Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics
Applicable for Batch: 2017-20

DIT UNIVERSITY
Dehradun

Detailed Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Approved by the Academic Council at its 6th Meeting held on 13.05.2017

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Year: 1st **Semester: I**

Course Category	Course Code	Course Title	L	T	P	Credit
GEC	PY107	Mechanics	3	1	4	5.5
CC	MA106	Matrices &Linear Algebra	3	1	0	3.5
CC	MA107	Calculus I	3	1	0	3.5
SEC	CA102	Programming in C	3	0	2	4
AEC	HS101	Professional Communication	2	1	1	3
		Total				**19.5**

Year: 1st **Semester: II**

Course Category	Course Code	Course Title	L	T	P	Credit
CC	MA108	Calculus II	3	1	0	3.5
CC	MA109	Solid Geometry	3	1	0	3.5
SEC	CA114	Computer Organization	3	1	0	3.5
CC	MA116	Ordinary Differential Equations and Laplace Transforms	3	1	0	3.5
SEC	HS102	Corporate Communication & Soft Skills	2	1	1	3
		Total				**17**

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Year: 2nd **Semester: III**

Course Category	Course Code	Course Title	L	T	P	Credit
CC	MA206	Computer Based Numerical and Statistical Techniques (CBNST)	3	0	2	4
CC	MA207	Real Analysis	3	1	0	4
CC	MA208	Partial Differential Equations	3	1	0	4
CC	MA209	Introduction to Statistical Methods	3	1	0	4
CC	MA219	Linear Programing	3	1	0	4
		Total				**20**

Year: 2nd **Semester: IV**

Course Category	Course Code	Course Title	L	T	P	Credit
CC	MA216	Probability Distributions & Regression Analysis	3	1	0	4
CC	MA217	Introduction to Abstract Algebra &Number Theory	3	1	0	4
CC	MA218	Complex Analysis	3	1	0	4
GEC	CH201	Environmental Science	2	0	0	2
GEC	CA112	Data Structure	3	0	2	4
		Total				**18**

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics
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Year: 3rd **Semester: V**

Course Category	Course Code	Course Title	L	T	P	Credit
CC	MA306	Mathematical Modeling	3	1	0	4
CC	MA307	Differential Geometry	3	1	0	4
CC	MA308	Mathematical Methods	3	1	0	4
CC	MA309	Discrete Mathematics	3	1	0	4
PRJT	MA-311	Project-I	0	0	16	8
Total						**24**

Year: 3rd **Semester: VI**

Course Category	Course Code	Course Title	L	T	P	Credit
CC	MA-316	Integral Equations	3	1	0	4
CC	MA-317	Graph Theory	3	1	0	4
DSE		Elective – 1	3	1	0	4
DSE		Elective – 2	3	0	2	4
PRJT	MA-312	Major Project	0	0	16	8
Total						**24**

Elective-1	**L-T-P**
MA346- Metric Spaces	3 1 0
MA347-Special Theory of Relativity	3 1 0
MA348-Statistical Inference	3 1 0

Elective-2	**L-T-P**
CS342- Linux Operating System	3 0 2
CS203-Computer Networks	3 0 2
CS345-Web Technology	3 0 2

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Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Summary of the Credit

Year	Semester	Credits
1	1	19.5
	2	17
2	3	20
	4	18
3	5	24
	6	24
Total		**122.5**

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Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	PY107	Subject Title	Mechanics						
LTP	3 1 4	Credit	5.5	Subject Category	GEC	Year	1st	Semester	I

COURSE OBJECTIVE: The aim of this course is to introduce students to both elementary classical mechanics and the basic ideas of Special Relativity

COURSE OUTCOME:

Having successfully completed this course the student will be able to:

CO1. To know Newton's laws of motion, potentials, conservation of energy, momentum and angular momentum, and be able to apply them to projectiles, circular motion, and gravity

CO2. Demonstrate rigid body and rotational dynamics using the concept of angular velocity and momentum.

CO3. Demonstrate an understanding of intermediate mechanics topics such as co-ordinate transformations, oscillatory motion, gravitation etc.

CO4. Understand the concept of non-inertial frames of reference, coriolis and centripetal accelerations and their applications

CO5. Understand the postulates of Special Relativity and their consequences in terms of Time dilation and length contraction, Lorentz transformations, relativistic kinematics and the relation between mass and energy

Unit 1: Work, Energy and Collisions **7 Hrs**

Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. Elastic and inelastic collisions between particles.

Unit 2: Rotational Dynamics **10 Hrs**

Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube

Unit 3: Gravitation and Central Force Motion **9 Hrs**

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Physiological effects on astronauts.

Unit-4: Non-Inertial Systems **5 Hrs.**

Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems

Unit- 5: Special Theory of Relativity **8 Hrs**

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

TEXT BOOKS

1. Mechanics – D.S. Mathur, S. Chand & Co., 2012.
2. Introduction to Mechanics – D. Kleppner& R. Kolenkow, Cambridge University Press, 2017

REFERENCE BOOKS

1. Analytical Mechanics, G.R. Fowles and G.L. Cassiday., Cengage Learning India Pvt. Ltd., 2006
2. Introduction to Special Relativity, R. Resnick, John Wiley and Sons, 2007
3. Principles of Mechanics — J.L. Synge & B.A. Griffiths, Andesite Press, 2015

SR.NO.	LIST OF EXPERIMENTS
1	To measure internal diameter, external diameter and depth of a vessel using vernier calipers
2	To measure density of a wire using screw gauge.
3	To determine the Moment of Inertia of a Flywheel
4	To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method)
5	To determine the Modulus of Rigidity of a Wire by Maxwell's needle
6	To determine the elastic Constants of a wire by Searle's method
7	To determine the value of g using Bar Pendulum
8	To measure the Young's Modulus using Bending of Beam
9	To determine the value of g using Kater's Pendulum
10	To determine the moment of inertia of a body using Torsion pendulum

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA106	Subject Title	Matrices and Linear Algebra						
LTP	3 1 0	Credit	3.5	Subject Category	CC	Year	1st	Semester	I

Objectives:

- Identify properties of vectors in R^2 and R^3 and generalize to R^n.
- Other spaces satisfying properties of R^n (notion of vector space).
- Properties of vector spaces.
- Properties of functions from one vector space to another.
- Basis and coordinates of a vector with respect to a given basis.

UNIT I: Matrices

Review of Matrix Algebra and Determinants, Inverse of Square Matrix, Matrix Form of Linear Systems of Equations, Cramer's Rule, Elementary Row and Column Operations, Elementary Matrices, Echelon Form of Matrix, Rank of a Matrix, Existence and Uniqueness of the solution, Solution of system of linear equations.

UNIT II: Vector Space

Review of Algebraic Properties of R, R^2 *and* R^3; Definition of Vector Space, Examples; Subspace, Linear Independence and Dependence, Basis, Dimension, Coordinates with respect a basis, Relation between coordinates with respect to different bases.

UNIT III: Linear Transformations

Definition, Examples, Range and Null Space, Rank-Nullity Theorem, Matrix of Linear Transformation, Relation between Matrices with Different Bases, Equivalent and Similar Matrices.

UNIT IV: Diagonalization

Definition, Necessary and Sufficient Condition for Diagonalization, Eigen Values and Eigen Vectors, Characteristic Equation; Methods of Finding Eigen Values and Eigen Vectors; Cayley-Hamilton Theorem and Applications; Symmetric, Skew-Symmetric, Orthogonal and Orthonormal Matrices; Complex Matrices: Hermitian, Skew-Hermitian, Unitary Matrices, Similar and Diagonalizable Matrices.

UNIT V: Inner Product Spaces and Quadratic Forms

Scalar Product and its Properties in R^n, Definition of Inner Product Space, C^n as an inner product spaces, Properties of inner product, Orthogonal and Orthonormal bases, Gram-Schmidt Process, Definition of Quadratic Form, Matrix of Quadratic Form; Positive Definite, Negative Definite, Indefinite Forms; Rank, Index and Signature of Quadratic Form, Canonical Quadratic Form (Principal Axes Form), Hermitian and Skew-Hermitian Form.

Outcomes:

- Learn about properties of vector spaces and their applications.
- Learning applications of Cayley-Hamilton Theorem
- Applications of eigen values and eigen vectors.

Text Books:

E. Kreyszig, **Advanced Engineering Mathematics**, latest edition

Reference Books:

R. K. Jain & S. R. K. Iyenger, **Advanced Engineering Mathematics**, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA107	Subject Title	Calculus-I						
LTP	3 1 0	Credit	3.5	Subject Category	CC	Year	1st	Semester	I

Objectives:

- Prepare the students with basic concepts of limit, continuity, differentiability, and integration of functions.
- Learn about application of differentiation and integrations.
- Learn properties of function of one variable.
- Learn meaning of infinite sum and properties of infinite series.

UNIT I: Sequences and Series

Convergence of sequences, Subsequences, Bolzano-Weierstrass Theorem, Monotone and Bounded Sequences, Cauchy Criteria; Convergence of infinite series, Comparison, Ratio, Root, Condensation and Integral Tests; Alternating Series, Leibnitz Test; Uniform Convergence.

UNIT II: Continuity and Differentiability

Review of Functions of single variable, Limit, continuity and differentiability; Properties of Continuous Functions; Exponential, Logarithmic and Hyperbolic functions; Indeterminate forms, L'Hospital Rule; Rolle's and Mean Value Theorems & their applications; Successive Differentiation, Leibnitz Theorem, Maclaurin & Taylor series of functions of one variable.

UNIT III: Applications of Derivatives

Review conic sections and their Graphs; Monotonicity, Maxima, Minima, Concavity, Convexity, Point of inflection & Asymptotes; Polar Coordinates, Curvature, Envelope of a family of curves, Graphs of functions and curves.

