Menu controls, Submenus, Popup Menus
Common Dialog Controls: Color Dialog Box, Font Dialog Box, Open and Save as Dialog Box, Print Dialog Box, Help Dialog Box.
Database Programming: Data Access Object, Data Binding, Data Control and Data Bound Controls, Database Object, Recordset Object, Field Object.

Section - IV

Crystal Reports:Introduction to Reports, Crystal Reports, Creating and Using a Report in VB
Library Functions: Conversion functions, String functions, Numeric functions, Date and Time Functions.

Note: The question paper will consist of **five** sections. Each of the first four sections ***(I-IV)***will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Books Recommended

1. Reselman& Other, Using Visual Basic 6, Prentice Hall of India.
2. Donald &Oancea, Visual Basic 6 from Scratch, Prentice- Hall of India.
3. Noel Jerke, Visual Basic 6, Tata Mc-Graw Hill
4. Days Maver, Teach Yourself More VB in 21 days, Techmedia.

(w.e.f. 2018-19)

Physics – II

Code: BHM 126 Opt(ii)

Max. Marks : 60
Time : 3 Hours

NOTE : The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of ten marks will be compulsory having five parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section-I

Semiconductor Diodes

Energy bands in solids. Intrinsic and extrinsic semiconductor, Hall effect, P-N junction diode and their V-I characteristics. Zener and avalanche breakdown. Resistance of a diode, Light Emitting diodes (LED). Photo conduction in semiconductors, photodiode, Solar Cell.

Diode Rectifiers

P-N junction half wave and full wave rectifier. Types of filter circuits. Zener diode as voltage regulator, simple regulated power supply.

Transistors

Junction Transistors, Bipolar transistors, working of NPN and PNP transistors, Transistor connections (C-B, C-E, C-C mode), constants of transistor. Transistor characteristic curves (excluding h parameter analysis), advantage of C-B configuration. C.R. O. (Principle, construction and working in detail).

Section-II

Transistor Amplifiers

Transistor biasing, methods of Transistor biasing and stabilization. D.C. load line. Common-base and common-emitter transistor biasing. Common-base, common-emitteer amplifers. Classification of amplifers. Resistance-capacitance (R-C) coupled amplifer (two stage; concept of band width, no derivation). Feed-back in amplifers, advantage of negative feedback Emitter follower.

Oscillators

Oscillators, Principle of Oscillation, Classification of Oscillator. Condition for self sustained oscillation ; Hartley oscillator.

Section-III

Lasers

Main features of a laser : Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification, momentum transfer, life time of a level, kinetics of optical obsorption. Threshold condition for laser emission, Laser pumping, He-Ne laser and RUBY laser (Principle, Construction and Working). Applications of laser in the field of medicine and industry.

References

1. Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)
2. Lassers, Theory and Application (2nd Ed.) by Thagrajan and Ajay Ghatak.
3. Laser and Nonlinear Optics by B.B. Laud (2nd Ed.)
4. Basic Electronics and Linear circuits by N.N. Bhargava, D.C. Kulshreshtha and S.C.Gupta (TITI, CHD).
5. Electronic Fundamentals and Applications by J.D. Ryder (Prentice Hall India).

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 127

(Based on paper BHM125 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: : The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 127

(Based on paper BHM125 Opt(ii))

Time:3 Hours

Max. Marks: 25

Section - I(Inorganic)

Volumetric analysis

Complexometric titrations: Determination of Mg^{2+}, Zn^{2+} by EDTA.

Paper Chromatography

Qualitative Analysis of the any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+} , Cu^{2+} , Ca^{2+} , Ni^{2+} , Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).

Section - II (Physical)

1. To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi – and trivalent anions.
2. To determine the surface tension of a given liquid by drop number method.
3. To determine the viscosity of a given liquid**.**

Section - III (Organic)

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point

i) *m*-Dinitrobenzne from nitrobenzene (use 1:2 conc. HNO_3-H_2SO_4 mixture if fuming HNO_3 is not available)

ii) p-Bromoacetanilide from acetanilide.

iii) Dibenzalacetone from acetone and benzaldehyde

iv) Aspirin from salicylic acid.

Distribution of marks

1.	Section I	5 marks
2.	Section II	5 marks
3.	Section III	5 marks
4.	Viva-voce	5 marks
5.	Lab Record	5 marks

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 128

(Based on paper BHM126 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: : The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 128

(Based on paper BHM126 Opt(ii))

Time:3 Hours

Max. Marks: 25

SPECIAL NOTES

1. Do any eight experiments .
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 10 marks
Viva Voce :	= 10 marks
Lab Record :	= 5 marks
Total	= 25 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. Low resistance by Carey Foster's Bridge with calibration.
2. Frequency of A.C. mains and capacity by elctrical vibrator.
3. Frequency of A.C. mains by sonometer using an electromagnet.
4. High resistance by substitution method.
5. To draw forward and reverse bias characteristics of a semiconductor diode.
6. Zener Doide volage regulation characteristics.
7. Verification of Inverse square law by photo-cell.
8. To study the characteristics of a solar cell.
9. e/m by Thomson method.
10. Transistor as voltage Amplifier in C-B Configuration.
11. Transistor as voltage Amplifier in C-E Configuration.
12. Study of B-H Curve by C.R.O.
13. Study of Hartley Oscillator (Calibration of Gang Condenser)

(w.e.f. 2018-19)

English- II

Code: BHM 129

Max. Marks : 60
Time : 3 Hours

Part-A Short Stories

The following Stories from **The Pointed Vision: An Anthology of Short Stories** By Usha Bande and Krishan Gopal (Oxford University Press, New Delhi) :

1. 'The Bet' by Anton Chekhov
2. 'Gift of Magi' by O Henry
3. 'The Postmaster' by Rabindranath Tagore
4. 'Three Questions' by Leo Tolstoy.
5. 'The Dying Detective' by Arthur Conana Coyle.
6. 'Under the Banyan Tree' by R.K. Narayan.

