1st Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-101	Calculus-I	3	1	0	40	60	100	4
BMATS1-102	Algebra-I	3	1	0	40	60	100	4
BMATS1-103	Analysis-I	3	1	0	40	60	100	4
BHSMC0-001	English	3	1	0	40	60	100	4
BMATS1-104	Fortran Programming	3	1	0	40	60	100	4
BMATS1-105	Fortran Programming Lab.	0	0	2	60	40	100	1
	Total	**15**	**5**	**2**	**260**	**340**	**600**	**21**

2nd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-201	Calculus-II	3	1	0	40	60	100	4
BMATS1-202	Algebra-II	3	1	0	40	60	100	4
BMATS1-203	Analysis-II	3	1	0	40	60	100	4
BMNCC0-003	Environmental Science	3	1	0	40	60	100	4
BMATS1-204	Fundamentals of Computers and C Programming	3	1	0	40	60	100	4
BMATS1-205	C Programming Lab.	0	0	2	60	40	100	1
	Total	**15**	**5**	**2**	**260**	**340**	**600**	**21**

3rd Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-301	Differential Equations-I	3	1	0	40	60	100	4
BMATS1-302	Mathematical Statistics	3	1	0	40	60	100	4
BMATS1-303	Geometry	3	1	0	40	60	100	4
BMATS1-304	Number Theory	3	1	0	40	60	100	4
BMATS1-305	Object Oriented Programming	3	1	0	40	60	100	4
BMATS1-306	Object Oriented Programming Lab.	0	0	2	60	40	100	1
	Total	**15**	**5**	**2**	**260**	**340**	**600**	**21**

4th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-401	Differential Equations-II	3	1	0	40	60	100	4
BMATS1-402	Linear Algebra	3	1	0	40	60	100	4
BMATS1-403	Mechanics-I	3	1	0	40	60	100	4
BMATS1-404	Numerical Methods	3	1	0	40	60	100	4
BMATS1-405	Latex and R	3	1	0	40	60	100	4
BMATS1-406	Latex and R Lab.	0	0	2	60	40	100	1
	Total	**15**	**5**	**2**	**260**	**340**	**600**	**21**

5th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-501	Mechanics-II	3	1	0	40	60	100	4
BMATS1-502	Mathematical Methods	3	1	0	40	60	100	4
BMATS1-503	Differential Geometry	3	1	0	40	60	100	4
BMATS1-504	Finite Element Methods	3	1	0	40	60	100	4
BMATS1-505	MATLAB	3	1	0	40	60	100	4
BMATS1-506	MATLAB Lab.	0	0	2	60	40	100	1
	Total	**15**	**5**	**2**	**260**	**340**	**600**	**21**

6th Semester		Contact Hrs.			Marks			Credits
Subject Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BMATS1-601	Linear Programming and Optimization	3	1	0	40	60	100	4
BMATS1-602	Complex Analysis	3	1	0	40	60	100	4
BMATS1-603	Mathematical Modelling	3	1	0	40	60	100	4
BMATS1-604	Discrete Mathematics	3	1	0	40	60	100	4
BMATS1-605	Financial Mathematics	3	1	0	40	60	100	4
	Total	**15**	**5**	**0**	**200**	**300**	**500**	**20**

Calculus-I

Subject Code- BMATS1-101

L	T	P
3	1	0

University Exam: 60
Internal Assessment: 40
Time Allowed: 3 hours
Total: 100

Course Objectives

To make students familiar with basic concepts of limit and continuity, Differentiability and differentials, Successive differentiation,, Derivatives of higher order, Partial derivatives of higher order, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative.

Course Outcomes

To determine the nth derivative of well-known functions, Tracing of Cartesian curves, parametric and polar curves, Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians, Gradient, Curl and Divergence.

UNIT-I (15 Hours)

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

UNIT-II (14 Hours)

Concavity, Convexity, Points of inflexion, Increasing and decreasing function, Asymptotes, Polar curves, Multiple points, Tracing of Cartesian curves, Idea of some well-known parametric and polar curves, Curvature of a curve at a point, Radius of curvature for Cartesian, Parametric, Polar forms, Centre of curvature.

UNIT-III (15 Hours)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

UNIT-IV (16 Hours)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function z= f (x, y), Lagrange's method of undetermined multipliers, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative.

Recommended Books:

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Algebra-I

Subject Code- BMATS1-102

L	T	P
3	1	0

Time Allowed: 3 hours

University Exam: 60
Internal Assessment: 40
Total: 100

Course Objectives

Define and interpret the concepts of Matrices and determinants, Introduction of Group, Ring and field, Vector space, Linear Transformation, singular and non singular transformation.

Course Outcomes

Students will have knowledge of significant concepts of group, Ring and field and Rings, also students will be able to analyze & demonstrate examples of Matrices, Row and Column Space of Matrix, echelon forms, Rank, Systems of linear equations, direct sum of spaces, Quotient space, Homomorphism & Isomorphism of vector space, Eigen value & Eigen vectors of linear transformation.