UNIT IV: Integral Calculus

Review of Indefinite and Definite Integrals, Fundamental Theorem of Integral Calculus, Area, Volume and Surface of Revolution, Arc lengths; Improper integral, Beta and Gamma functions; Double and Triple integrals, change of order of integration, change of variables; Dirichlet integral, Application of multiple integrals.

Learning Outcomes:

- Use of increasing and decreasing properties of functions.
- Drawing the graph of various functions by determining its maxima and minima points, point of inflexion and asymptotes.
- Use of integration for determining area bounded by a function and volume on rotating area under the curve about an axis.
- Properties of Improper integrals.

Text Books:

G. B. Thomas and R. L. Finney, **Calculus and Analytic Geometry**, Latest Edition

Reference Books:

R. K. Jain & S. R. K. Iyenger, **Advanced Engineering Mathematics**, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.

E. Kreyszig, **Advanced Engineering Mathematics**, 9th Edition, John &Wiley Sons, U.K., 2006.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CA102	Subject Title	Programing in C						
LTP	3 0 2	Credit	4	Subject Category	SEC	Year	1st	Semester	I

Objectives: To understand computer programming and its roles in problem solving, Understand and develop well-structured programs using C language, basic file handling operation through implementing in C language.

Unit I

Problem analysis, need for programmed languages, introduction to algorithms, algorithmic representations, Pseudo codes flow charts and decision tables, structured programming and modular programming .

Unit II

Over view of C, Constant, variables, data, types and size, variable declaration, operators and expressions, type conversion, conditional expression, special operators, precedence rules. Decision making, looping and control structures. Data input/output. Input/output: Unformatted & formatted I/O function in C, Input functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(),putch(), putchar(), puts().

Unit III

Arrays and String: defining and processing an array, one dimensional arrays, multidimensional arrays, passing arrays to functions, Handling of character strings. Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays. Structure and Unions: Defining and processing a structure, user defined data types, structure and Pointers, nested structure, self-referential structures, and unions

Unit IV

Program structure: Storage classes, automatic, external, and static variables. Data files: Opening, closing, creating, and processing and unformatted data field.

UnitV

File Management in C: introduction to data files, opening & closing a file, file types, fopen, fgets, fputs, fscanf, fprintf, fclose.

List of practicals:

1. Program to find area and circumference of circle.
2. Program to find the simple interest.
3. Program to convert temperature from degree centigrade to Fahrenheit.
4. Program to calculate sum of 5 subjects & find percentage.
5. Program to show swap of two no's without using third variable.
6. Program to find that entered year is leap year or not.
7. Program to find whether given no is even or odd.
8. Program to find whether given no is a prime no or not.
9. Program to display sum of series 1+1/2+1/3+…….+1/n.
10. Program to add two number using pointer.
11. Program to show sum of 10 elements of array & show the average.

12. Program to find sum of two matrices.

Learning Outcomes: After studying this course, you should be able to:

- Problem solving through computer programming
- Ability to use different memory allocation methods
- Ability to deal with different input/output methods
- Ability to use different file structures

Text Books

1. **Programming in ANSI C**, Balaguruswamy, Tata McGraw-Hill, 4th Edition, 2008.

2. **Problem Solving and Program Design in C,**Jeri R. Hanly& Elliot P, Pearson, 7thEdition, 2013.

Reference Books

1.The C programming Language., Dennis Ritchie, Pearson,6th Edition,2015.

2.Structured programming approach using C, Forouzan Ceilber, Thomson learning publication, 3rdEdition, 2007.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	HS101	Subject Title	Professional Communication						
LTP	2 1 1	Credit	3	Subject Category	AEC	Year	1st	Semester	I

Objectives

- To promote efficiency in English Language with the development of the four skills of communication i.e., LSRW (Listening, Speaking, Reading & Writing).
- To help students perform better in all academic subjects through greater command over the English language.
- To develop technical writing skills with a focus on critical thinking, rhetorical analysis, effective writing & effective document design.

Learning Outcomes

- Build confidents of the students through practice of the basic skills of the basic skills of communication.
- The students will be equipped to comprehend a variety of content & develop deeper insight.
- Enable the students to effectively create standard formats used to construct meaningful documents.

Unit-I-Communication 6 hrs

Communication: Meaning, Types of Communication: General & Technical Communication
Barriers to Communication, Overcoming strategies.

Unit II-Non Verbal Communication 3 hrs

Knowledge and adoption of Non Verbal cues of communication: Kinesics, Proxemics, Chronemics, Oculesics, Haptics, Paralinguistics

Unit III-Listening & Speaking Skills 6 hrs

Listening Comprehension: identifying General & Specific information, Note taking and drawing inferences
Introduction to Phonetics: Articulation of consonants and vowel sounds.
Public Speaking
Discussion Techniques

Unit IV-Reading Skills 4 hrs

Reading Strategies and Vocabulary Building
Reading Comprehension

Unit V-Technical Writing Skills 7 hrs

Paragraph development
Technical Articles, Research Articles, Plagiarism
Intra office Correspondence: Notice, Agenda, Minutes and Memorandum,
Technical Proposal & Report

TEXT BOOKS

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Lata, Pushp and Sanjay Kumar, Communication Skills, Oxford University Press, New Delhi. 2011.

REFERENCE BOOKS

1. Aslam, Mohammad. Introduction to English Phonetics and Phonology Cambridge.2003.
2. Ford A, Ruther. Basic Communication Skills; Pearson Education, New Delhi.2013.
3. Gupta, Ruby. Basic Technical Communication, Cambridge University Press, New Delhi.2012.
4. Kameswari, Y. Successful Career Soft Skills and Business English, BS Publications, Hyderabad.2010.
5. Tyagi, Kavita & Padma Misra. Basic Technical Communication, PHI, New Delhi. 2011.

Professional Communication LAB

Lab 1	Neutralization of Mother Tongue Influence through manner of articulation, Introduction to Speech Sounds – Practicing Vowel and Consonant sounds
Lab 2	Listening (Biographies through software)
Lab 3	Presentation of Biographies
Lab 4	Role Play on Situational Conversation
Lab 5	Role Play on Situational Conversation
Lab 6	Public Speaking
Lab 7	Public Speaking
Lab 8	Group Discussion
Lab 9	Group Discussion
Lab 10	Final evaluation based on Extempore
Lab 11	Final evaluation based on Extempore

Professional Communication Tutorials

Tutorial 1	Body Language (Visual Presentation of Gestures, Postures, Facial Expression etc followed by an activity)
Tutorial 2	Listening (Audio Clip to be played and Listening comprehension assessed through Question Answers or Note - taking)
Tutorial 3	Pronunciation (common errors in spoken words)
Tutorial 4	Speaking (exercise grid in similar sounding words with different spellings)
Tutorial 5	Reading Comprehension
Tutorial 6	Vocabulary Building exercise, Use of Dictionary
Tutorial 7	Paragraph Writing/ Story Writing/Picture Composition
Tutorial 8	Notice, Agenda, Minutes of Meeting
Tutorial 9	Proposal Writing
Tutorial 10	Report Writing

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA108	Subject Title	Calculus- II						
LTP	3 1 0	Credit	3.5	Subject Category	CC	Year	1st	Semester	II

Objectives:

- Concepts of functions of two and more variables.
- Exposure to concepts of vector Calculus, vector Geometry.
- Vector Integration, Line and Surface Integrals
- Applications of vector integration.

UNIT I: Vector Differential Calculus

Review of Vector Algebra in R^2 & R^3, Inner(Dot) Product, Cross Product, Parametric representation of curves, Continuity, Differentiation and Integration of Vector Functions, tangent and arc-length, Curves in Mechanics: Velocity and Acceleration, Motion of a particle on a curve, Gradient of a scalar field, Directional Derivative Normal to a curve, Divergence & Curl of vector function and their applications.

UNIT II: Functions of Two or More Variables

Limit, Continuity and differentiability, Partial differentiation; Euler's theorem and applications; Total Differential and its use in approximation; Taylor series of functions of two variables; Extrema of functions of several variables; Lagrange's multiplier method.

UNIT III: Vector Integration

Line integrals, Work done by a variable force, Determination of a potential, Integration around closed curves, Conservative and Non-conservative physical systems, Exactness and Independence of path, Green's Theorem and its various forms, Area of plane region as a line integral.

UNIT IV: Surface Integrals

Parametric Representation of Surfaces, Parametric representations of cylinder, sphere and cone, Tangent Plane and Surface Normal, Surface Area and Surface Integrals, Change of Orientation, Mobius Strip, Surface areas of sphere and torus, Moment of inertial of spherical lamina

UNIT V: Relation of Vector Integrals with Double and Triple Integrals

Review of Double and Triple Integration, Gauss Divergence Theorem and applications to potential theory, Evaluation of Surface Integrals by Gauss Divergence Theorem, Physical interpretation of Divergence, Stokes Theorem, Green's theorem in the plane as a special case of Stokes theorem, Evaluation of line integral by Stokes theorem, Physical interpretation of Curl, Stokes theorem applied to path independence, Work done in displacement around a closed curve.

Learning Outcomes:

- Familiarity with double and triple integrals.
- Importance of Curl and divergence of vector functions.
- Applications of Green's theorem, Gauss divergence theorem and Stoke's theorem.

Text Books:

E. Kreyszig, **Advanced Engineering Mathematics**, latest edition

Reference Books:

R. K. Jain & S. R. K. Iyenger, **Advanced Engineering Mathematics**, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.

Outcome: Much needed concepts of Vector Calculus and Geometry would be learnt and assimilated for further applications.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA109	Subject Title	Solid Geometry						
LTP	3 1 0	Credit	3.5	Subject Category	CC	Year	1st	Semester	II

Objective:

- Learning three dimensional coordinate system.
- Equations of straight line, plane and conic sections with their graph.
- Properties of tangent and normal to a conicoid.
- Polar and pole of central conicoid.