Part-B (i) Grammar and Writing Skills

a) Synonyms and Antonyms
b) Prefix-Suffix
c) Homophones and Homonyms
d) One word substitution

(ii) a) Developing writing skills through theme based paragraphs.
b) Technical writing: E-mail writing, Reporting, Resume Writing, Re-viewing. T.V. Programmes

Instruction to the Paper-Setter and the Students

Q. No. 1 Explanation with reference to the context. The student will be required to attempt two passages (with internal choice) from the book of Stories. **(6x2=12)**

Q. No. 2 Two essay type questions (with internal choice) will be asked from the book of stories. **(6x2=12)**

Q. No.3 This question will be based on grammar. Students will be required to attempt 12 sentences out of the given 20. **(12)**

Q. No. 4.& 5 Question No. 4 & 5 will be based on writing skills and technical writing. **(12x2=24)**

Total=60

Suggested Reading:

High School Grammar by Wren and Martin.
Remedial English Grammar for Foreign Students by F.T. Wood.
Essentials of Communication by D.G. Sexena, Kuntal Tamang (Top Quark)

NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics, Semester-III
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assessment	Practicals	Total Marks
BHM 231	Advanced Calculus	4 Hours/ week	60	15	-	75
BHM 232	Partial Differential Equations	4 Hours/ week	60	15	-	75
BHM 233	Statics	4 Hours/ week	60	15	-	75
BHM 234	Differential Geometry	4 Hours/ week	60	15	-	75
BHM 235	Opt(i) : Probability Distributions	4 Hours/ week	60	15	-	75
	Opt(ii) ;Chemistry- III	4 Hours/ week				
BHM 236	Opt(i) : Database Management and Oracle	4 Hours/ week	60	15	-	75
	Opt(ii) : Physics - III	4 Hours/ week				
BHM 237	Practicals/ Computational work (based on Paper BHM 235)	4 Hours/ week	-		25	25
BHM 238	Practicals/ Computational work (based on Paper BHM 236)	4 Hours/ week	-		25	25
Total marks of Semester-III						500

Note : The conditions with regard to the above scheme will be as per the relevant ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Advanced Calculus

Code: BHM 231

Max. Marks: 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

Books Recommended:

1. C.E. Weatherburn : Differential Geometry of three dimensions, Radhe Publishing House, Calcutta
2. Gabriel Klaumber : Mathematical analysis, Mrcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad : Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan : A Course in Mathemtical Analysis, S.Chand and company, New Delhi
7. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

(w.e.f. 2018-19)

Partial Differential Equations

Code: BHM 232

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – II

Linear partial differential equations of second and higher orders, Linear and non-linear homogenious and non-homogenious equations with constant co-efficients, Partial differential eqution with variable co-efficients reducible to equations with constant coefficients, their complimentary functions and particular Integrals, Equations reducible to linear equations with constant co-efficients.

Section – III

Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

Section – IV

Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
4. Ian N.Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. Frank Ayres : Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972
6. J.N. Sharma & Kehar Singh : Partial Differential Equations

(w.e.f. 2018-19)

Statics

Code: BHM 233

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Composition and resolution of forces. Parallel forces. Moments and Couples.

Section – II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

Section – III

Virtual work. Forces in three dimensions. Poinsots central axis.

Section – IV

Wrenches. Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney : Statics, Macmillan Company, London
2. R.S. Verma : A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad

(w.e.f. 2018-19)

Differential Geometry

Code: BHM 234

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

One Parameter family of Surfaces : Envelope, Characteristics , edge of regression , Developable surfaces.

Developables Associated with a Curve : Osculating developable, Polar developable, Rectifying developable.

Section – II

Two- parameter Family of Surfaces: Envelope, Characteristics points,

Curvilinear coordinates, First order magnitudes, Directions on a surface, The normal, Second order magnitudes, Derivatives of **n**.

Section III

Curves on a Surface: Principal directions and curvatures, First and second curvatures, Euler's theorems, Dupin's indicatrix, The surfaces z = f(x,y), Surface of revolution.Conjugate directions, Conjugate systems.Asymptotic lines, Curvature and torsion,Isometric parameters, Null lines, or minimal curves.

Section IV

Geodesics and Geodesic Parallels: Geodesics: Geodesic property, Equation of Geodesics, Surface of revolution, Torsion of Geodesic.

Curves in Relation to Geodesics: Bonnet's theorem, Joachimsthal's theorems, Vector curvature, Geodesic curvature, κ_g, Other formulae for κ_g, Bonnet's formula.

Books Recommended:

1. Weatherburn, C.E., Differential Geometry of Three Dimensions, Radhe Publishing House.
2. Erwin Kreyszig, Differential Geometry.
3. Singh, A.K., Mittal, P.K., A Textbook of Differential Geometry, Har-Anand Publications.

(w.e.f. 2018-19)

Probability Distributions

Code: BHM 235 Opt(i)

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Generating Functions: Moment generating function and cumulant generating function along with their properties and uses.

Tchebychev's inequality, Convergence in probability, Weak and strong laws of large numbers (Statements only).

Section – II

Bernoulli, binomial, Poisson, geometric and hyper-geometric distributions with their properties.

Section – III

Uniform, gamma, beta (first and second kinds) and exponential distributions with their properties.

Section – IV

Normal distribution with its properties. Central Limit Theorem (Statement only) and its applications.

Books Suggested:

1. Baisnab and M. Jas, Element of Probability and Statistics, Tata McGraw Hill.
2. P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.

(w.e.f. 2018-19)

Chemistry - III

Code: BHM 235 Opt(ii)

Max. Marks: 60
Time: 3 Hours

Note: Examiner will set three questions from each sec tion. The candidate will be required to attempt five questions in all, selecting not more than two questions from each section. All questions carry equal marks.

Section-I

Chemistry of d-Block Elements

Definition of transition elements, position in the periodic table, General characteristics & properties of d-block elements, Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii, oxidation state, magnetic and spectral properties.

Coordination Compounds

Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral and tetrahedral complexes, factors affecting the crystal-field parameters.

Section-II

Thermodynamics

Definition of thermodynamic terms: system,surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Calculation of w.q. dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Kirchoffs equation.

Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorm, Thermodynamics scale of temperature. Concept of entropy – entropy as a state function, entropy as a function of P, V & T.