UNIT-I (14 Hours)

Matrices, Row and Column Space of Matrix, Row reduction and echelon forms, Rank, Systems of linear equations, Gaussian elimination, Determinants and their properties, Cramer's rule, Vector equations, The matrix equation AX = B, Solution sets of linear systems (Homogeneous & Non-homogeneous), Applications of linear systems.

UNIT-II (15 Hours)

Eigenvalues, Eigenvectors, Characteristic polynomial, Minimal polynomial, Characteristic equation of a matrix, Cayley-hamilton theorem and its use in finding the inverse of a matrix, Diagonalization, Linear transformations, Representation of linear transformations by matrices, Change of basis, Rank-nullity theorem, Minimal polynomial.

UNIT-III (16 Hours)

Binary space, Definition of group, Ring and field, Vector space, Subspace, Linear combination, Linear span, Dimension of vector space, Direct sum of spaces, Quotient space, Homomorphism & Isomorphism of vector space.

UNIT-IV (15 Hours)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation.

Recommended books:

1. Chandrika Prasad, ‘ Text Book on Algebra and Theory of Equations,’ Pothishala Private Ltd.
2. Herstein, I.N., ‘ Topics in Algebra.’2nd Ed, Vikas Publishing House,**1976**.
3. Linear Algebra by Schaum Outline series.
4. H.S. Hall and S.R. Knight , ‘ Higher Algebra,’ H.M. Publications **1994**.
5. Shanti Narayan, ‘ A Text Books of Matrices.’

Analysis-I

Subject Code- BMATS1-103

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To Introduce the Concepts and to Develop Working Knowledge of Sets and Functions, Binary and decimal representation of real numbers, Infinite series, Continuous functions, uniform continuity, Differentiability and Derivatives of real functions.

Course Outcomes

Students will be able to assess properties implied by the definitions of Finite and infinite sets, Convergence of a sequence, Infinite series, Convergence of infinite series, Monotone and inverse functions, of mean value theorem, Intermediate value property of derivatives, Differentiation of vector valued functions.

UNIT-I (13 hours)

Real Numbers and Sequences of Real Numbers

Preliminaries: Sets and Functions, Mathematical induction, Finite and infinite sets.

Algebraic and order properties of R, Absolute value and the real line, Completeness property of R, Applications of supremum property, Archimedean property, Density of rational numbers in R, Intervals- Characterization theorem, Nested intervals, Nested interval property, The uncountability of R, Binary and decimal representation of real numbers.

A sequence in R, The limit of a sequence, Convergence of a sequence, Uniqueness of limits, Limit theorems, Monotone sequence, Euler's number, Subsequence, Divergent criteria, Monotone subsequence theorem, Bolzano- Weierstrass theorem, Cauchy sequence, Cauchy convergence criterion, Properties of divergent sequences.

UNIT-II (15 hours)

Infinite Series

Infinite series- partial sums, Convergence of infinite series, The nth term test, Cauchy criterion for series, Examples including the geometric series, The harmonic series, P- series, The alternating harmonic series, Comparison test and limit comparison test.

Absolute convergence, Grouping and rearrangements of series, Tests for absolute convergence- The root test, The ratio test, The integral test, The Rabbe's test, Alternating series, Alternating series test, Dirichlet test, Abel's test.

UNIT-III (16 hours)

Limits and Continuous Functions

Cluster point of a subset of R, Limit of a function at a cluster point of a set, Sequential criterion for the limits, Divergence criterion, Limit theorems, Squeeze theorem, Left handed and right handed limits, Infinite limits.

Continuous functions, Sequential criterion of continuity, Discontinuity criterion, Combinations of continuous functions- sum, Difference, Product and quotient and compositions.

Continuous functions on intervals, Boundedness theorem, Maximum-Minimum theorem, Bolzano's Intermediate value theorem, Preservation of intervals theorem,

Uniform continuity, Non-uniform continuity criteria, Uniform continuity theorem, Lipschitz functions, Continuous Extension theorem, Approximations of continuous functions by step functions and by piecewise linear functions, Weierstrass Approximation theorem. Monotone and inverse functions, The nth root function and rational powers.

UNIT-IV (16 hours)

Differentiation

Differentiability and Derivatives of real functions, Differentiability and Continuity, Basic properties of the derivatives, Caratheodory theorem, Chain rule, Inverse functions and their derivatives, Rolle's theorem, Mean Value theorem, Applications of mean value theorem, Intermediate value property of derivatives, Darboux's theorem, L'hospital rules, Taylor's theorem, Applications of Taylor's theorem, Convex functions, Newton's method, Differentiation of vector valued functions.

Recommended Books:

1. ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc.2000.
2. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
3. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.
4. T.M. Apostol, Mathematical Analysis, 2/e, Narosa Publishing House, Reprint 2002.