Unit I. Three dimensional geometry

Three dimensional system of co-ordinates, distance between two points, Projection and direction cosines, Straight lines, Angle between two lines, Shortest distance between two straight lines.

Unit II:Planes

Equation of plane, normal form of plane, distance of a point from plane, Image of a point w. r.t. given plane.

Unit III: Sphere

Vector form of Sphere, Distance of point from sphere, Equation of tangent and normal to the sphere.

Unit II. Conicoids

Sphere, cone and cylinder, Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar, Conjugate diameters, Generating lines, Plane sections.

Outcome:

- Concepts of direction cosines, shortest distance between two skew lines.
- Normal to a tangent plane and applications.
- Properties of coincoid and spheres.

Text Books:

1. Shanti Narayan, P.K. Mittal, Analytical Solid Geometry, S. Chand & Company, New Delhi, 2008.

Reference books:

1. R. J. T. Bell, An Elementary Treatise on Co-ordinate geometry of three dimensions, Macmillan India Ltd., New Delhi, 1994.
2. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
3. M.M. Tripathi, Coordinate Geometry: Polar Coordinates Approach, Narosa Publishing House, New Delhi.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CA114	Subject Title	Computer Organization						
LTP	3 1 0	Credit	3.5	Subject Category	SEC	Year	1st	Semester	II

Objective: To become familiar the topics e.g. how Computer Systems work & its basic principles: how to analyze the system performance: Concepts behind advanced pipelining techniques. The current state of art in memory system design and how I/O devices are being accessed and its principles.

Unit I

A Brief History of computers, Designing for Performance, Von Neumann Architecture, Hardware architecture, Computer Components, Interconnection Structures, Bus Interconnection, Scalar Data Types, Fixed and Floating point numbers, Signed numbers, Integer Arithmetic, 2's Complement method for multiplication, Booths Algorithm, Hardware Implementation.

Unit II

Machine Instruction characteristics, types of operands, types of operations, Addressing modes, Instruction formats, Instruction types, Processor organization, Intel 8086 as example, Programmers model of 8086, max/min mode, Register Organization, Instruction cycles, Read Write cycles, 8086 assembly instruction examples to explain addressing modes

Unit III

Single Bus Organization, Control Unit Operations: Instruction sequencing, Micro operations and Register Transfer. Hardwired Control: Design methods – State table and classical method, Design Examples - Multiplier CU. Micro-programmed Control: Basic concepts, Microinstructions and micro-program sequencing

Unit IV

Characteristics of memory systems, Internal and External Memory, Types of memories: ROM: PROM, EPROM, EEPROM, RAM: SRAM, DRAM, SDRAM, RDRAM. High-Speed Memories: Cache Memory, Replacement Algorithms, Cache Coherence, MESI protocol. Virtual Memory: Main Memory allocation, Segmentation, Paging, Address Translation Virtual to Physical. Secondary Storage: Magnetic Disk, Tape, DAT, RAID, Optical memory, CDROM, DVD

Unit V

Input/output Systems, Programmed I/O, Interrupt Driven I/O, 8086 Interrupt structure, Direct Memory Access (DMA), 8237 features Buses and standard Interfaces: Synchronous, Asynchronous, Parallel I/O 8255 features, Serial I/O 8251 features, PCI, SCSI, USB Ports Working mechanisms of Peripherals: Keyboard, Mouse, Scanners, Video Displays.

Learning Outcome: The successful completion of this course will enable the students to create an assembly language program to program a microprocessor system: to design a hardware component for an embedded system; To deal with different types of computers; To identify high performance architecture design; To develop independent learning skills and be able to learn more about different computer architectures and hardware.

Text Books:

1. W. Stallings, **Computer Organization and Architecture: Designing for performance**, Prentice Hall of India, 6th Edition, 2003.
2. C. Hamacher, V. Zvonko, S. Zaky, **Computer Organization**, McGraw Hill, 5th edition, 2002.

Reference Books:

1. D. A. Patterson and J. L. Hennessy, **Computer Organization and Design - The Hardware/Software Interface**, Morgan Kaufmann, 5th Edition, 1998.
2. J .P. Hayes, **Computer Architecture and Organization,** McGraw-Hill, 3rd Edition, 1998.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA116	Subject Title	Ordinary Differential Equations and Laplace Transforms						
LTP	3 1 0	Credit	3.5	Subject Category	CC	Year	1st	Semester	II

Objectives:

- Learn the techniques for solving certain differential equations
- Properties of Laplace Transform.
- Use of Laplace transforms in solving initial value problems.

UNIT I: Introduction to Differential Equations:
Formation of differential equations. Basic definitions (linearity, order, homogeneous and non-homogeneous, explicit and implicit solution, general solution, particular solution). Existence and uniqueness theorem for linear ordinary differential equation.

UNIT II: First order ODE:
Separable equations, ODE with homogenous coefficients. Exact equations. Integrating factors. ODE with linear coefficients, Bernoulli, Ricatti and Clairaut equation; orthogonal trajectories.

UNIT III: Second and Higher order ODE:
Linear dependent and independence of functions, Wronskian and its basic properties. Solution of homogeneous and non-homogeneous linear ODE with constant coefficients usingmethod of undetermined coefficients and inverse operator method. Equation with variable coefficients, Euler-Cauchy equations, Variation of parameters. Solution of second order differential equations by changing dependent and independentvariables.

UNIT IV: Laplace Transform (LT)
Laplace of some standard functions, Existence conditions for the Laplace Transform, Shifting theorems, Laplace transform of derivatives and integrals, Inverse Laplace transform and their properties, Convolution theorem, Initial and final value theorem, Laplace transform of periodic functions, error functions, Heaviside unit step function and Dirac delta function, Applications of Laplace transform to solve Ordinary differential equations.

Outcome: The students would be well versed in modelling various physical experiments in to differential equations and providing their solutions.

Outcome:

- Linear and homogeneous differential equations.
- Techniques of solving differential; equations.
- Applications of Laplace transform.

Text Books:
Simmons, G. F., "Differential Equations", McGraw-Hill, 2nd Edition
Reference Books: Tenenbaum, M. and Polard, H., "**Ordinary Differential Equations**", Dover Publications
R. K. Jain & S. R. K. Iyenger, **Advanced Engineering Mathematics**, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	HS102	Subject Title	Corporate communication & Soft Skills						
LTP	2 1 1	Credit	3	Subject Category	SEC	Year	1st	Semester	II

Objectives

- To introduce to students to the business & corporate environment and its expectations.
- To help students to identify and sharpen their personal and professional skills.
- To ensure employability of students through a perfect blend of hard & soft skills.

Learning Outcomes

- Students identify their goals and through enhanced soft skills work towards achieving them.
- Greater self-confidence and knowledge of life skills helps them to develop healthier interpersonal relationships.
- Prepares the students to face future challenges and excel in their personal and professional lives.

Unit I

Business Communication **8 hrs**

Importance & Features of Business Communication, Flow of Communication: Channels & Networks
Communication: E mails & E- Tools
Business Presentation
Business Etiquette, Telephonic Etiquette
Business Letter Writing
Job Application Letter & Resume
Interview Skills, Impression Management

Unit II

Personal Skills for Corporate Communication **9 hrs**

SWOT Analysis: Self-Assessment, Identifying Strength & Weakness
Self-Awareness, Self-Disclosure & Self-Management (Stress, Anger)
Goal Setting: Personal & Professional Goals, SMART-ER Goals
Human Perception: Understanding People, Perceptions, Attitudes
Personality (Personality Test)

Unit III **9 hrs**

Professional Skills for Corporate Communication

Decision Making: Techniques, Six Thinking Hats
Creative Thinking, Lateral Thinking
Team Building & Leadership Skills
Time Management: Planning Organizing, Time Wasters
Conflict Resolution Skills
Negotiation Skills

TEXT BOOKS

1. Rizvi, Ashraf. Effective Technical Communication, McGraw Hill, New Delhi. 2005.
2. Gulati, Sarvesh. Corporate Softskills, Rupa & Company, 2006

REFERENCE BOOKS

1. Steven R. Covey. The Seven Habits of Highly Effective People, Simon and Schuster, London, 2007.
2. Robbins, Stephen. Management, Pearson Prentice Hall. 2009
3. Carnegie, Dale. How to win Friends and influence People, Simon and Schuster, London, 2009.
4. Dr. Alex. Soft Skills : Know Yourself & Know the World, S. Chand Publications, 2001.
5. Gopalswamy, Ramesh. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson, New Delhi, 2008.
6. Ghosh, B. N. Managing Soft skills for Personality development, Laxmi Publications Ltd., New Delhi, 2013.
7. Elizabeth B. Hurlock. Personality Development, TMH Publication, 2010.

Corporate Communication & Soft Skills - LAB

Lab 2 Telephone Etiquette: Making an appointment, answering calls (Role Play)
Lab 3 Business Presentations (PPT Presentation)
Lab 4 Business Presentations (PPT Presentation)
Lab 5 Interview Skills: Mock Interview
Lab 6 Interview Skills: Mock Interview
Lab 7 Panel Discussion
Lab 8 Panel Discussion
Lab 9 Conflict & Negotiation (Situational Role Play)
Lab 10 Conflict & Negotiation (Situational Role Play)
Lab 11 Evaluation
Lab 12 Evaluation

Corporate Communication & Soft Skills - Tutorials

Tutorial 1 Writing Practice **(**2 Types of Business Letters)

Tutorial 2 Writing Practice(Job Application Letter & Resume)

Tutorial 3 Personality Test

Tutorial 4 SWOT Analysis (Exercise)

Tutorial 5 Team Building (Exercise)

Tutorial 6 Time Management(Exercise)

Tutorial 7 Case Studies (Goal setting, Perception)

Tutorial 8 Case Studies (Decision making, lateral thinking)

Tutorial 9 Case Studies (Leadership)

Tutorial 10 Group Discussion

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA206	Subject Title	Computer Based Numerical and Statistical Techniques						
LTP	3 0 2	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective:

- Numerical methods for solving Transcendental equations.
- Interpolation and its use in determining a polynomial that approximates a given function.
- Numerical differentiation and integration.