Section-III

Alcohols

Monohydric alcohols — nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature.

Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols,

Phenols

Nomenclature, structure and bonding. Preparation of phenols, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Mechanisms of Fries rearrangement, Claisen rearrangement, and Schotten and Baumann reactions.

Epoxides

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides,

Ultraviolet (UV) absorption spectroscopy

Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.

Carboxylic Acids & Acid Derivatives

Nomenclature of Carboxylic acids, structure and bonding, , acidity of carboxylic acids, effects of substituents on acid strength. Hell-Volhard-Zelinsky reaction. Mechanism of decarboxylation.

Relative stability of acyl derivatives. interconversion of acid derivatives by nucleophilic acyl substitution.

Mechanisms of esterification and hydrolysis (acidic and basic).

(w.e.f. 2018-19)

Database Management System and Oracle

Code: BHM 236 Opt(i)

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section - I

Terminologies of database, Drawbacks of conventional file systems, Data administrator (Role and functions), Characteristics of databases, Data redundancy, Data integrity, Data independence. DBMS and its functions. Advantages and disadvantages of database.

Section - II

Three levels of the architecture: External level, Conceptual level and Internal level, Mappings and Schemas, Client/Server architecture, Distributed processing.

Section - III

Data model, Relational data model, Hierarchical data model, Network data model.
Relational model, Basic structure, Terminology.
Normalization, First Normal Form, Second Normal Form, Third Normal Form, BCNF, Relational algebra and Relational Calculus

Section - IV

PL/SQL Blocks, Data types, PL/SQL functions, Cursors, Error handling inPL/SQL, Package functions, Package procedures.
Database Triggers: Use & type of database Triggers, DatabaseTriggers Vs. Declarative Integrity Constraints, Creatinga Trigger, BEFORE vs AFTER Trigger Combinations, Dropping a Trigger.

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Books Recommended

1. C.J. Date, Sixth Ed., An Introduction to Database System, Addison-Wesley Publishing Co.
2. Ullman, D.Jeffery, Principles of Database System, Computer Science Press.
3. James Martin, Principles of Database Management System, Prentice Hall of India Pvt. Ltd.
4. Desai, C.Bipin, Introduction to Data base Systems, Galgotia Publ.
5. R.P. Whittington, Data Base Systems Engineering, Clavendon Press.
6. D.M.Kroenke, Database Processing : Fundamental Design, Implementation, 2nd Edn. Galgotia Publ. Pvt. Ltd.
7. Wiederhold, Database Design, McGraw Hill Book Comp.

(w.e.f. 2018-19)

Physics - III

Code: BHM 236 Opt(ii)

Max. Marks: 60
Time: 3 Hours

NOTE : The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of ten marks will be compulsory having five parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section - I

Interference

Interference by Division of Wavefront : Fresnel's Biprism and its applications to determination of wave length of sodium light and thickness of a mica sheet, Lioyd's mirror, phase change on reflection.
Interference by Division of Amplitude :Colour of thin, films, wedge shaped film, Newton's rings. Interferometers: Michelson's interferometer and its application to (I) Standardisation of a meter (II) determination of wave length.

***Section** - II*

Diffraction

Fresnel's Diffraction : Fresnel's half period zones, zone plate, diffraction at a straight edge, rectangular slit and circular apperture.
Fraunhoffer diffraction : One slit diffraction, Two slit diffraction, N-slit diffraction, Plane transmission grating spectrum, Dispersive power of a grating , Limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating.

Polarisation

Polarisation and Double Refraction : Polarisation by reflection, Polarisation by scattering, Malus law, Phenomenon of double refraction, Huytgen's wave theory of double refraction (Normal and oblique incidence), Analysis of Palorised light : Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii)Elliptically polarized light, Optical activity, Fresnel's theory of rotation, Specific rotation, Polarimeters (half shade and Biquartz).

Section - III

Nuclear Physics

Nuclear mass and binding energy, systematics nuclear binding energy, nuclear stability, Nuclear size, spin, parity, statistics magnetic dipole moment, quadrupole moment (shape concept).
Interaction of heavy charged particles (Alpha particles), alpha disintegration and its theory Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Energetics of alpha -decay, Range and straggling of alpha particles. Geiger-Nuttal law.
Introduction of light charged particle (Beta-particle), Origin of continuous beta-spectrum (neutrino hypothesis) types of beta decay and energetics of beta decay, Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles.
Interaction of Gamma Ray, Nature of gamma rays, Energetics of gamma rays, passage of Gamma radiations through matter (photoelectric, compton and pair production effect) electron Positron anhilation. Asborption of Gamma rays (Mass attenuation coefficient) and its application.

References :

1. Optics by Ajay Ghatak, Tata McGraw Hill 1977.
2. Introduction of Optics by Frank L. Pedrotti and Leno S. Pedrotti, Prentice Hall 1987.
3. Nuclear Physics by D.C. Tayal, Umesh Prakashan, 125, Goblind Dev Khurja (UP).
4. Nuclear Physics by W.E. Burcham.
5. Experimental Nuclear Physics by M. Singru.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 237

(Based on paper BHM235 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 237

(Based on paper BHM235 Opt(ii))

Time:3 Hours

Max. Marks: 25

Section-I (Inorganic)

Preparations: Preparation of Cuprous chloride, prussion blue from iron fillings, tetraammine cupric sulphate, chrome alum, potassium trioxalatochromate (III).

Section-II (Physical)

1. To determine the solubility of benzoic acid at various temperatures and to determine the ▲H of the dissolution process
2. To determine the enthalpy of neutralization of a weak acid/weak base vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride

4 .To study the distribution of iodine between water and CCl_4.