English

Subject Code- BHSMC0-001

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

Define and interpret the concepts of Communication Skills, Elements of Communication, Basic Listening Skills, Interview Skills.

Course Outcomes

Students will be able to assess properties implied by the concept of Communication Skills, Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Perspectives in Communication.

UNIT-I (12 hours)

Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.

Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

UNIT-II (15 hours)

Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

Communication Styles: Introduction, The Communication Styles Matrix with example for each - Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

UNIT-III (16 hours)

Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active

Listener, Listening in Difficult Situations
Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication

Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT-IV (17 hours)

Interview Skills: Purpose of an interview, Do's and Dont's of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

Recommended books:

1. Organizational Behaviour, Stephen .P. Robbins, 1st Edition, Pearson,2013
2. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5th Edition, Pearson,2013
3. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD,2010
4. Personality development and soft skills, Barun K Mitra, 1st Edition, Oxford Press, 2011
5. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
6. Soft skills and professional communication, Francis Peters SJ, 1st Edition, Mc Graw Hill Education,2011
7. Effective communication, John Adair, 4th Edition, Pan MacMillan,2009
8. Bringing out the best in people, Aubrey Daniels, 2nd Edition, Mc Graw Hill,1999

Fortran Programming

Subject Code- BMATS1-104

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To Introduce the Concepts of Computing, Digital Computers, Data Types, Constants, and Variables, Logical Operators and Logical Expression, Fortran I/O and External Files.

Course Outcomes

Students will have working knowledge of Operating Systems, Linux, Windows and other Operating Systems, Open Source Foundation and GNU, Programming and Problem Solving, Basic FORTRAN, Control Constructs.

UNIT-I (14 hours)

Introduction to Computing, Introduction to Digital Computers, Operating Systems, Linux, Windows and other Operating Systems, Open Source Foundation and GNU, Programming and Problem Solving.

UNIT- II (16 Hrs)

Basic FORTRAN, Introduction to FORTRAN, Data Types, Constants, and Variables, Operation and Intrinsic Functions, Expressions and Assignment Statements, Simple Input/Output, Program

Structure, Example: Simple Unit Conversion.

UNIT- III (15 Hrs)

Control Constructs, Logical Operators and Logical Expression, If Constructs, The Case Construct, Do Loops, Programming Units, Types of Programming Units, Main Program, External Procedures, Internal Procedures, Modules, Subroutines, Functions, Arguments of Procedures, Scope of Variables, Recursion, Arrays and Array Operations, Arrays in Fortran, Array Processing, Array Constructors, Mask Array.

UNIT- IV (15 Hrs)

Fortran I/O and External Files, Formatted Output, Formatted Input, File Processing User Defined Types and Structures, Derived Types, Type Bound Procedures, Polymorphism Graphics (Gnu plot),The Gnu plot Scientific Graphic Library, Linking Fortran Programs to Gnu Plot Graphic Library.

Recommended Books

1) Jane sleightholme, Ian chivers, Introduction to Programming with FORTRAN, Springer, 2003.

2)V. Rajaraman, Computer Programming in FORTRAN 77, PHI Learning Pvt. Ltd, 1997.

Fortran Lab

Subject Code- BMATS1-105

L	T	P	
0	0	2	Internal Assessment: 60 External Assessment: 40

Course Objectives

Operational Knowledge and Implementation of numerical methods & statistical Techniques using FORTRAN Programming Language.

Course Outcomes

Students will be able to use Operating Systems, Linux, Windows and other Operating Systems, Open Source Foundation and GNU, Programming and Problem Solving, Basic FORTRAN, Control Constructs.

1. Input-output statements: formatted and non-formatted statements
2. Decision Making: switch, if-else, nested if, else-if ladder
3. Jumping Statements: break, continue, go to
4. Loops: while, do-while, for
5. Functions: definition, declaration, variable scope, parameterized functions, return statement
6. Call by value, call by reference, recursive functions
7. Arrays: Array declarations, Single and multi-dimensional
8. Strings and string functions

Calculus-II

Subject Code- BMATS1-201

L	T	P
3	1	0

University Exam: 60
Internal Assessment: 40
Total: 100
Time Allowed: 3 hours

Course Objectives

To Introduce the Concepts of Areas under curves, Volume and surfaces of revolution of curves, Definite integrals, double integrals and Green, Gauss and Stokes Theorems.

Course Outcomes

Students will be able to assess Arc formula for the Cartesian equation y=f(x), Area of the closed curve, Volume and surfaces of revolution of curves, Integration by partial fractions, Integration of rational and irrational functions, Beta and Gamma functions and their properties, Double integrals, Scalar line integrals, Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stokes.

UNIT-I (15 hours)

Arc formula for the Cartesian equation y=f(x), Other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves, Area of the surface of the frustum of a cone, Area of the surface obtained by revolving the curve about axes.