Unit I:

Errors: Approximations and Errors in Computation.

Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method, rate of convergence.

Unit II:

Interpolation: Finite differences, Newton's Forward and Backward Interpolation Formula; Central Difference Interpolation: Gauss's Forward and Backward Interpolation Formula, Stirling's Interpolation Formula, Divided differences, Lagrange, Newton's Divided Difference Formula.

Unit III:

Numerical Differentiation and Numerical Integration: First and second order derivatives of Newton's Forward & Backward Interpolation; Newton - Cote's Quadrature Formula: Trapezoidal, Simpson's rules, Gaussian Quadrature Formula.

Unit IV:

Solution of Simultaneous Linear Algebraic Equations: Direct Methods: Gauss Elimination, Gauss Jordan method, LU Decomposition method; Iterative Methods: Gauss – Jacobi Iteration method, Gauss - Seidal Iteration method, Power Method to compute the largest eigen value.

Principle of Least Square and Curve Fitting: Fitting a Straight line, Parabola and Exponential curve.

Unit V:

Numerical Solution of Ordinary Differential Equations: Single Step Methods: Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge - Kutta method of Fourth order (First order, Second order & Simultaneous Differential Equations), Predictor - Corrector methods: Milne's method, Adams - Bashforth method.

Outcome:

- Importance of numerical solutions of a given equations.
- Use of differentiation in determining approximate values.
- Differential equations not solvable by usual methods.
- Techniques of determining numerical solution.

Text Books:

- Curtis F. Gerald and Patrick O. Wheatley, **Applied Numerical Analysis,** 7th Edition, Pearson Education Lt, 2004.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Reference Books:

- S.S. Sastry, **Introductory Methods of Numerical Analysis,** 5th edition, PHI learning Pvt. Ltd, 2012
- M.K Jain, S.R.K Iyengar and R.K Jain, **Numerical Methods for Scientific and Engineering Computation, 6th**Edition, New age International Publishers, 2012.
- F. B. Hildebrand, **Introduction to Numerical Analysis**, 2nd edition, McGraw-Hill Book Company Inc. 1974.
- B. S. Grewal, **Numerical Methods in Engineering and Science,** 10th Edition, Khanna Publishers, New Delhi, India, 2013.

List of Practical:

(1) Bisection Method.

(2) Regula Falsi Method.

(3) Newton Raphson Method.

(4) Newton's Forward Interpolation Formula.

(5) Newton's Backward Interpolation Formula. .

(6) Newton's Divided Difference Formula.

(7) Trapezoidal rule.

(8) Simpson's $\frac{1}{3}rd$ rule.

(9) Simpson's $\frac{3}{8}rd$ rule.

(10)Gauss Elimination Method.

(11)Gauss Jordan Method.

(12)Gauss - Jacobi Method.

(13)Gauss - Seidal Method

(14)Fitting a Straight Line and Parabola.

(15)Modified Euler's Method.

(16)Fourth Order Runge - Kutta Method.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA207	Subject Title	Real Analysis						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objectives:

- Learning topological properties of real numbers.
- Completeness Axioms.
- Riemann integration and properties.
- Convergence of improper integrals.

Unit – I

Real Numbers, Field of Real Numbers, Ordering properties, Supremum, Infimum, Completeness, Sequences, Lim sup, Lim inf, Cauchy Sequences, subsequence, Bolzano-Weierstrass theorem, series, Convergence, Review of infinite series

Unit-II

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

Unit – III

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.

Unit – IV

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, Continuous functions, uniform continuity, compactness, connectedness.

Outcome:

- Metric properties of real numbers.
- Cauchy sequence
- Uniform continuity, connectedness and compactness.

Text Books:

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1. R.R. Goldberg : Real analysis, Oxford & IBH publishing Co., New Delhi, 1970

Recommended Books:

1. G.F. Simmons : Introduction to Topology and Modern Analysis, McGraw Hill, 1963
2. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
3. Shanti Narayan and M. D. Raisinghania, Elements of Real Analysis, S. Chand & Co., New Delhi
4. H. L. Royden : Real Analysis, The Macmillan Co., Collier-Macmillan Limited, London.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics
Applicable for Batch: 2017-20

Subject Code	MA208	Subject Title	Partial Differential Equations						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective:

- Introduction to Partial Differential Equations (PDE).
- Solving first order PDE.
- Fourier series and their applications.

Objective: To introduce the students various kinds of Partial Differential Equations (PDE), methods of their solutions and applications of some the well know PDE.

UNIT I: Introduction

Introduction, Derivation of some well-known PDE like Heat Equation and Wave Equation, Linear and Nonlinear PDE, Homogenous and Non-Homogenous PDE, Concept of general solution and solution surface of PDE, Initial and Boundary Conditions.

UNIT II: First Order PDE

Definitions of Complete, General and Singular Solutions, Cauchy Problem, Lagrange PDE and its geometrical interpretation, Auxiliary Equations and their solutions, Particular solution of Lagrange PDE passing through a given curve, Charpit Method, Surfaces orthogonal to a given family of surfaces, Special Kinds of first order PDE.

UNIT III: Fourier series and Fourier Integrals

Periodic Functions, Basic Properties of Definite Integrals of Periodic Functions, Fourier Series of Functions with Period 2π , Even and Odd Functions and Their Fourier Series, Half-Range Expansions, Fourier Series of Functions with Arbitrary Period. Definition and Relation to Fourier Series, Fourier Sine and Cosine Integrals, Fourier Sine and Cosine Transforms and their Inverses, Complex Fourier Transform and its inverse, Linearity, Shifting on t-axis, Frequency Shifting, Modulation Theorem, Convolution Theorem, Fourier Transform of Derivatives, Derivative of Fourier Transform, Symmetry Property Finite Fourier Transform.

UNIT IV: Higher Order PDE with Constant Coefficients

Complementary Function, Particular Integral and General Solution, Wave Equation for a string and its solution by Fourier series, Forced Vibrations of elastic string, Uniqueness of solution of one dimensional non-homogenous wave equation, PDE governing heat flow in a thin wire and 3-dimensional body, Solution of one dimensional Heat Equation and its uniqueness, Solution of non-homogenous Heat Equation, PDE for heat flow in infinite thin wire, PDE for vibration of two dimensional membranes and their solutions, Laplace and Dirichlet Equations.

UNIT V: Classification of PDE and Canonical Forms

Hyperbolic, Parabolic and Elliptic PDE and their Canonical Forms, Examples, Transformation functions in each case, Solution of Wave equation and Heat Equation using its canonical form,

Outcome:

- Importance of PDE in day to day live problems.
- Methods of solving PDE.
- Applications of Fourier integrals.

Text Books:

E. Kreyszig, **Advanced Engineering Mathematics**, 9th Edition, John &Wiley Sons, U.K., 2006.
R. K. Jain & S. R. K. Iyenger, **Advanced Engineering Mathematics**, 2nd Edition, Narosa Publishing House, New Delhi, India, 2006.

Reference Books:

T. Amarnath: An Elementary Course in Partial Differential Equations, Narosa Pub. House, 1997

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics
Applicable for Batch: 2017-20

Subject Code	MA209	Subject Title	Introduction to Statistical Methods						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective:

- Probability and its use in day to day problems.
- Conditional probability and its applications.
- Properties of random variables.

Unit I

Statistical Methods: Concepts of statistical population and sample from a population, quantitative and qualitative data, Nominal, ordinal data, discrete and continuous data. Measures of central tendency and Measures of dispersion. Central Moments, non-central moments, measures of Skewness and measures of Kurtosis.

Unit II

Probability Theory: Random experiments, sample point and sample space. Definition of Probability and axioms of probability. Conditional probability, independent events, Bayes theorem and its applications.

Unit III

Random Variables: Discrete and continuous random variables, probability mass function, Probability density function, cumulative distribution function. Illustrations of random variables and its properties.

Unit IV

Mathematical Expectation: Expectation of random variable and its properties. Parameters of distribution, Moments, Cumulants, Moment generating function, Cumulant generation function and Characteristic function.

Unit V

Bivariate Probability Distributions: Two dimensional random variables, joint probability mass function, joint probability density function, joint distribution function, marginal and conditional distributions. Conditional probability and stochastic independence of variates.

Outcome:

- Properties of Standard deviation, Correlation and regression lines.
- Different distributions and their properties.
- Properties of Moments and Moment generating functions.

Text Book:

Gupta, S.C. and Kapoor, V.K. (2013): Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons.

Reference Books:

1. Goon A.M., Gupta M.K. and Dasgupta B. (2005): Fundamentals of Statistics, Vol. I, 8th Edn. World Press, Kolkata.
2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.

3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
4. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.
5. Rohatgi, V. K. and Saleh, A. K. Md. E. (2009): An Introduction to Probability and Statistics, 2nd Edn. (Reprint). John Wiley and Sons.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA219	Subject Title	Linear Programming						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective: Optimization methods using calculus have several limitations and thus not suitable for many practical applications. Most widely used optimization method is linear programming. The characteristics of linear programming problem (LPP) and also different techniques to solve LPP are introduced.