Distribution of marks

1.	Section I	5 marks
2.	Section II	10 marks
3.	Viva-voce	5 marks
4.	Lab Record	5 marks

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 238

(Based on paper BHM236 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set **3(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 238

(Based on paper BHM236 Opt(ii))

Time:3 Hours

Max. Marks: 25

SPECIAL NOTES

1. Do any eight experiments .
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 10 marks
Viva Voce :	= 10 marks
Lab Record :	= 05 marks
Total	= 25 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. To measure the (a) area of a window (b) height of an inaccesible object.
2. Refractive index and dispersive power of a prism material by spectrometer.
3. Determination of wave length of Na light and the number of lines per cerntimeter using a diffraction grating.
4. Wave length by Newton's Rings.
5. Resolving power of a telescope.
6. Comparision of Illuminating Powers by a Photometer.
7. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
8. Diameter of Lycopodium powder particies by Carona rings.
9. To study double slit interference by He-Ne laser.
10. Diameter of a thin wire by diffraction method (using He-Ne Laser).
11. Young's modulus by Newtons rings method.
12. Resolving power of a prism.
13. Thickness of a thin plate using air wedge.
14. Resolving Power of plane transmission grating.

NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics Semester-IV
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assesment	Practicals	Total Marks
BHM 241	Sequences and Series	4 Hours/ week	60	15	-	75
BHM 242	Special Functions and Integral transforms	4 Hours/ week	60	15	-	75
BHM 243	Programming in C and Numerical Methods	4 Hours/ week	45	-	30	75
BHM 244	Hydrostatics	4 Hours/ week	60	15	-	75
BHM 245	Opt(i) : Elementary Inference	4 Hours/ week	60	15	-	75
	Opt(ii) : Chemistry - IV	4 Hours/ week				
BHM 246	Opt(i) : Data Structures using C	4 Hours/ week	60	15	-	75
	Opt(ii) : Physics - IV	4 Hours/ week				
BHM 247	Practicals/ Computational Work (Based on paper BHM 245)	4 Hours/ week	-		25	25
BHM 248	Practicals/ Computational Work (Based on paper BHM 246)	4 Hours/ week	-		25	25
Total marks of Semester-IV						500

Note : The conditions with regard to the above scheme will be as per the relevant ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Sequences and Series

Code: BHM 241

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

Section – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

Section – III

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

Section – IV

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only) Convergence and absolute convergence of infinite products.

Books Recommended:

1. R.R. Goldberg : Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan : A Course in Mathematical Analysis, S.Chand and company, New Delhi
4. Murray, R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing co., New York
5. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York

(w.e.f. 2018-19)

Special Functions and Integral Transforms

Code: BHM 242

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties-Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

Section – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

Section – III

Laplace Transforms – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

Section – IV

Fourier transforms: Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

Books Recommended:

1. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
2. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.
4. W.W. Bell : Special Functions for Scientists & Engineers.
5. I.N. Sneddon: the use of integral transform, McGraw Hill, 1972
6. Murray R. Spiegel: Laplace transform, Schaum's Series

(w.e.f. 2018-19)

Programming in C and Numerical Methods

Code: BHM 243

Part-A (Theory)

Max. Marks: 45
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions.

Section – II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Section – III

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions.

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number, Order of convergence of above methods.

Section – IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie : The C Programming Language, 2nd Edition
2. V. Rajaraman : Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried : Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
4. Babu Ram: Numerical Methods, Pearson Publication
5. M.K. Jain, S.R.K.Iyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
6. M.K. Jain, S.R.K. Iyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
7. Computer Oriented Numerical Methods, Prentice Hall of India Pvt. Ltd.
8. Programming in ANSI C, E. Balagurusamy, Tata McGraw-Hill Publishing Co. Ltd.
9. Babu Ram: Numerical Methods, Pearson Publication.
10. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.

Part-B (Practical)

Max. Marks: 30
Time: 3 Hours

There will be a separate practical paper which will consist simple programs in C and the implementation of Numerical Methods, studied in the paper BHM 243 (Part-A).

(w.e.f. 2018-19)

Hydrostatics

Code: BHM 244

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Pressure equation. Condition of equilibrium. Lines of force. Homogeneous and heterogeneous fluids. Elastic fluids. Surface of equal pressure. Fluid at rest under action of gravity. Rotating fluids.

Section – II

Fluid pressure on plane surfaces. Centre of pressure. Resultant pressure on curved surfaces. Equilibrium of floating bodies. Curves of buoyancy. Surface of buoyancy.

Section – III

Stability of equilibrium of floating bodies. Metacentre. Work done in producing a displacement. Vessels containing liquid.

Section – IV

Gas laws. Mixture of gases. Internal energy. Adiabatic expansion. Work done in compressing a gas. Isothermal atmosphere. Connective equilibrium.

Books Recommended

1. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Cambridge University Press, 1956.
2. A.S. Ramsey, Dynamics, Part I, Cambridge University Press, 1973.
3. W.H. Basant and A.S. Ramsey, A Treatise on Hydromechanics, Part I Hydrostatics, ELBS and G. Bell and Sons Ltd., London.

(w.e.f. 2018-19)

Elementary Inference

Code: BHM 245 Opt(i)

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Parameter and statistic, sampling distribution and standard error of estimate. Point and interval estimation, Unbiasedness, Efficiency, Consistency and Sufficiency.

Section – II

Method of maximum likelihood estimation.
Null and alternative hypotheses, Simple and composite hypotheses, Critical region, Level of significance, One tailed and two tailed tests, Types of errors, Neyman- Pearson Lemma.

Section – III

Testing and interval estimation of a single mean, single proportion, difference between two means and two proportions. Fisher's Z transformation.

Section – IV

Definition of Chi-square statistic, Chi-square tests for goodness of fit and independence of attributes.
Definition of Student's 't' and Snedcor's F-statistics. Testing for the mean and variance of univariate normal distributions, Testing of equality of two means and two variances of two univariate normal distributions. Related confidence intervals. Analysis of variance(ANOVA) for one-way and two-way classified data.

Books Suggested:

1. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2. A.M. Goon, M.K. Gupta, and B. Das Gupta, Fundamentals of Statistics, Vol-II.
3. R.V. Hogg and A.T. Craig, Introduction to Mathematical Statistics.
4. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.

(w.e.f. 2018-19)

Chemistry – IV

Code: BHM 245 Opt(ii)

Max. Marks : 60
Time : 3 Hours

Note: Examiner will set three questions from each sec tion. The candidate will be required to attempt five questions in all, selecting not more than two questions from each section. All questions carry equal marks.