UNIT-II (15 hours)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

UNIT-III (14 hours)

Definite integrals and their properties, Reduction formulae for integral of the form $\int_0^{\frac{\pi}{2}} \sin^n \theta \, d\theta$, $\int_0^{\frac{\pi}{2}} \cos^n \theta \, d\theta$, $\int_0^{\frac{\pi}{2}} \sin^m \theta \cos^n \theta \, d\theta$, Improper Integral and special function- Beta and Gamma functions and their properties.

UNIT-IV (16 hours)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds, Scalar line integrals, Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stokes.

Recommended Books:

1. G.B. Thomas and R.L. Finney: Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. T. Veerarajan: Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B. V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
4. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Algebra-II

Subject Code- BMATS1-202

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To know the Concepts of group and ring , Subgroups, Generation of groups and cyclic groups, Order of group, Integral domains, Characteristics of ring, Division rings and Fields, Ring homomorphism and isomorphism, Ideals and Quotient rings, Inner product spaces.

Course Outcomes

Students will be able to assess the in depth knowledge of topics of group and ring, examples and properties, Normal subgroup, Quotient group, Homomorphism, Isomorphism, Automorphism, Permutation of group, Inner product spaces.

UNIT-I (15 hours)

Definition of a group its examples and simple properties, Abelian group, Groups of transformations, Subgroups, Generation of groups and cyclic groups, Order of group, Coset decomposition, Lagrange's theorem and its consequences, Fermat's and Euler's theorems.

UNIT-II (16 hours)

Normal subgroup, Quotient group, Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

UNIT-III (14 hours)

Definition and examples of a ring, Its properties, Sub-rings, Integral domains, Characteristics of ring, Division rings and Fields, Ring homomorphism and isomorphism, Ideals and Quotient rings.

UNIT-IV(15 hours)

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Recommended books:

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, **2004.** 2. Surjeet Singh and Qazi Zameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,**1993.**
3. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, 1976.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
5. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
6. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
7. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.

Analysis-II

Subject Code- BMATS1-203

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To work comfortably with completeness of R, convergence of sequence in metric space, uniform continuity in metric space, Riemann - Stieltjes integration.

Course Outcomes

To Determine the Riemann integrability & Riemann-Stieltjes integrability of a bounded function & Recognize the difference between Countable and uncountable sets, Open and closed sets, also illustrate the effect of Continuity with compactness, connectedness.

UNIT-I (16 hours)

Riemann Integral

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem, Lebesgue's integrability criterion, Composition theorem, Product theorem, Taylor's theorem with remainder, Approximate integration, The trapezoidal rule, The midpoint rule, Simpson's rule.

UNIT-II (15 hours)

Sequences of Functions

Point wise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic functions, trigonometric functions.

UNIT-III (15 hours)

Series of Functions

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weierstrass M-test, Power series, Radius of convergence, Cauchy hadamard theorem, Term by term differentiation, Taylor's series.

UNIT-IV (14hours)

Metric Spaces

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set, Subspaces of a metric space, Compact sets, k-Cells, Compactness of a k-Cells, Weierstrass theorem, Perfect sets in R^k, Connected sets in R, Images of compact and connected sets under continuous functions, Compactness and uniform continuity of functions.

Recommended Books:

1. ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
2. Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
3. S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.
4. S. Shirali& H.L. Vasudeva, Metric Spaces, Springer, 2006.
5. T.M. Apostol, Mathematical Analysis, 2/e, Narosa Publishing House, Reprint 2002.

Environmental Science

Subject Code: BMNCC0-003

L	T	P	
3	1	0	

University Exam: 60
Internal Assessment: 40
Time Allowed: 3 hours
Total: 100

Course Objectives

To have important knowledge of Natural resources and associated problems, Forest resources, Water resources Biodiversity, Environmental Pollution, Social Issues and the Environment.

Course Outcomes

To know about Renewable and Non-renewable Resources, Ecosystems, Biodiversity and its Conservation, Environmental Pollution, Social Issues and the Environment.

UNIT-I (17 Hrs.)

Natural Resources: Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

UNIT-II (13 Hrs.)

Ecosystems: (a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

Biodiversity and its Conservation: (a) Introduction – Definition: genetic, species and ecosystem diversity. (b) Biogeographically classification of India. (c) Value of biodiversity: consumptive use, productive use, social, ethical aesthetic.

UNIT-III (15 Hrs.)

Environmental Pollution: Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT-IV (15 Hrs.)

Social Issues and the Environment: (a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. Case studies. (e) Environmental ethics: Issues and possible solutions (f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Recommended Books:

1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.
3. Erach Bharucha, 'Textbook for Environmental Studies', UGC, New Delhi.

Fundamentals of Computers and C Programming

Subject Code- BMATS1-204

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C language (structured programming).