Unit-I

Introduction, Linear Programming Problem, Mathematical Formulation of LPP, Case Studies of LPP, Graphical Methods to Solve Linear Programming Problems, Standard and matrix forms of linear programming problem, Basic feasible solution, Applications, Advantages, Limitations

Unit –II

Convex sets, Convex sets. Extreme points, Hyperplanes and Halfspaces, Convex cones, Polyhedral sets and cones. Fundamental theorem of linear programming, Simplex method. Artificial variables, Big-M method, Two phase method.

Unit – III

Resolution of degeneracy, Revised simplex method, Sensitivity Analysis, Duality in linear programming problems, Dual simplex method, Primal-dual method, Integer programming.

Text Book:

1. Hamdy A. Taha, " Operations Research: An Introduction" Pearson; 9 edition.

Reference Books:

1. P. Sankara Iyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.
3. S.D. Sharma, Operations Research: Theory, Methods and Applications
4. J K Sharma., "Operations Research Theory & Applications , 3e", Macmillan India Ltd, 2007.
5. 2. P. K. Gupta and D. S. Hira, "Operations Research", S. Chand & co., 2007.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA216	Subject Title	Probability Distributions & Regression Analysis						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective: The objectives of the course include the following points: To relate the common statistical behavior of real phenomenon with distribution theory. Recognition of the statistical distributions. To familiarize the students with specific statistical rules which include some basic inequalities. Applications of the basic statistical laws in real life problems. Establishment and analysis of regression problems for descriptive data as well as for mathematical/statistical functions.

Unit I

Standard discrete probability distributions: Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric Distributions and their parameters. Applications of the discrete probability distributions.

Unit II

Standard continuous probability distributions: Normal, Uniform, Exponential, Gamma distributions and their parameters. Applications of the continuous probability distributions.

Unit III

Statement and application of Markov's inequality, Chebyshev's inequality, weak laws of large numbers(WLLN) & strong laws of large numbers (SLLN), Central limit theorem (CLT) for i.i.d. variates, and its applications. De Moivere's Laplace Theorem.

Unit IV

Regression Analysis: Scatter diagram, Covariance, Coefficient of correlation, Spearman's rank correlation coefficient and Regression coefficients. Two lines of regression X on Y and Y on X. Two variable linear model: estimation, testing and problems of predication. Predication of the estimated regression equation.

Text Book:

Gupta, S.C. and Kapoor, V.K. (2013): Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons.

Reference Books:

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
2. Hogg, R.V. and Tanis, E.A. (2009): A Brief Course in Mathematical Statistics. Pearson Education.
3. Johnson, N.L., Kotz, S. and Balakrishnan, N. (1994): Discrete Univariate Distributions, John Wiley.
4. Johnson, N.L., Kotz, S. and Balakrishnan, N. (1994): Continuous Univariate Distributions, Vol. I & Vol. II, 2nd Edn., John Wiley.
5. Sheldon Ross, *Introduction to Probability Models,* 9th Ed., Academic Press, Indian Reprint, 2007.
6. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw- Hill, Reprint 2007

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA217	Subject Title	Introduction to Abstract Algebra &Number Theory						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective: To introduce the students algebraic structures which include groups, rings, fields, modules and elementary number theory.

UNIT-1: Number System and Number Theory

Binary Operations +, . , - and ÷ in Natural Numbers (N), Integers (Z), Rational Numbers (Q), Real Numbers (R) & Complex Numbers (C) with their properties. Division Algorithm, Factorization, Prime Numbers in N, Fundamental Theorem of Arithmetic, gcd and lcm of a given set of integers, congruence relation in Z and properties, Euler's ϕ-Function, Theorems of Euler, Fermat & Wilson, Residue modulo m, Linear Congruence, Chineese Remainder Theorem

UNIT-2 : Groups

Definition; Examples; Basic Properties; Order, Sugroups, Cosets, Normal Subgroup of a group. Abelian and Non-Abelian Groups, Fundamental Theorem of Homomorphism, Isomorphism Theorems, Examples from Number Theory, Cyclic Group, Finite and Infinite Groups, Permutation Groups and Their Properties, Automorphism Groups, Finite Basis Theorem for Abelian Groups.

UNIT-3: Rings

Definition; Examples; Basic Properties; Subring, Ideal, Quotient Ring of a given ring. Fundamental Theorems of Homomorphism and Isomorphisms , Commutative and Non-Commutative rings and their properties, Prime and Maximal Ideals Integral Domain, Ring of Polynomials over the set of real numbers and its ideals, Division Algorithm, Principal Ideal Ring, Eucledian Ring and Unique Factorization Domain.

UNIT-4: Fields and Modules

Definition; Examples; Basic Properties; of a Field; Finite Fields, Quotient Field of an Integral Domain, Quotient Field of the Ring of Polynomials over the set of Real Numbers and their properties.

Definition; Examples; Basic Properties; of an R-module, Sub-module, Cyclic Sub-module, Homomorphism and Isomorphism Theorems for Modules.

TEXT BOOKS:

1. Neal H. McCoy: Introduction to Abstract Algebra

REFRENCE BOOKS:

1. I. N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi.
2. N. Jacobson, Basic Algebra, Vol. I & II, W. H. Freeman,1980/ Hindustan Publishing Company.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA218	Subject Title	Complex Analysis						
LTP	3 1 0	Credit	4	Subject Category	CC	Year	2nd	Semester	III

Objective: To develop in a rigorous and self-contained manner the elements of complex variables and to furnish an introduction to applications and residues and conformal mappings.

Unit I : Complex Functions

Complex numbers, Algebra of complex numbers, Polar and exponential forms, complex plane, extended complex plane, stereographic projection, Elementary complex functions (polynomials, power series, transcendental functions such as exponential, trigonometric and hyperbolic functions, Multi-valued function and its branches, logarithmic function, Inverse trigonometric and hyperbolic functions), Powers and roots.

Unit II: Analytic Functions

Function of complex variable, Limit, Continuity, Differentiability, Analytic functions, Necessary and sufficient condition for analyticity, Cauchy-Riemann equations, Harmonic function, Harmonic conjugate, Construction of analytic function- Milne-Thomson method.

Unit III: Complex Integrals

Contour (line) integrals and their properties, Simply and multiply connected domains, Cauchy's integral theorem, Cauchy-Goursat theorem, Extensions of Cauchy-Goursat theorem, Cauchy's Integral Formula, Cauchy's Integral Formula for derivatives, Cauchy's inequality, Liouville's theorem, Fundamental theorem of algebra, Maximum and minimum Modulus Principle, Schwarz lemma.

Unit IV Series and Residues

Power series, Integration and differentiation of power series, Taylor series, Laurent series, Zeros, and Singularities - classification of singularities as isolated and no-isolated, Removable singularities, Pole, Essential singularities, Behavior of function at infinity, Residues, Calculus of residues, Jordan's lemma, Definite integrals involving sine and cosine functions, Evaluation of improper integrals involving rational functions, involving sines and cosines.

Unit V Conformal Mapping

Conformal mapping: Definition, Conformality Theorem, Bilinear (Mobius) Transformation.

Text Books:

1. **Brown and Churchill:** Complex Variables and Applications, 9th edition, McGraw-Hill, 2013.

Reference books:

1. **Murray Spiegel, Seymour Lipschutz, John Schiller**: Schaum's Outline of Complex Variables, 2ed – 2009.

2. **Erwin Kreyszig**. Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2011.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CA112	**Subject Title**	**Data Structures in C**						
LTP	3 0 2	**Credit**	4	**Subject Category**	GEC	**Year**	2nd	**Semester**	IV

Objectives : The objectives of this course are

- To develop students' knowledge and understanding of the fundamental principles of data structures.
- Develop students' skills in analyzing data structures.
- Build up students' capacity to evaluate different algorithmic techniques.

Unit I

Introduction and Overview: Definition, Elementary data organization, Data Structures, data structures operations, Abstract data types, algorithms complexity, time-space tradeoff. Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms. String Processing: Definition, Storing Stings, String as ADT, String operations, word/text processing, Pattern Matching algorithms.

Unit II

Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting, Sorting: Bubble sort, Insertion sort, Selection sort, searching: Linear Search.

Unit III

Linked list: Definition, Representation of Singly linked list in memory, Traversing a Singly linked list, Searching a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly liked list; Doubly liked list, Header liked list, Circular linked list.

Unit IV

Stacks–Definition, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic Expressions: Polish Notation, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack. Queues–Definition, Array representation of queue, Linked list representation of queues Types of queue: Simple queue, Circular queue, Double ended queue, Priority queue, Operations on Queues, Applications of queues.

Unit V

Graphs: Graph theory terminology, Sequential representation of Graphs: Adjacency matrix, traversing a Graph. Tree–Definitions, Binary trees, Representing binary trees in memory, Traversing, Binary Trees, Binary Search Trees, Searching, Inserting and Deleting in a Binary Search Tree

List of practicals:

1. Write a program which accept information about five student and display same Information According to ascending order of their name.
2. Write a program to implement stack.
3. Write a program to convert infix expression into postfix expression
4. Write a program to check balanced parentheses for a given infix expression
5. Write a program to evaluate postfix expression
6. Write a program to implement queue
7. Write a program to implement link list with insert, delete, search, view, and delete function
8. Write a program to create doubly link list
9. Write a program to implement tree with insert, delete and search function
10. Write a program for inorder, postorder and preorder traversal of tree
11. Write a program for bubble sort and sequential search
12. Write a program for insertion sort and quicksort

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

- Describe the basic operations on arrays, lists, stacks and queue data structures.

- Explain the notions of hashing, trees and binary search trees.
- Describe the efficiency of algorithms with respect to the choice of data structures.
- Explain the basic concepts of object-oriented programming.