Section-I

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Acids and Bases, HSAB Concept

Arrhenius, Bronsted – Lowry, the Lux – Flood, Solvent system and Lewis concepts of acids & bases, relative strength of acids & bases, Concept of Hard and Soft Acids & Bases.

Chemistry of f – block elements

Lanthanides

Occurrence, Electronic structure, oxidation states and ionic radii and lanthanide contraction and complex formation of lanthanide compounds.

Actinides

General features and chemistry of actinides, Comparison of properties of Lanthanides and Actinides and with transition elements. Elementary idea about the transuranic elements.

Section-II

Thermodynamics

Third law of thermodynamics: Nernst heat theorem, Thermodynamic functions G,H,E,A & S. Criteria for thermodynamic equilibrium and spontaneity of a process in terms of thermodynamic functions.

Chemical Equilibrium

Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Clapeyron equation and clausius – clapeyrou equation its applications.

Electrochemistry

Electrolytic and Galvanic cells – reversible & Irreversible cells, conventional representation of electrochemical cells. EMF of cell and its measurement, Weston standard cell, activity and activity coefficients.

Calculation of thermodynamic quantities of cell reaction ($\blacktriangle G$, $\blacktriangle H$ & K).

Nernst equation, prediction of single electrode potentialand EMF of cell. Reference electrodes; standard hydrogen electrode & calomel

electrode standard electrode potential, sign convention, electrochemical series and its applications.

Section-III

Infrared (IR) absorption spectroscopy

Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups. **2.**

Amines

Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. . Gabriel-phthalimide reaction, Hofmann bromamide reaction.

electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

Diazonium Salts

Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO_2 and CN groups.

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate.,. Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin and aldol, condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction.

(w.e.f. 2018-19)

Data Structures using C

Code: BHM 246 Opt(i)

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Data structure and its essence, Data structure types.
Linear and list structures: Arrays, stacks, queues and lists; Sequential and linked structures; Simple lists, circular lists, doubly linked lists.
Inverted lists, threaded lists, Operations on all these structures and applications.

Section – II

Arrays, Multidimensional arrays, sequential allocation, address calculations, sparse arrays. Tree structures: Trees, binary trees and binary search trees. Implementing binary trees, Tree traversal algorithms, threaded trees, trees in search algorithms, AVL Trees.

Section – III

Graph data structure and their applications. Graph traversals, shortest paths, spanning trees and related algorithms.
Family of B-Trees: B-tree, B*-Trees, B+ Trees.

Section – IV

Sorting: Internal and External sorting. Various sorting algorithms, Time and Space complexity of algorithms.
Searching techniques and Merging algorithms. Applications of sorting and searching in computer science.

Suggested Readings:

1. Lipschutz: Data Structures (Schaum's Outline Series), Tata McGraw-Hill.
2. Adam Drozdek: Data Structures and Algorithms in C++, Vikas Pub. House (Thmpson), New Delhi.
3. Gupta Amit: Data Structures Through C, Galgotia Booksource Pvt. Ltd., New Delhi.
4. Sofat S.: Data Structures With C and C++, Khanna Book Pub. Co.(P) Ltd, N. Delhi.
5. Dromey R.G: How to Solve it by Computer ?, Prentice Hall India.
6. Loomis: Data Structure and File Management, Prentice-Hall India Ltd.
7. Tannenbaum: Data Structure Using C, Tata McGraw-Hill.

(w.e.f. 2018-19)

Physics - IV

Code: BHM 246 Opt(ii)

Max. Marks: 60
Time: 3 Hours

NOTE : The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of ten marks will be compulsory having five parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section - I

Computer Programming Computer organisation, Binary representation, Algorithm development, flow charts and their interpretation.

Fortran Preliminaries; Integer and floating point arithmetic expression, built in functions executable and non-executable statements, input and output statements, Formats, I.F. DO and GO TO statements, Dimesion arrays statement function and function subprogram.

Section-II

Statistical MechanicsProbability, some probability considerations, combinations possessing maximum probability, combinations possessing minimum probability, distribution of molecules in two boxes. Case with weightage (general). Phase space, microstates and macrostates, statistical fluctuations constraints and accessible States Thermodynamical probability.

Postulates of Statistical Physics. Division of Phase space into cells, Condition of equilibrium between two system in thermal contact. b-Parameter. Entropy and Probability, Boltzman's distribution law. Evaluation of A and b. Bose-Einstein statistics, Application of B.E. Statistics to Plancks's radiation law, B.E. gas

Section-III

Quantum MechanicsFailure of (Classical) E.M. Theory. quantum theory of radiatio (old quantum theory), Photon, photoelectric effect and Einsteins photoelectric equation compton effect (theory and result). Inadequancy of old quantum theory, de-Broglie hypothesis. Davisson and Germer experiment. G.P. Thomson experiment. Phase velocity group velocity, Heisenberg's uncertainty principle. Time-energy and angular momentum, position uncertainty, Uncertainty principle from de-Broglie wave, (wave-partice duality). Gamma Ray Microscope, Electron diffraction from a slit.

Derivation of time dependent Schrodinger wave equation.

References:

1. Rajaraman, Fortran Programming.
2. Schaum Series, Fortran 77.
3. Ram Kumar, Programming with Fortran - 77.
4. B.B. Laud, "Introduction to Statistical Mechanics" (Macmillan 1981).
5. F. Reif, "Statistical Physics' (McGraw Hill 1988).
6. Quantum Mechanics by L.I. Schiff, McGraw Hill Book Company, Inc.
7. Quantum Mechanics by B. Crasemand and J.D. Powel (Addison Wesley.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 247

(Based on paper BHM245 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set 3**(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 247

(Based on paper BHM245 Opt(ii))

Time:3 Hours

Max. Marks: 25

Section-I

1**. Gravimetric Analysis**

Quantitative estimations of, Cu^{2+} as copper thiocyanate and Ni^{2+} as Ni – dimethylglyoxime.

2**. Colorimetry:**

To verify Beer - Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/K_2Cr_2O_7$ solution.