Course Outcomes

1. Ability to implement programs using C.
2. Ability to implement fundamental data structures in C.

UNIT-I (15 hours)

Computer Fundamentals: Block diagram of a computer, Characteristics of computers, Hardware-input devices, Output devices, Memories, Software, System software, Application software, Compiler, Interpreter, utility program, Introduction to operating Systems-Windows based/MACOS/LINUX, Significance and advantages of operating systems.

UNIT-II (16 hours)

C programming: Introduction to C language, Evolution and characteristics of C language, Character set, Keywords, Identifiers, Data types, Variables, Constants, Operators, Expressions, Type conversion and type casting, Overview of pre-processors, Structure of a C program, Input and output statements, Control Statements: Basic programming constructs, 'if', 'if-else', 'nested-if' statements, Conditional operator, 'for', 'while', 'do - while', Switch, Break, Continue.

UNIT-III (15 hours)

Arrays and strings need for an array, Declaration and initialization, Basic operation on arrays, Multidimensional array, Structures, Union, Introduction to strings, String handling, Pointers Introduction, Declaration and initialization, Pointers and arrays: Similarities and advantages/disadvantages of using pointers.

UNIT-IV (14 hours)

Functions and Storage classes need for functions, Prototype, Function definition, Function call, Return type and Return statement, Passing arguments, Functions and arrays, Functions and pointers, Recursive functions, Difference between recursion and iteration storage classes, Files Introduction, File Operations, Character I/O, String I/O, Numeric I/O, Formatted I/O, Block I/O.

Recommended Books

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming in ANSI C', 3rd Edn., Tata McGraw Hill.
3.V. Rajaraman, 'Fundamentals of Computers', 3rd Edn., PHI.UNIT-II (8 Hrs.) C programming:
4. P.K Sinha, 'Computer Fundamental', 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language', 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, 'Application Programming in C', Edn', Khanna Book Publishing.

Lab of C Programming

Subject Code- BMATS1-205

L	T	P	
0	0	2	Internal Assessment: 60 External Assessment: 40

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C language (structured programming).

Course Outcomes

1. Ability to implement programs using C.
2. Ability to implement fundamental data structures in C.

List of following programs are as follows:

1. Operators: Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, go to
3. Loops: while, do-while, for
4. Functions: Definition, Declaration, Call by value, Call by reference, Recursive Function
5. Arrays: Arrays declarations, Single and multi-dimensional, Strings and string functions
6. Pointers: Pointer declarations, Pointer to function, Pointer to array.

Recommended Books

1. Shubhnandan Jamwal, 'Programming in C', 3rd Edn., Pearson.
2. E. Balagurusamy, 'Programming inANSI C', 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, 'Fundamentals of Computers', 3 rd Edn., PHI.
4. P.K. Sinha, 'Computer Fundamentals', 5th Edn.', BPB Publication.
5. Brian Kernighan and Dennis Ritchie, 'C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, 'Programming with C', 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, 'Let us C', 4th Edn., BPB Publications, NewDelhi.
8. R.S. Salaria, 'Application Programming in C', 2nd Edn., Khanna Book Publishing.

Differential Equations– I

Subject Code- BMATS1-301

L	T	P	
3	1	0	University Exam: 60 Internal Assessment: 40

Time Allowed: 3 hours Total: 100

Course Objectives

To introduce the theoretical concepts of ordinary and partial differential equations.

Course Outcomes

Ability to apply differential equations to significant applied and theoretical problems. Investigate the qualitative behaviour of solutions of systems of differential equations and interpret in the context of an underlying model.

UNIT-I (16 hours)

Elementary Methods in Ordinary Differential Equations, Formation of a differential equation, Solutions: General, particular, and singular, First order exact equations and integrating factors, Degree and order of a differential equation, Equations of first order and first degree, Equations in which the variable are separable, Homogeneous equations, Linear equations and equations reducible to linear form.

UNIT-II (14 hours)

First order higher degree equations solvable for x, y, p. Clairaut's form and singular solutions, Orthogonal trajectories, Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations, Linear differential equations of second order.

UNIT-III (15 hours)

General solution of homogeneous equation of second order, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

UNIT-IV (15 hours)

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Series solutions of Bessel equation and Legendre equation, Bessel function and their Integral expression & recurrence relations, Legendre Polynomials , Rodrigue's formula, Recurrence relations, generating functions and orthogonal properties.

Recommended books:

1. W.E.Boyce and P.C.Diprima : Elementary Differential Equations and Boundary value problems, John Wiley, **1986.**
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover ,**1956**.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

Mathematical Statistics

Subject Code- BMATS1-302

L	T	P	
3	1	0	University Exam: 60
			Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To introduce the concept of random variables, distribution functions, various probability distributions, and concepts in testing of statistical hypotheses.

Course Outcomes

To understand and use the concept of probability theory and statistics to solve industrial problems Define and examine the random sampling and graphical methods with technology, Recognize and compute the sampling distributions, sampling distributions of means and variances (S2) and the t- and F-distributions, recognize the relationship between the confidence interval estimation and tests of hypothesis.