Text Books

1.**Data Structure** ,Seymour Lipschutz, Tata-McGraw-Hill, 10th Edition, 2014

2. **Fundamentals of Data Structures in C**, Horowitz, Sahni & Anderson-Freed, University Press, 2nd Edition 2009.

Reference Books

1. **An Introduction to Data Structures with Applications**. , Jean-Paul Tremblay & Paul G, Mc Graw Hill Publishing, 7th Edition, 2014.

2.**Data Structures: A Pseudo-code approach with C**, Gilberg & Forouzan, Thomson Learning, 3rd Edition 2010.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CH201	**Subject Title**	**Environmental Science**						
LTP	2 0 0	**Credit**	2	**Subject Category**	GEC	**Year**	2nd	**Semester**	IV

Objective:

To impart basic knowledge about the environment and its allied problems and to develop an attitude of concern for the environment. Further the course structure will create the awareness about environmental problems among students and motivate the students to participate in environment protection and environment improvement programs. The course aims to develop skills to help the concerned individuals in identifying and solving environmental problems.

Course Outcome:

At the end of the course, the student will be able to :

CO1. Demonstrate depleting nature of Environmental Resources and Ecosystem concepts.
CO2. Able to identify the structure and functioning of natural ecosystems.
CO3. Establish man-wildlife harmonious relationship.
CO4. Adapt to 3R (Reuse, Recovery, Recycle).Identify the causes and control measures related to Pollutions.
CO 5. Illustrate and analyse various Case Studies related to Environmental issues and Env. Legislation.

Unit 1: Basics of Environment and Natural Resources **04 Hrs.**

Definition and Concept of Environment, Multidisciplinary nature of environmental studies. Scope and importance of environmental studies, Need for public awareness, Environmental concerns and people. Introduction and classification of natural resources. Energy Resources, Water Resources, Land Resources, Forest Resources, Food Resources, Mineral Resources, Case studies related to over exploitation of resources and their impacts. Role of an individual in conservation of natural resources, Sustainable lifestyles.

Unit 2: Ecosystems **04 Hrs.**

Definition and concept of ecology, Structure and Function of an Ecosystem, Energy Flow in Ecosystems, Biogeochemical cycles (Nitrogen, Carbon, Phosphorus, Oxygen, Hydrological). Species interactions in ecosystems. Ecological succession and ecological pyramids. Characteristic features of grassland, pond, desert and forest ecosystems. Ecosystem services and conservation

Unit 3: Biodiversity and its conservation **04 Hrs.**

Introduction and types of biodiversity. Bio-geographic classification of India, Value and significance of biodiversity, Biodiversity at global, national and local levels, India: A mega-diversity nation, Biodiversity hotspots, Threats to Biodiversity: Poaching and man-wildlife conflicts, IUCN Red Data Book and endangered & endemic species of India. Biodiversity conservation strategies, Institutes and organizations.

Unit-4 Environmental Pollutions: **05 Hrs.**

Introduction and Definition. Causes, consequences and control measures of: Air pollution, Water pollution, Noise pollution, Nuclear pollution, Soil pollution, Thermal and Marine pollution. Solid waste management, Bio-medical waste management. Disasters and its mitigation strategies, Global warming, Climate change, Acid rain, Ozone depletion and Smog. Pollution case studies. Role of an individual in pollution prevention.

Unit-5 Social Issues and Environment: **04 Hrs.**

Sustainable Development: Concept and importance, Environmental Impact Assessment (EIA), GIS, Remote sensing. Water conservation and rain water harvesting. Resettlement and rehabilitation problems,

Environmental audit, eco-labeling and eco-friendly business. Environmental Legislation in India, Population explosion and its impact on environment and human health, Value Education and environmental ethics.

Field work **03 Hrs.**

- Visit to a local area to document environmental asset: river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common flora and fauna.
- Study of a common ecosystem-pond, river, hill slopes, etc.

TEXT BOOKS

1. BharuchaErach, 2004. Textbook for Environmental Studies, University Grants Commission, New Delhi.

2. Kaushik A &Kaushik C P. 2007. Perspectives in Environmental Studies, New Age International Publ.

3. S. Deswal & A. Deswal 2015. A Basic Course in Environmental Studies. Dhanpat Rai & Co.

REFERENCES

1. Miller T.G. Jr. 2002. Environmental Science, Wadsworth Publishing Co. (TB).

2. De A.K.,1996. Environmental Chemistry, Wiley Eastern Ltd.

3. Sharma, P.D. 2005. Ecology and environment, Rastogi Publication.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics
Applicable for Batch: 2017-20

Subject Code	MA306	Subject Title	MATHEMATICAL MODELING						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVE: To understand the process of developing a mathematical model which explain a system and to study the effects of different components, and to make predictions about behavior.

Unit-I: Introduction

Models, Reality, Properties of models, Model classification and characterization, Steps in building mathematical models, Sources of errors, Dimensional analysis.

Modeling using Proportionality, Modeling using geometric similarity, Graphs of a functions as models

Model Fitting – Fitting models to data graphically, Analytic methods of model fitting, Applying the least square criterion,

Experimental Modeling – High order polynomial models, Cubic Spline models.

Unit-II: Discrete Probabilistic and Optimization Modeling

Discrete Probabilistic Modeling –Probabilistic modeling with discrete system, Modeling components & System Reliability, Linear regression

Discrete Optimization Modeling – Linear Programming – Geometric solutions, Algebraic solutions, Simplex method and sensitivity analysis.

Unit-III: Modeling with a Differential Equations

Population growth, Graphical solutions of autonomous differential equations, Numerical approximation methods-- Euler's method and R.K. method.

Unit-IV: Modeling with systems of Differential Equations

Predator Prey model, Epidemic models, Euler's method for systems of differential equations.

Learning Outcome: Students will able to

- Understand the basic components of Mathematical modeling.
- Use modeling in the natural sciences (such as physics, biology, earth science, meteorology) and engineering
- Construct differential equation describing physical problems by constructing a model for it.
- Analyze various discrete probabilistic models.

Text Books:

1. J. N.Kapur, "Mathematical Modeling", New Age International, New Delhi, 2015.
2. Frank R. Giordano, Mawrice D Weir, William P. Fox, A first course in Mathematical Modeling, latest edition.

Reference Books:

1. Thomson Brooks/Cole,Vikas Publishing House (P) Ltd, 3rd ed3 2003
2. J.D. Murray, Mathematical Biology – I, Springer International Edition, 3rd ed2 2004.
3. J.N. Kapur, Mathematical Models in Biology and Medicine, East West Press, New Delhi, 1985.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA307	Subject Title	DIFFERENTIAL GEOMETRY						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVE: Introduce students about the key concepts and techniques of Surfaces in Euclidean space; General differentiable manifolds; Tangent spaces and vector fields; Differential forms; Riemannian manifolds and Gauss-Bonnet theorem in Differential Geometry and other courses.

Unit-I: Theory of Space Curves

Space curves, Planer curves, Curvature, Torsion, Osculating circles, Osculating circles and spheres, Normal lines and normal planes, Rectifying plane, Existence of space curves.

Unit II: Theory of Surfaces

Parametric curves on surfaces, Direction coefficients, First and second fundamental forms, Principal and Gaussian curvatures, Lines of curvature, Euler's theorem, Rodrigue's formula, Conjugate and asymptotic lines, Mainardi Codazzi equations, Weingarten equations

Unit III: Developable

Developable associated with space curves and curves on surfaces, Minimal surfaces.

Unit IV: Geodesics

Canonical geodesic equations, Nature of geodesics on a surface of revolution, Clairaut's theorem, Normal property of geodesics, Torsion of a geodesic, Geodesic curvature, Gauss-Bonnet theorem, Surfaces of constant curvature, Conformal mapping, Geodesic mapping, Tissot's theorem.

Learning Outcome: Students will have

- knowledge and skills about the concepts and language of differential geometry and its role in modern mathematics.
- Capability to solve complex problems using appropriate techniques from differential geometry.
- Capability to solving live problems in physics having diverse situations with differential geometry.

Text Books:

1. Christian Bär, "Elementary Differential Geometry", Cambridge University Press, 2010. T.J.
2. Willmore, "An Introduction to Differential Geometry", Dover Publications, 2012.

Reference Books:

1. B.O'Neill, "Elementary Differential Geometry", 2nd Edition, Academic press, 2006.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA308	Subject Title	MATHEMATICAL METHODS						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVE: Learning about determining solutions of differential equation having continuous coefficients, Fourier-transform and Z- transforms, apply them to live discrete and continuous problems.

UNIT-I: Series Solution

Power series solution of differential equations, Ordinary point, Solution about singular points, Frobenius method.

UNIT-II: Special Function

Bessel's equation, Solution of Bessel's equation, Bessel's functions $J_n(x)$, Recurrence formulae, Equations reducible to Bessel's equation, Orthogonality of Bessel's Functions, Generating function for $J_n(x)$, Legendre's equation, Legendre's polynomial $P_n(x)$, Legendre's function of the second kind $[Q_n(x)]$, General solution of Legendre's equation, Rodrigue's formula, Legendre polynomials, Generating function of Legendre's polynomial, Orthogonality of Legendre polynomials, Recurrence formulae for $P_n(x)$.

UNIT –III: Fourier Transform

Fourier integrals, Fourier sine and cosine integrals, Complex form of Fourier integral representation, Fourier transform, Fourier transform of derivatives and integrals, Fourier sine and cosine transforms and their properties, Convolution theorem, Application of Fourier transforms to Boundary Value Problems.

UNIT-IV: Z-Transform

Z–transform and inverse Z-transform of elementary functions, Shifting theorems, Convolution theorem, Initial and final value theorem, Application of Z-transforms to solve difference equations.

Learning Outcome: Students will be able to:

- Find series solution for second order linear differential equations, both at ordinary points and at regular singular points.
- Determine Fourier and Z-Transforms for various functions.
- Use properties of Fourier and Z-Transforms to solve physical problems.