Section- II (Organic)

Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds: Naphthalene, anthracene, acenaphthene, benzyl chloride, *p*-dichlorobenzene, *m*-dinitrobenzene, *p*-nitrotoluene, resorcinol , hydroquinone, α-naphthol, β-naphthol, benzophenone, ethyl methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide, urea, acetanilide, benzanilide, aniline hydrochloride, p-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, *o-, m-, p*-nitroanilines, thiourea.

Distribution of marks

1.	Section I	5 marks
2.	Section II	10 marks
3.	Viva-voce	5 marks
4.	Lab Record	5 marks

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 248

(Based on paper BHM246 Opt(i))

Max. Marks : 25

i) Written Practical/ Lab work : 20 Marks

ii)Viva-voce and practical record : 05 Marks

Time:3 Hours

Note: The examiner is requested to set 3**(Three)** experiments. The candidate is required to attempt **2(Two)** of the allotted experiments.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 248

(Based on paper BHM246 Opt(ii))

Time:3 Hours

Max. Marks: 25

SPECIAL NOTES

1. Do eight experiments .(Four from each section)
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 10 marks
Viva Voce :	= 10 marks
Lab Record :	= 5 marks
Total	= 25 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

(i) Electronics

1. To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters.
2. To study the ripple factor in a d.c. power supply.
3. To draw frequency response curve of transistorised R.C. coupled amplifier.
4. To find out the frequency of a tuning fork by Melde's experiment.
5. Study of series and parallel resonance circuits.
6. Electronic Voltmeter measurement of peak, average & R.M.S. valus of signal.
7. Study of voltage doubler and trippler circuits.

(ii) Computer Experiments

1. To print out all natural (even/odd) number between given limits using computer.
2. To find maximum, minimum and range of a given set of numbers using computer.
3. To evaluate sum of finite series.
4. Find the roots of a quadratic equation.
5. To find intergration of a definite integral by trapezoidal rule.
6. To find the area of a triangle, sphere and cylinder.
7. Given value for a,b,c and d and a set of values for the variable x evaluate the function defined by

   $F(x)= ax^2+bx+c$ if $x<d$

   $F(x)= O$ if $x=d$

   $F(x)= ax^2+bx-c$ if $x>d$

   For each value of x, and print the value of x and F(x). Write a program for an arbitary number of x values.

NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics Semester-V
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assesment	Practicals	Total Marks
BHM 351	Real Analysis	4 Hours/ week	60	15	-	75
BHM 352	Groups and Rings	4 Hours/ week	60	15	-	75
BHM 363	Numerical Analysis	4 Hours/ week	45	-	30	75
BHM 354	Integral Equations	4 Hours/ week	60	15	-	75
BHM 355	Methods of Applied Mathematics	4 Hours/ week	60	15	-	75
BHM 356	Operations Reasearch-I	4 Hours/ week	60	15	-	75
BHM 357	Practical/ Lab work to be performed on computers using EXCEL/SPSS)	4 Hours/ week	-		50	50
Total marks of Semester-V						500

Note : The conditions with regard to the above scheme will be as per the relevant ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Real Analysis

Code: BHM 351

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Section – II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and integrability of an integral of a function of a parameter.

Section – III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, contraction Principle

Section – IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness , components, continuity in relation with connectedness.

Book s Recommended:

1. P.K. Jain and Khalil Ahmad: Metric Spaces, 2nd Ed., Narosa, 2004
2. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
4. D. Somasundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
5. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi
6. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
7. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

(w.e.f. 2018-19)

Groups and Rings

Code: BHM 352

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Largrage's theorem and its consequences, Normal subgroups, Quotient groups,

Section – II

Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

Section – III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Section – IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, R unique factorization domain implies so is $R[X_1, X_2, \ldots\ldots X_n]$

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.

(w.e.f. 2018-19)

Numerical Analysis

Code: BHM 363

Part-A (Theory)

Max. Marks: 45
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae, Hermite Formula.

Section – II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula.

Probability distribution of random variables, Binomial distribution, Poisson's distribution, Normal distribution: Mean, Variance and Fitting.

Section – III

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in Sections –I & II.

Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method, Lanczos method.

Section – IV

Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third and three-eighth rule, Chebychev formula, Gauss Quadrature formula.

Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.

Books Recommended:

1. Babu Ram: Numerical Methods, Pearson Publication.
2. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.
3. M.K. Jain, S.R.K.Iyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
4. M.K. Jain, S.R.K. Iyengar, R.K. Jain : Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
5. C.E. Froberg : Introduction to Numerical Analysis (2nd Edition).
6. Melvin J. Maaron : Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York
7. R.Y. Rubnistein : Simulation and the Monte Carlo Methods, John Wiley, 1981
8. Computer Oriented Numerical Methods, Practice Hall of India Pvt. Ltd.

Part-B (Practical)

Max. Marks: 30
Time: 3 Hours

There will be a separate practical paper which will consist implementation o numerical methods, studied in the theory paper BHM 363(Part-A), in C Programming Language.

(w.e.f. 2018-19)

Integral Equations

Code: BHM 354

Max. Marks : 60
Time : 3 Hours

Section I

Linear integral equations, Some basic identities, Initial-value problems reduced to Volterra integral equations, Method of successive approximation to solve Volterra integral equations of second kind, Iterated kernels and Neumann series for Volterra equation. Resolvent kernel as a series in λ, Laplace transform method for a difference kernel, Solution of a Volterra integral equation of the first kind.

Section II

Boundary value problems reduced to Fredholm integral equations, method of successive approximations to solve Fredholm equation of second kind, Iterated kernels and Neumann series for Fredholm equations, Resolvent kernel as a sum of series, Fredholm resolvent kernel as a ratio of two series. Fredholm equations with degenerate kernel, approximation of a kernel by a degenerate kernel, Fredholm Alternative.

Section III

Green's function. Use of method of variation of parameters to construction the Green's function for a nonhomogeneous linear second degree BVP, Basic four properties of the Green's function, Alternate procedure for construction of the Green's function by using its basic four properties. Method of series representation of the Green's function in terms of the solutions of the associated homogeneous BVP. Reduction of a BVP to a Fredholm integral equation with kernel as Green's function.