UNIT-I (14 hours)

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem, Random variable, function of random variable and their distributions, probability mass function, probability density function, cumulative distribution function.

UNIT-II (15 hours)

Concept of random variables and probability distributions: Two dimensional random variables, Joint, Marginal and conditional distributions, Independence of random variables, Expectation, Conditional expectation, Moments, Product moments, Probability generating functions, Moment generating function and its properties.

UNIT-III (15 hours)

Study of various discrete and continuous distributions: Binomial, Poisson, Negative binomial distributions.

UNIT-IV (16 hours)

Concept of sampling distribution and its standard error, Derivation of sampling distributions of Chisquare, t and F distribution of sample mean and variance Testing of hypotheses, fundamental notions important tests based on normal distributions, Tests of significance: tests based on normal distribution, Chi-square, t and F statistic.

Recommended Books:

1. R.V. Hogg & Craige, 'Introduction to Mathematical Statistics', 7th Edn.,2005
2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, 1990.
3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, 1975.
4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', 2009.
5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, 1975.

Geometry (Co-ordinate and Solid)

Subject Code- BMATS1-303

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

Define and interpret the concepts of Transformation of axes, cone, sphere and cylinder.

Course Outcomes

Students will be able to understand and utilise the concept of Transformation of axes, Shifting of origin, Rotation of axes, Intersection of three planes, Cone with a vertex at the origin as the graph of homogeneous equation of second degree, Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve, Sphere, Section of a sphere by a plane.

UNIT-I (14 hours)

Transformation of axes, Shifting of origin, Rotation of axes, Reduction of the second degree equation into standard forms by transformation of co-ordinates, Intersection of three planes, Condition for three planes to intersect in a point or along a line or to form a prism.

UNIT-II (15 hours)

Cone with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z, Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, Right circular and elliptic cones.

UNIT-III (16 hours)

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve.

Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms.

UNIT-IV (15 hours)

Sphere, Section of a sphere by a plane, Spheres of a given circle, Intersection of a line and a sphere, Tangent line, Tangent plane, Power of a point w.r.t. a sphere, Radical planes.

Recommended Books

1. Gorakh Prasad and H.C. Gupta, Text Book on Coordinate Geometry.
2. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London.
3. Narayan, S.: Analytical Solid Geometry, Sultan Chand & Sons (2005).
4. Kreyszig, E.: Advanced Engineering Mathematics.
5. Thomos, G.B. and Finney, R.L.: Calculus and Analytic Geometry

Number Theory

Subject Code- BMATS1-304

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To introduce the concept of Division algorithm, Euclid's algorithm, Modular arithmetic, Arithmetic modulo p, Greatest integer function.

Course Outcomes

To understand and use the concept of Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, Simultaneous linear congruence's, Solving congruences modulo prime powers, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

UNIT-I (15 hours)

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, Fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

UNIT-II (14 hours)

Modular arithmetic, Basic properties of congruence's, linear congruence's, Simultaneous linear congruence's, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

UNIT-III (16 hours)

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

UNIT-IV (15 hours)

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler's Phi function, Euler's theorem, some properties of the Phi Function.

Recommended Books:

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, 'Introduction to Analytic Number Theory', Springer.
4. Paul T. Bateman, 'Analytic Number Theory', World scientific.
5. H. Rosen Kenneth, 'Elementary Number Theory', 6th Edn.

6. G.H. Hardy, 'An Introduction to the Theory of Numbers', 6th Edn.

Object Oriented Programming Language Using C++

Subject Code- BMATS1-305

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C++ language (structured programming).

Course Outcomes

1. Ability to implement programs using C++.
2. Ability to implement fundamental data structures in C++.

UNIT- I (13 Hrs.)

Characteristics of Object Oriented Programming: Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types. Introduction to C++: Identifier, Keywords, Constants, And Operators: Arithmetic, relational, logical, And conditional and assignment. size of operator, Operator precedence and associativity.

UNIT- II (15 Hrs.)

Classes and Objects: Class Declaration and Definition, Defining member functions, making functions inline, Nesting of member functions, Members access control. this pointer. Objects: Object as function arguments, array of objects, functions returning objects, Const member functions.
Constructors and Destructor: properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes, Virtual destructors. Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes.

UNIT- III (16 Hrs.)

Inheritance: Defining derived classes, inheriting private members, single inheritance, types of derivation, function redefining, constructors in derived class. Types of Inheritance: Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability.

UNIT- IV (16 Hrs.)

Polymorphism and Operator Overloading: Methods of achieving polymorphic behavior. Operator overloading: overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function. Function overloading: early binding, Polymorphism with pointers, virtual functions, late binding, pure virtual functions and abstract base class. Introduction to File Handling.

Recommended Books:

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGraw Hill.