Text Books:

1. W.W. Bell, "Special Functions for Scientist and Engineers", Dover Publication, New York, 1996.
2. E. Kreyszig, "Advanced Engineering Mathematics**"**, 10thEdition, John & Wiley Sons, U.K., 2016.

Reference Books:

1. Ian N. Sneddon, "Fourier Transforms", Dover Publications,2010.
2. Ronald N. Bracewell,"The Fourier Transforms and its Applications", 3rd Edition, McGraw Hill Science,1999.
3. R. K. Jain, & S. R. K.Iyenger,"Advanced Engineering Mathematics", 4thEdition, Narosa Publishing House, New Delhi, India, 2014.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA309	Subject Title	DISCRETE MATHEMATICS						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	V

OBJECTIVE: Learnthe properties of relations and functions, partial order relation, concepts in basic logic and set theory, understand the core ideas in combinatorial mathematics.

Unit I: Set Theory

Definition of Sets, Venn Diagrams, Complements, Cartesian products, Power sets, Counting principle, Cardinality and countability (Countable and Uncountable sets), Proofs of some general identities on sets, Pigeonhole principle.

Unit II: Relations and Function

Relation: Definition, Types of relation, Composition of relations, Domain and range of a relation, Pictorial representation of relation, Properties of relation, Partial Ordering Relation.

Function: Definition and types of function, Composition of functions, Recursively defined functions.

Unit III: Propositional logic

Proposition logic, Basic logic, Logical connectives, Truth tables, Tautologies, Contradiction, Normal forms (conjunctive and disjunctive), Modus ponens and modus tollens, Validity, Predicate logic, Universal and existential quantification, (Notion of proof):by implication, Converse, Inverse, Contrapositive, Negation, and contradiction, Direct proof, Proof by using truth table and by counter example.

Unit IV: Combinatorics

Mathematical induction, Recursive mathematical definitions, Basics of counting, Permutations, Combinations, Inclusion-exclusion, Recurrence relations (n^{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, and Inhomogeneous recurrence relation), and generating function (closed form expression, properties of G.F., solution of recurrence relation using G.F, solution of combinatorial problem using G.F.), Pigeon Hole principle.

Learning Outcome: Students will be able to

- use properties of sets in the design and analysis of algorithms.
- use properties of logic sentence in terms of predicates, quantifiers, and logical connectives.
- evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

Text Books:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw Hill, 2016.
2. J.P.Tremblay& R. Manohar, “Discrete Mathematical Structure with Applications to Computer Science” Mc.Graw Hill, 1975.

Reference Books:

1. V. Krishnamurthy, “Combinatorics: Theory and Applications”, East-West Press, 2008.
2. Seymour Lipschutz, M. Lipson, “Discrete Mathematics”, Tata McGraw Hill, 2005.
3. C. L. Liu, “Elements of Discrete Mathematics”, Tata McGraw Hill, 4th edition.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA316	Subject Title	INTEGRAL EQUATIONS						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	VI

OBJECTIVE: To learn the techniques for solutions of certain integral equations and their applications. Conversion of boundary value problems into integral equations using Green's function.

Unit-I

Definition of integral equation and their classification, Solution of an integral equation, Differentiation of a function under integral sign, Conversion of an ordinary differential equation into integral equation, Eigenvalues and Eigen functions.

Unit-II

Iterated kernel, Resolvent kernel, Solution of Fredholm integral equation of second kind by successive substitution, Solution of Volterra integral equation of the second kind by successive substitution.

Unit-III

Solution of Fredholm integral equation of second kind by successive approximation, Solution of Volterra integral equation of second kind by successive approximation, Iterative method, Neumann series, Classical Fredholm theory.

Unit-IV

Green's function and its application in Initial and Boundary Value Problems to integral equations, Conversion of a Boundary Value Problem into Fredholm integral equation.

Unit-V

Solution of integral equations using integral transform, Singular integral equation, Applications of integral equations to differential equations and Boundary Value Problem.

Learning Outcome: Students will be able to

- convert boundary value problems into integral equations using Green's function.
- solve different types of integral equations and their applications to various real life problems.
- solve Volterra integral equation of the second kind by successive substitution.
- convert a boundary Value Problem to Fredholm integral equation.

Text Books:

1. M. D. Raisinghania, "Integral equations and boundary value problems"6th revised Edition, S. Chand Publications. 2013
2. Shanti Swaroop, "Integral Equations", 22ndEdition, Krishna Prakashan, 2014.

Reference Books:

1. R. P. Kanwal, "Linear Integral Equations: Theory and Techniques", 2ndEdition, Birkhäuser, 2013.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA317	Subject Title	GRAPH THEORY						
LTP	3 1 0	Credit	4	Subject Category	DC	Year	3rd	Semester	VI

OBJECTIVE: The objective of the course is to explain basic concepts in combinatorial graph theory Define how graphs serve as models for many standard problems discuss the concept of graph, tree, Euler graph, cut set and Combinatorics.

Unit I

Preliminaries: Graphs (Walks, trails, paths, connected graphs, connectivity, distance), Isomorphism, Subgraphs, Matrix representations, Degree, Operations on graphs, Degree sequences, Connected graphs and shortest paths and its algorithms, cut-vertices, cut-edges, blocks, weighted graphs.

Unit II

Trees: Characterizations, Number of trees, Minimum spanning tree.

Bipartite graphs, Line graphs, Chordal graphs Eulerian graphs, Fleury's algorithm, Chinese-postman-problem, Hamilton graphs.

Unit III

Independent sets, Coverings, Matchings, Basic equations, Matchings in bipartite graphs, Perfect matchings, Greedy and approximation algorithms, vertex colorings, Chromatic number and cliques, greedy coloring algorithm, coloring of chordal graphs, Brook's theorem Edge colorings, Class-1 graphs and Class-2 graphs, equitable edge-coloring.

Unit IV

Planar graphs, Eulers formula, Polyhedrons, Planarity testing, 5-color-theorem, Directed graphs, Eulerian directed graphs, Hamilton directed graphs, Tournaments.

Learning Outcome: Student will be able to

- formulate problems in graph theoretic terms and have increased ability in graph theoretic problem solving.
- Deal with various versions of connectedness of a graph.
- formulate applied problems as coloring problems.
- Construct different models of random graphs (random networks).

Text Books:

1. J. A. Bondy and U.S.R. Murty, "Graph Theory with Applications", Springer, 2008.
2. D. B. West, "Introduction to Graph Theory", Prentice-Hall of India/Pearson, 2009.

Reference Books:

1. J. A. Bondy and U. S. R. Murty, "Graph Theory", Springer, 2008.
2. R. Diestel, "Graph Theory", Springer, 2000.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA346	Subject Title	METRIC SPACES						
LTP	3 1 0	Credit	4	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVE: The main objective of the course is to study the concept of distance on abstract spaces. This also provides the concept of convergence, compactness and connectedness.

UNIT I: Basic concepts

Metric Spaces: Definition and examples, Neighborhood, Open set, Interior of a set, Limit point of a set, Closed sets, Diameter of a set, Dense sets, Nowhere dense sets, Separable spaces, Continuous functions, Uniform continuity.

UNIT II: Complete metric spaces

Sequences in metric spaces, Convergence of a sequence, Cauchy sequences, Complete metric spaces, completion of a metric spaces, Baire category theorem, Banach contraction theorem.

Unit III: Compact metric spaces

Compact spaces and their properties, Characterization of compact metric spaces, Sequentially compact metric spaces, Continuous functions on compact metric spaces.

UNIT IV: Connected metric spaces

Separated sets, Connected metric spaces, Path connected spaces, Continuous functions on connected spaces, Components.

Learning Outcome: students will be able to understand

- the concept of distance on a given abstract space.
- the idea of completeness, compactness and connectedness in a metric space.
- Banach contraction theorem and applications.

Text Books:

1. Q. H. Ansari “Metric Spaces”, 1st Edition, Narosa Publishing House, 2010.
2. P. K. Jain and K. Ahmad, “Metric Spaces” 2nd Edition, Narosa Publishing House, 2004

Reference Books:

1. S. Kumaresan “Topology of Metric Space”, 2nd Edition, Narosa Publishing House, 2011.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA347	Subject Title	SPECIAL THEORY OF RELATIVITY						
LTP	3 1 0	Credit	4	Subject Category	DE	Year	3rd	Semester	VI

OBJECTIVE: Learn about Newtonian Relativity and related conservation laws, Clock paradox, Geometrical Interpretation of Lorentz transformation and its applications.

Unit-I : Classical Theory of Relativity

Review of Newtonian Mechanics (Inertial System, Event), Newtonian Relativity, Conservation laws in Newtonian Mechanics, Ether, Maxwell's electromagnetic theory, The Michelson-Morley experiment, Fitzgerald and Lorentz Contraction hypothesis.

Unit-II: Lorentz Transformations

Einstein's Special Relativity Theory, Einstein's Principle of Relativity, Principle of Constancy of Light Speed, Lorentz Transformation, Lorentz- Fitzgerald length contraction, Time Dilation, Clock paradox or twin paradox, Simultaneity, Geometrical Interpretation of LT, Group property of Lorentz Transformations and Examples.

Unit-III : Relativistic Kinematics

Introduction, Transformation of Particle Velocity, Relativistic addition law for velocities, Transformation of the Lorentz contraction factor $(1- v^2/c^2)^{1/2}$, The Transformations for the acceleration of a particle.