Section IV

Homogeneous Fredholm equations with symmetric kernels, Solution of Fredholm equations of the second kind with symmetric kernel, Method of Fredholm Resolvent Kernel, Method of Iterated Kernels, Fredholm Equations of the First Kind with Symmetric Kernels.

Books Recommended:

1. Jerri, A.J., Introduction to Integral Equations with Applications.
2. Polyanin, A.D., Manzhirov, A.V., handbook of Integral Equations, CRC Press.
3. Kondo, J., Integral Equations, Oxford Applied mathematics and Computing Science Series.

(w.e.f. 2018-19)

Methods of Applied Mathematics

Code: BHM 355

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section - I

Solution of 3D Laplace, wave and heat equations in spherical polar co-ordinates and cylindrical polar co-ordinates by the method of separation of variables. Fourier series solution of the wave equation, transformation of boundary value problems.

Section - II

Fourier series solution of the heat equation, steady-state temperature in plates, The heat and wave equations in unbounded domains, Fourier transform solution of boundary value problems. The heat equation in an infinite cylinder and in a solid sphere.

Section - III

Hankel transform of elementary functions. Operational properties of the Hankel transform. Applications of Hankel transforms to PDE.
Definition and basic properties of finite Fourier sine and cosine transforms, its applications to the solutions of BVP's and IVP's.

Section - IV

Moments and products of inertia, Angular momentum of a rigid body, principal axes and principal moment of inertia of a rigid body, kinetic energy of a rigid body rotating about a fixed point, Momental ellipsoid and equimomental systems, coplanar mass distributions, general motion of a rigid body.

Books Recommended :

1. Jerri, A.J., Introduction to Integral Equations with Applications.
2. Lokenath Debnath, Integral Transforms and their Applications, CRC Press, Inc., 1995.
3. Peter V. O'Neil, Advanced Engineering Mathematics, 4th Edition, An International Thomson Publishing Company.
4. Sneddon, I.N., Elements of Partial Differential Equations, Printice Hall, McGraw Hill.
5. Sneddon, I.N., Special Functions of Mathematical Physics and Chemistry.
6. Chorlton, F., Dynamics, CBS publishers and Distributors.

(w.e.f. 2018-19)

Operations Research-I

Code: BHM 356

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section- I

Definition, scope, methodology and applications of OR. Types of OR models.
Concept of optimization, Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP), Requirements for an LPP, Advantages and limitations of LP. Graphical solution: Multiple, unbounded and infeasible solutions.

Section-II

Principle of simplex method: standard form, basic solution, basic feasible solution.
Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, multiple solution and unbounded solution and degeneracy. Two Phase and Big-M methods.

Section-III

Duality in LPP, primal-dual relationship.
Transportation Problem: Methods for finding basic feasible solution of a transportation problem, Modified distribution method for finding the optimum solution, Unbalanced and degenerate transportation problems, transshipment problem, maximization in a transportation problem.

Section-IV

Assignment Problem: Solution by Hungarian method, Unbalanced assignment problem, maximization in an assignment problem, Crew assignment and Travelling salesman problem.
Game Theory: Two person zero sum game, Game with saddle points, the rule of dominance; Algebraic, graphical and linear programming methods for solving mixed strategy games.

Books Recommended

1. Sharma, J.K., Mathematical Model in Operations Research, Tata McGraw Hill.
2. Taha, H.A., Operations Research – An Introduction.
3. Kanti Swarup, Gupta, P.K. and Manmohan. Operations Research.
4. Gupta, P.K. and Hira, D.S., Operations Research, S. Chand & Co.
5. S.I. Gass, Linear Programming (3rd Edition), McGraw Hill, NY, 1985.
6. S.D.Sharma, Operations Research.
7. N.S. Kambo, Mathematical Programming.
8. G. Hadley, Linear Programming, Narosa Publishing House, 1987.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 357

Max. Marks : 50
i) Written Practical/ Lab work : 40 Marks
ii)Viva-voce and practical record : 10 Marks
Time:3 Hours

Note: The examiner is requested to set **4** experiments. The candidate is required to attempt **2** of the allotted experiments.

This paper covers the practical/Lab-work to be performed on computer using EXCEL/SPSS.

NEW SCHEME

Scheme of Examination of
B.Sc. (Honours) Mathematics Semester-VI
(w.e.f. 2018-2019)

Paper Code	Title of the paper	Teaching Hours	Max. Marks			
			Theory	Internal Assesment	Practicals	Total Marks
BHM 361	Real and Complex Analysis	4 Hours/ week	60	15	-	75
BHM 362	Linear Algebra	4 Hours/ week	60	15	-	75
BHM 353	Dynamics	4 Hours/ week	60	15	-	75
BHM 364	Elementary Topology	4 Hours/ week	60	15	-	75
BHM 365	Fluid Dynamics	4 Hours/ week	60	15	-	75
BHM 366	Operations Research-II	4 Hours/ week	60	15	-	75
BHM 367	Practical/ Lab work to be performed on computers using MATLAB/TORA	4 Hours/ week	-		50	50
Total marks of Semester-VI						500

Note : The conditions with regard to the above scheme will be as per the relevant ordinance and rules and regulations of the University.

(w.e.f. 2018-19)

Real and Complex Analysis

Code: BHM 361

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

Section – II

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

Section – III

Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions.

Section – IV

Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings, Mobius transformations. Fixed pints, Cross ratio, Inverse Points and critical mappings.

Books Recommended:

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 Course 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 & J.W. Brown: Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990
6. Shanti Narayan : Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

(w.e.f. 2018-19)

Linear Algebra

Code: BHM 362

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimentional vactor spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Section – III

Algebra of Liner Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

1. I.N. Herstein : Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal : Basic Abstract Algebra (2nd edition).
3. Vivek Sahai and Vikas Bist : Algebra, NKarosa Publishing House.
4. I.S. Luther and I.B.S. Passi : Algebra, Vol.-II, Norsa Publishing House.

(w.e.f. 2018-19)

Dynamics

Code: BHM 353

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

Section – II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

Section – III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

Section – IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.

Books Recommended:

1. S.L.Loney : An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
2. F. Chorlton : Dynamics, CBS Publishers, New Delhi
3. A.S. Ramsey: Dynamics Part-1&2, CBS Publisher & Distributors.