2. Deitel and Deitel, 'C++ How to Program', Pearson Education.
3. Herbert Schildt, 'The Complete Reference C++', Tata McGraw Hill.
4. Robert Lafore, 'Object Oriented Programming in C++', Galgotia Publications.
5. Bjarne Strautrup, 'The C++ Programming Language', Addition-Wesley Publication Co.
6. Stanley B. Lippman, JoseeLajoie, 'C++ Primer', Pearson Education, 2002.

Object Oriented Programming Lab

Subject Code- BMATS1-306

L	T	P
0	0	2

External Assessment: 40
Internal Assessment: 60
Total: 100

Course Objectives

1. The intention is for the student to be able to articulate and demonstrate a basic understanding of the fundamental concepts of information technology and office tools.
2. The objective of this course is to help the students in finding solutions to various real life problems and converting the solutions into computer program using C++ language (structured programming).

Course Outcomes

1. Ability to implement programs using C++.
2. Ability to implement fundamental data structures in C++.

Operational Knowledge and Implementation of numerical methods & statistical Techniques using C++ Language.

Differential Equations– II

Subject Code- BMATS1-401

L	T	P
3	1	0

Time Allowed: 3 hours

University Exam: 60
Internal Assessment: 40
Total: 100

Course Objectives

To introduce the theoretical concepts of partial differential equations, Classification of linear partial differential equations of second order, Boundary-value problems.

Course Outcomes

Ability to apply differential equations to PDEs of the first order, non-linear PDE of first order, compatible system of first order PDE, Partial differential equations reducible to equations with constant coefficients, Separation of variables in a PDE, Laplace, wave and diffusion equations, Solution of boundary-value problems for various linear PDEs in various geometries.

UNIT-I (16 hours)

Formation of partial differential equations, PDEs of the first order, Lagrange's method, determination of integral surfaces of linear first order partial differential equations passing through a given curve, surfaces orthogonal to given system of surfaces, non-linear PDE of first order, Cauchy's method of characteristic, compatible system of first order PDE, Charpit's and Jacobi's general method of solution.

UNIT-II (14 hours)

Classification of linear partial differential equations of second order, Homogeneous and non-homogeneous equations with constant coefficients, Partial differential equations reducible to equations with constant coefficients, Characteristic curves of the second order PDE, Monge's method of solution of non-linear PDE of second order.

UNIT-III (13 hours)

Method of Solution: Separation of variables in a PDE, Laplace, wave and diffusion equations, Elementary solutions of Laplace equations.

UNIT-IV (17 hours)

The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions, one dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Recommended books:

1. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, **2003**.
2. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011
3. Elements of Partial Differential Equation (3rd edition) – I. N. Sneddon, McGraw Hill Book Company, 1998.
4. Partial Differential Equations (2nd edition) – E. T. Copson, Cambridge University Press, 1995.
5. J.N. Sharma and K. Singh, Partial differential equations for engineers and scientists, 2nd Edition, Narosa Publication House, New Delhi, 2009

Linear Algebra

Subject Code- BMATS1-402

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40
Time Allowed: 3 hours			Total: 100

Course Objectives

To introduce the theoretical concepts linear transformations, Range, Null space, Eigen values and Eigen vectors, Invertibility and Isomorphisms.

Course Outcomes

Ability to find the Vector spaces, Subspaces, algebra of subspaces, Rank and nullity of a linear transformation, Dual Space, Dual Basis, Invertibility and Isomorphisms.

UNIT-I (15 hours)

Vector spaces, Subspaces, algebra of subspaces, Quotient spaces, linear combination of vectors, Linear span, linear independence, Basis and dimension, dimension of subspaces.

UNIT-II (15 hours)

Linear transformations, Range, Null space, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, algebra of linear transformations.

UNIT-III (14 hours)

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

UNIT-IV (16 hours)

Isomorphisms, Isomorphism theorems, Invertibility and Isomorphisms, Change of coordinate matrix.

Recommended Books:

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

Mechanics-I

Subject Code- BMATS1-403

L	T	P	
3	1	0	

Time Allowed: 3 hours

University Exam: 60
Internal Assessment: 40
Total: 100

Course Objectives

To study mechanical systems under generalized coordinate systems, Virtual work, Energy and momentum, to study mechanics developed by Lagrange, Hamilton, Jacobi and small oscillation**.**

Course Outcomes

On successful completion of the course, students will be able to use of the Lagrange's equation for deriving equation of motions and apply the knowledge in Dynamics at higher levels.

UNIT-I (14 hours)

Generalized coordinates, Holonomic and non-holonomic systems scleronomic and rhenomic systems, Generalized potential, Lagrange's equation of first kind and second kind uniqueness of solution.

UNIT-II (16 hours)

Hamilton canonical equation, cyclic coordinates, Routh's equation , Poisson bracket , Poisson's identity , Jacobi -Poisson theorem, Hamilton's principle, Principle of least action.

UNIT-III (15 hours)

Small oscillations of conservative system, Lagrange's equation for small oscillations, Nature of roots of frequency equation, Principle oscillations. Normal coordinates, Canonical transformations, Hamilton- Jacobi equation.