Unit-IV : Relativistic Mechanics

Introduction (Mass and Momentum). M= $\frac{m_0}{\sqrt{1-\frac{u^2}{c^2}}}$, The mass of moving particle, Relativistic Expression for Force, Transverse and Longitudinal mass of the particle, Mass energy equivalence $E= mc^2$, Transformation equations for mass, Transformation equations for momentum and energy, Deduction to prove that $p^2 – E^2/c^2$ is Lorentz invariant, Minkowski Space (Four Dimensional Continuum), Time-like, Space-like, Light-like (null) intervals, Events occurring at the same point and the same time.

Learning Outcome: Students will be able to understand

- Concept of relativity and its applications.
- Lorentz transformation and its use in physical problems.
- Minkowski Space and events occurring at the same point and the same time

Text Books:

1. J. K. Goyal and K. P. Gupta, "Theory of Relativity", Krishna Prakash Media (P) Ltd., 2006.
2. L. D. Landau and E. M. Lifshitz, "Mechanics", Butterworth, 1998.

Reference Books:

1. T. M. Karade, "Relativity and Tensor Calculus", Einstein Foundation International, 1980.
2. C. Moller, "The theory of Relativity", Oxford University Press, 1982.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	MA348	Subject Title	STATISTICAL INFERENCE						
LTP	3 1 0	Credit	4	Subject Category	DE	Year	3rd	Semester	VI

Objective: The course objective includes the concepts of estimation theory, statistical hypothesis testing and non-parametric test procedures. The objective is to provide a sufficient knowledge of statistical inference and their significance in real world.

Unit I: Theory of estimation

Point estimation. Criterion of a good estimator: unbiasedness, consistency, sufficiency and efficiency. Interval estimation.

Unit II: Statistical Inference

Simple, composite, null and alternative hypothesis, level of significance, Type I and Type II errors. Critical region and power of test, one tail and two tail test.

Unit III: Hypothesis Testing

Test statistic, parameter and statistic, standard error, large sample test & small sample test. Tests of significance based on chi-square, t and F Statistics.

Unit IV: Non-Parametric Tests

One sample and two sample sign test, Wald-Wolfowitz run test, run test for randomness, Median test and Wilcoxon-Mann-Whitney test. Applications of non-parametric tests.

Learning Outcome: The student will be able to

- proceed the tools of statistical inference in any statistical experiment.
- The course outcome includes the application of various inferential test procedures in case of small and large sample sizes.
- Students shall be able to use the distribution-free tests and their identification with parametric test.

Text Books:

1. S.C. Gupta, “Fundamentals of Statistics, 7th Edition, Himalaya Publishing House, 2018.
2. V. K. Rohatgi, “Introduction to Probability Theory and Mathematical Statistics”, Wiley Eastern, 1988.

Reference Books:

1. G. Casella and R.L. Berger, “Statistical Inference”, 2nd Edition, Thomson Duxbury, 2002.
2. J.D. Gibbons and S. Chakraborty, “Non Parametric Statistical Inference”, 4th Edition, Marcel Dekkar, CRC, 2003.
3. A.M. Goon, M.K. Gupta and B. Dasgupta, “An Outline of Statistical Theory” (Vol. I), 4th Edition, World Press, Kolkata, 2003.
4. S.C. Gupta, “Fundamentals of Statistics”, 7th Edition, Himalaya Publishing House, 2018.

roduction to Probability and Statistics”, 2nd Edition, John Wiley and Sons, 2009.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CS342	Subject Title	LINUX ADMINISTRATION AND SHELL PROGRAMMING						
LTP	3 0 2	Credit	4	Subject Category	GEC	Year	3rd	Semester	VI

OBJECTIVES: This course is designed to get the exposure to the students about the functioning and shell programming in Linux operating system.

UNIT I 8L

Introduction to Linux and UNIX, What is an operating system?, A brief history of UNIX, Architecture of the Linux operating system, Logging into (and out of) UNIX systems, Changing your password, General format of UNIX commands. The UNIX filesystem, Typical UNIX directory structure ,Directory and file handling commands, Making hard and soft (symbolic) links, Specifying multiple filenames, Quotes.

UNIT II 8L

File and directory permissions ,Inspecting file content ,Finding files, Finding text in files, Sortingfiles, File compression and backup, Handling removable media, Processes, Pipes, Redirecting input and output, Controlling processes associated with the current shell ,Controlling other processes

UNIT III 7L

Connecting to remote machines, Network routing utilities, Remote file transfer, Other Internet related utilities, User Information and Communication, Printer control, Email utilities. Server Configuration in Linux environment: Telnet, FTP.

UNIT IV 7L

Introduction to vi, Basic text input and navigation in vi ,Moving and copying text in vi, Searching for and replacing text in vi, Other useful vi commands, Quick reference for vi ,Introduction to emacs, Basic text input and navigation in emacs, Moving and copying text in emacs, Searching for and replacing text in emacs, Other useful emacs commands ,Other UNIX editors. The superuserroot, Shutdown and system startup, Adding users, Controlling user groups, Reconfiguring and recompiling the Linux kernel ,Cronjobs, Keeping essential system processes alive.

UNIT V 8L

Unix Shell programming: Types of Shells, Shell Metacharacters, Shell variables, Shell scripts, Shell commands, the environment, Integer arithmetic and string Manipulation, Special command line characters, Decision making and Loop control, controlling terminal input, trapping signals, arrays. C/C++ code execute in Linux platform.

LEARNING OUTCOMES

After the completion of the course the students will able to learn:

CO1**.** About the Linux installation & working of Linux commands.

CO2. Know the network related activities on the computer system.

CO3. Expertise in shell programming using Linux.

CO4. The student will learn about System Administration in Linux.

Text Book:

1. Sumitabh Das, “Unix Concepts and applications”, TMH, 2003

2. *Mike Joy, Stephen Jarvis, Michael Luck, “Introducing Unix and Linux”, Palgrave Macmillan.*

Reference Book:

1. O'Reilly Media “Linux System Administration”

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CS203	Subject Title	Computer Networks						
LTP	3 0 2	Credit	4	Subject Category	DSE	Year	3rd	Semester	VI

OBJECTIVE:

The objective of this course is familiarizing the students with the concepts of networking in computers, routing of data packets on the network and protocols followed in the networked computers.

Unit 1: Introduction to Computer Network (8)

Introduction: Motivation, OSI model, Signals and media, Bits over signals, Synchronous communication, Modulation and modems, Bandwidth, Throughput, and noise, Time division and Frequency division multiplexing, Standards, Switching methods, ISDN.

Unit 2: Data Link Protocol (8)

Packet Transmission: Multiplexing, Frames, Error correction techniques, LAN/WAN/MAN, Topology, CSMA/CD,LAN protocol, Elementary Data link protocol- Sliding window protocols, Token passing rings, FDDI, IEEE 802.3, 802.5.

Unit 3 Routing algorithms of Data Packets in networked computers (8)

Routing Algorithms: Distance-Vector, Link-State, Shortest path computation, Dijkstra's algorithm, Congestion control, WAN technologies including frame relay, X.25, ATM.

Unit-4 Interworking & IP addressing (8)

Internetworking: Motivation, Concept, Goals, TCP/IP model, IP addressing with sub netting, Address binding with ARP, IP Datagram, Encapsulation IP fragmentation and reassembly, ICMP,IGMP,TCP.

Unit- 5: Introduction to Network Services (8)

Network Services: Electronic mail, File transfer, Access and management, Virtual terminals, Remote procedure call.

COURSE OUTCOME:

At the end of the course, the student can:

CO1. An ability to perform Design and simulation of protocol using simulation tool.

CO2. Ability to create reliable communication using communication model with high quality of service.

CO3. Able to understand the data Packet Routing in networked computers.

CO4. Able to understand the protocols followed used in computer networks.

Course Structure& Syllabus of B.Sc. (Hons.) – Mathematics

Applicable for Batch: 2017-20

Subject Code	CS345	Subject Title	WEB TECHNOLOGY						
LTP	3 0 2	Credit	4	DSE	Year	3rd	Semester	VI	DSE

OBJECTIVES: Students undergoing this course are exposed to

- Get introduction about various Scripting Languages.
- Familiar with an up-to-date survey of developments in. Web Technologies.
- To know techniques involved to support real-time Software development.

UNIT 1 **(6 L)**

Web Essentials: Clients, Servers, and Communication. The Internet - Basic Internet Protocols - The World Wide Web-HTTP request message - response message - Web Clients Web Servers.

Markup Languages: An Introduction to HTML History-Versions-Basic Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms, Pages style sheets-CSS- Core Syntax- Properties-Box Model Normal Flow Box Layout-Other Properties.

UNIT 2 **(8 L)**

Client- Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax - Variables and Data Types – Statements – Operators – Literals – Functions – Objects – Arrays - Built-in Objects - JavaScript Debuggers, Browsers and the DOM.

PHP: Starting to script on server side, Arrays, function and forms, Advance PHP.

UNIT 3 **(8 L)**

Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces JavaScript and XML: Ajax-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers-Case Study- Related Technologies, Introduction to JQuery.

UNIT 4 **(8 L)**

Web Services: Introduction to Web Services, UDDI, SOAP, WSDL, Developing and deploying web services. Ajax – Improving web page performance using Ajax, Programming in Ajax.

UNIT 5 **(7 L)**

Web 2.0: Interactive and social web**:** Blogs, wikis, and social networking sites – The technology behind these applications - AJAX, Open APIs.

Web 3.0: Semantic Web, Mashups, RDF, Web based Information Systems, Search engines, Recommender Systems, Web Mining.

LEARNING OUTCOMES

Upon the successful completion of the course, students will be able to-

CO1.Design a basic web site using HTML, XML, XHTML.

CO2. Use client side technology to design web site.

CO3.Recognize and evaluate website organizational structure and design elements.

CO4. The students will be able to do programming in Ajax

Text Book:

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007.

Reference Book:

1. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
2. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
3. Bates, "Developing Web Applications", Wiley, 2006