(w.e.f. 2018-19)

Elementary Topology

Code: BHM 364

Max. Marks : 60
Time : 3 hours

Note: The question paper will consist of **five** sections. Each of the first four sections***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section-1

Definition and examples of topological spaces. Comparison of topologies on a set, Intersection and union of topologies on a set. Neighbourhoods, Interior point and interior of a set , Closed set as a complement of an open set , Adherent point and limit point of a set, Closure of a set, Derived set, Properties of Closure operator, Boundary of a set , Dense subsets, Interior, Exterior and boundary operators. Alternative methods of defining a topology in terms of neighbourhood system and Kuratowski closure operator.

Section-II

Relative(Induced) topology, Base and subbase for a topology, Base for Neighbourhood system. Continuous functions, Open and closed functions , Homeomorphism. Connectedness and its characterization, Connected subsets and their properties, Continuity and connectedness, Components, Locally connected spaces.

Section-III

Compact spaces and subsets, Compactness in terms of finite intersection property,Continuity and compact sets, Basic properties of compactness, Closedness of compactsubset and a continuous map from a compact space into a Hausdorff and its consequence. Sequentially and countably compact sets, Local compactness and one point compatification.

Section-IV

First countable, second countable and separable spaces, hereditary and topological property, Countability of a collection of disjoint open sets in separable and second countable spaces, Lindelof theorem. T0, T1, T2 (Hausdorff) separation axioms,their characterization and basic properties.

Note : The question paper of each course will consist of five Sections. Each of the sections I to IV will contain two questions and the students shall be asked to attempt one question from each. Section-V shall be compulsory and will contain eight short answer type questions without any internal choice covering the entire syllabus.

Books Recommended :

1. C.W.Patty, Foundation of Topology, Jones & Bertlett, 2009.
2. Fred H. Croom, Principles of Topology, Cengage Learning, 2009.
3. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, Book Company, 1963.
4. J. L. Kelly, General Topology, Springer Verlag, New York, 2000.

5. J. R. Munkres, Toplogy, Pearson Education Asia, 2002.
6. K. Chandrasekhara Rao, Topology, Narosa Publishing House Delhi,2009.
7. K.D. Joshi, Introduction to General Topology, Wiley Eastern Ltd, 2006.

(w.e.f. 2018-19)

Fluid Dynamics

Code: BHM 365

Max. Marks : 60
Time : 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections ***(I-IV)*** will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section - I

Kinematics - Eulerian and Lagrangian methods. Stream lines, path lines and streak lines. Velocity potential. Irrotational and rotational motions. Vortex lines. Equation of continuity. Boundary surfaces.

Section - II

Acceleration at a point of a fluid. Components of acceleration in cylindrical and spherical polar co-ordiantes, Pressure at a point of a moving fluid. Euler's and Lagrange's equations of motion. Bernoulli's equation. Impulsive motion. Stream function.

Section - III

Acyclic and cyclic irrotation motions. Kinetic energy of irrotational flow. Kelvin's minimum energy theorem. Axially symmetric flows. Liquid streaming past a fixed sphere. Motion of a sphere through a liquid at rest at infinity. Equation of motion of a sphere. Three-dimensional sources, sinks, doublets and their images. Stoke's stream function.

Section - IV

Irrotational motion in two-dimensions. Complex velocity potential. Milne-Thomson circle theorem. Two-dimensional sources, sinks, doublets and their images. Blasius theorem. Two- dimensional irrotation motion produced by motion of circular and co-axial cylinders in an infinite mass of liquid.

Books Recommended:

1. F. Chorlton, Text Book of Fluid Dynamics, C.B.S. Publishers, Delhi, 1985
2. M.E. O'Neill and F. Chorlton, , Ideal and Incompressible Fluid Dynamics, Ellis Horwood Limited, 1986.
3. R.K. Rathy, An Introduction to Fluid Dynamics, Oxford and IBH Publishing Company, New Delhi, 1976.
4. W.H. Besant and A.S. Ramsay, A Treatise on Hydromechanics Part I and II, CBS Publishers, New Delhi.
5. Bansi Lal, Theoretical Fluid Dynamics, Skylark Pub., New Delhi.

(w.e.f. 2018-19)

Operations Research-II

Code: BHM 366

Max. Marks: 60
Time: 3 Hours

Note: The question paper will consist of **five** sections. Each of the first four sections (***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section- I

Inventory Control: introduction of inventory, factors affecting inventory, Inventory models, Deterministic models: Economic order quantity model when shortages are allowed/not allowed, price discounts model, multi-item inventory models.

Section-II

Queuing Theory : Basic characteristics of queuing system, Birth-death equations, Steady state solution of Markovian queuing models with single and multiple servers (M/M/1 and M/M/c), with limited capacity (M/M/1/K and M/M/c/K).

Section-III

Sequencing problems: Processing of n jobs through 2 machines, n jobs through 3 machines, 2 jobs through m machines, n jobs through m machines.
Replacement problems: Replacement of items whose running cost increases with time, Replacement policies for the items that fail completely - Individual and the group replacement policies.

Section-IV

PERT and CPM: Introduction of PERT and CPM, Earliest and latest times, Determination of critical path and various types of floats, Probablistic and cost considerations in project scheduling

Books Recommended:

1. Sharma, J.K., Mathematical Model in Operations Research, Tata McGraw Hill.
2. Taha, H.A., Operations Research – An Introduction.
3. Kanti Swarup, Gupta, P.K. and Manmohan. Operations Research.
4. Gupta, P.K. and Hira, D.S., Operations Research, S. Chand & Co.
5. S.D.Sharma, Introduction to Operations Research.

(w.e.f. 2018-19)

Practical/ Computational Work

Code: BHM 367

Max. Marks : 50
i) Written Practical/ Lab work : 40 Marks
ii)Viva-voce and practical record : 10 Marks
Time:3 Hours

Note: The examiner is requested to set **4** experiments. The candidate is required to attempt **2** of the allotted experiments.

This paper covers the practical/Lab-work to be performed on computer using MATLAB/TORA.