UNIT-IV (15 hours)

Method of separation of variables, Lagrange's bracket condition of Canonical character of transformation in terms of Lagrange's bracket and Poisson's Bracket.

Recommended Books:

1. F. Gantmacher, 'Lectures in Analytic Mechanics', Mir Publisher, Moscow,1975.
2. H. Goldstien, C. Ppoole and J.L. Sofco, 'Classical Mechanics', 3rd Edn., Addison Wesely, 2002.
3. L.D. Landau and E.M. Lipshitz, 'Mechanics', Pergamon Press, Oxford, 1976.
4. J.E. Marsden, 'Lectures on Mechanics', Cambridge University Press, 1992.

Numerical Methods

Subject Code- BMATS1-404

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40

Time Allowed: 3 hours Total: 100

Course Objectives

Construction and use of numerical systems, Influence of data representation and computer architectures on algorithms choice and development, use numerical methods for solving a problem, locate and use good mathematical software, get the accuracy you need from the computer, assess the reliability of the numerical results, and determine the effect of round off error or loss of significance.

Course Outcomes

To analyze the error incumbent in any such numerical approximation, Compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation and approximation, numerical differentiation and integration.

UNIT-I (15 hours)

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss Jacobi, Gauss-Siedel and SOR iterative methods.

UNIT-II (16 hours)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

UNIT-III (14 hours)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

UNIT-IV (15 hours)

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

Recommended Books:

1. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.

2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.

3. S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, **1980.**

4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., **2001.**

LATEX and R

Subject Code- BMATS1-405

L	T	P	University Exam: 60
3	1	0	Internal Assessment: 40

Time Allowed: 3 hours Total: 100

Course Objectives

To study Latex and Basic tools for Formatting text: Structuring, Changing Fonts, Paragraph Justification, Mathematical Symbols and formulae, changing the mathematical style, Introduction and preliminaries of R.

Course Outcomes

On successful completion of the course, students will be able to use of Latex, Basic tools for Formatting text, Producing Mathematical Formulae using Latex, Arrays and Matrices amd consequently students can write research papers and prepare presentations .

UNIT-I (14 hours)

Introduction to Latex, Typical Latex input file, Basic Conventions: Spacing, Line breaking, page breaking, Modes and Environments, Forbidden characters.

UNIT-II (15 hours)

Basic tools for Formatting text: Structuring, Changing Fonts, Paragraph Justification etc

UNIT-III (15 hours)

Producing Mathematical Formulae using Latex: Mathematical Mode, Characters in Mathematical Mode, Superscripts and Subscripts, Greek letters, Mathematical Symbols and formulae, Changing the mathematical style, Matrices, arrays and tables in Latex

UNIT-IV (16 hours)

Introduction and preliminaries of R : R commands, R and Statistics, Simple manipulations: numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and Matrices, Lists and Data frames

Recommended books:

1. Lesile Lamport, **Latex: A document preparation system**, User's guide and reference manual, 2nd ed.,1994, Addison Wesley

2. F. Mittelbach, M Goosens, Johaaes Braams, D Carlisle, Chris Rowley**, Latex Companion**, 2nd ed., 2004, Addison-Wesley Professional

3. Norman Matloff, **The art of R programming**: no starch press

4. W.N Venables and B.D Ripley: **Modern Applied Statistics with S**, Springer – Verlag 4th ed.

LATEX and R LAB

Subject Code- BMATS1-406

L	T	P
0	0	2

External Assessment: 40
Internal Assessment: 60
Total: 100

Course Objectives

To study Typical Latex and Basic tools for Formatting text: Structuring, Changing Fonts, Paragraph Justification, Mathematical Symbols and formulae, changing the mathematical style, Introduction and preliminaries of R.

Course Outcomes

On successful completion of the course, students will be able to use of Latex, Basic tools for Formatting text, Producing Mathematical Formulae using Latex, Arrays and Matrices in writing good research papers and presentations..

1. Writing articles with Latex

1.1 Creating latex file
1.2 Writing mathematical symbols in text
1.3 Creating arrays and matrices
1.4 Writing references using latex
1.5 Presentation of articles using beamer class

2. Programming with R

2.1 Loops and vectorization
2.2. Writing a program in R
2.3. Creating own functions
2.4. Using R in Statistics

Recommended books:

1. Lesile Lamport, **Latex: A document preparation system**, User's guide and reference manual, 2nd ed.,1994, Addison Wesley

2. F. Mittelbach, M Goosens, Johaaes Braams, D Carlisle, Chris Rowley**, Latex Companion**, 2nd ed., 2004, Addison-Wesley Professional

3. Norman Matloff, **The art of R programming**: no starch press

4. W.N Venables and B.D Ripley: **Modern Applied Statistics with S**, Springer – Verlag 4th ed.