SHRI GURU RAM RAI UNIVERSITY

[Estd. by Govt. of Uttarakhand, vide Shri Guru Ram Rai University Act no. 03 of 2017 & recognized by UGC u/s (2f) of UGC Act 1956]

SYLLABUS

FOR

Bachelor of Science (Mathematics)

Under CBCS Pattern

School of Basic and Applied Sciences

(w.e.f. 2021-2022)

Bachelor of Science

OUTCOME BASED EDUCATION

Programme outcome (POs)

PO1. Graduates will develop scientific temperament to solve scientific problems in emerging areas of science at National and International level.

PO2. Graduates will acquire coherent understanding of the academic field to pursue multi and interdisciplinary science careers in future.

PO3. Graduate will have clarity of thought and expression. Qualities like logical thinking and decision making will be enhanced.

PO4. Graduates will be able to compete in various national and international competitive examinations.

PO5. Graduates will understand the principles of basic and applied sciences and apply them logically in environmental and socio-technological context with a systematic approach towards sustainable development.

PO6. Graduates will have critical thinking; will know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

PO7. Graduates will acquire effective communication skills in advanced areas of mathematics chosen by the student from the given courses.

PO8. Graduate will understand, formulate and use quantitative models arising in Business and other contexts.

PO9. Graduate will able to interlink the skills developed and gets an aptitude to address the problems in smart home design, smart vehicles etc.

PO10. Graduate will analyze the concepts of mathematics, Electronics and computer Networks and able to use them in solving real world problems.

PO11. Graduate will acquire the skills to study the properties of materials, implementation of numerical algorithms by using various Mathematical techniques.

PO12. Graduate will understand the concepts of vector spaces, group theory, quantum mechanics, and optical, thermal, electrical, mechanical properties of materials.

Program Specific Outcome (PSOs)

PSO1	Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Mathematics.
PSO2	Graduates will develop numerical, analytical and mathematical skills.
PSO3	Graduates will be prepared to Acquiring a range of general skills, solve problems, Evaluating information using computers productively to communicate with the society effectively and its allied areas in multiple disciplines concerned with mathematics.
PSO4	Graduates will acquire a job efficiently in diverse fields such as Science and Engineering, Education, Banking, Public Services, Business etc.

Eligibility for admission:

Any candidate who has passed the Plus Two of the Higher Secondary Board of Examinations in any state recognized as equivalent to the Plus Two of the Higher Secondary Board in with not less than 45 % marks in aggregate is eligible for admission, However, SC/ST, OBC and other eligible communities shall be given relaxation as per University rules.

Duration of the Programme: 3Years

STUDY & EVALUATION SCHEME
Choice Based Credit System
Bachelor of Science

First Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BMTC 101	Differential Calculus	6	0	0	6	30	70	100
2.	Ability Enhancement Compulsory course	AECC 101/ 102/ 103	Environment Science/ English/MIL communication	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

L – Lecture, T – Tutorial, P – Practical, C – Credit

Second Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BMTC 201	Differential Equations	6	0	0	6	30	70	100
2.	Ability Enhancement Compulsory course	AECC 201/ 202/ 203	Environmental Science/ English/MIL communication	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

Third Semester

S.no.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BMTC 301	Real Analysis	6	0	0	6	30	70	100
2	Skill enhancement course	BMTS 302	Elementary Algebra & Trigonometry	4	0	0	4	30	70	100
3	Skill enhancement course	BMTS 303	Analytical Geometry	4	0	0	4	30	70	100
4	Skill enhancement course	BMTS 304	Integral Calculus	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

Note: Student will select one skill paper among three papers.

Fourth Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Core	BMTC 401	Algebra	6	0	0	6	30	70	100
2	Skill enhancement course	BMTS 402	Vector Calculus	4	0	0	4	30	70	100
3	Skill enhancement course	BMTS 403	Theory of Equation	4	0	0	4	30	70	100
4	Skill enhancement course	BMTS 404	Number Theory	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

Note: Student will select one skill paper among three skill papers.

Fifth Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline specific Elective	BMTD 501	Matrices	6	0	0	6	30	70	100
2	Discipline specific Elective	BMTD 502	Mechanics	6	0	0	6	30	70	100
3	Discipline specific Elective	BMTD 503	Linear Algebra	6	0	0	6	30	70	100
4	Skill enhancement course	BMTS 504	Probability and Statistics	4	0	0	4	30	70	100
5	Skill enhancement course	BMTS 505	Mathematical Finance	4	0	0	4	30	70	100
6	Skill enhancement course	BMTS 506	Mathematical Statistics	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

Note: Student will select one Discipline specific elective and one skill enhancement course among three.

Sixth Semester

S. No.	Course Category	Couse Code	Course Name	Periods				Evaluation scheme		Subject Total
				L	T	P	C	Sessional (Internal)	External (ESE)	
Theory										
1	Discipline specific Elective	BMTD 601	Numerical Methods	6	0	0	6	30	70	100
2	Discipline specific Elective	BMTD 602	Complex Analysis	6	0	0	6	30	70	100
3	Discipline specific Elective	BMTD 603	Linear Programming	6	0	0	6	30	70	100
4	Skill enhancement course	BMTS 604	Boolean Algebra	4	0	0	4	30	70	100
5	Skill enhancement course	BMTS 605	Transportation and Game Theory	4	0	0	4	30	70	100
6	Skill enhancement course	BMTS 606	Graph Theory	4	0	0	4	30	70	100
			Total	10	0	0	10	60	140	200

Note: Student will select one Discipline specific elective and one skill enhancement course among three.

Examination Scheme:

Components	Ist internal (Presentation/ Assignment/ Project)	IInd Internal	External (ESE)
Weightage (%)	**15 %**	**15%**	**70 %**

Course Details:

Course code	: BMTC 101			
Course Name	: Differential Calculus			
Semester /Year	: First/First			
		L	**T**	**P**	**C**
		6	**0**	**0**	**6**

L - Lecture T – Tutorial P – Practical C – Credit

Course Objectives: The objectives of this course are

Student will be able to understand differentiation and fundamental theorem in differentiation and various rules. Verify the value of the limit of a function at a point using the definition of the limit. Learn to check function is continuous understand the consequences of the intermediate value theorem for continuous functions.

Course Contents

Unit 1
Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions.

[No. of Hours:15]

Unit 2
Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions,Tangents and normals.

[No. of Hours: 15]

Unit 3
Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

[No. of Hours: 15]

Unit 4
Rolle' s theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, ex, log(l+x), (1+x)m, Maxima and Minima, Indeterminate forms.

[No. of Hours: 15]

Text Books:

TB1. Ganesh Prasad, *A textbook for differential calculus*, London Green & co.
TB2. Shanti Narayan , Differential Calculus, S.Chand & co.

Reference Books:

RB1. Rai Singhania, M. D. Advanced Differential Equations. S. Chand & Company Ltd., New Delhi, 2001.

RB2. Simmons, G. F. Differential Equations with Applications and Historical Notes. 2nd edition, Tata McGraw Hill, New Delhi, 2016.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Identify the notions of limit of a sequence and convergence of a series of real numbers.
CO2	Interpret tracing of curves, different theorem based questions.
CO3	Examine successive differentiation by Leibnitz theorem, Indeterminate forms.
CO4	Evaluate Limit and Continuity, Tangents and normal, Indeterminate forms.
CO5	Distinguish Curvature, Asymptotes, Singular points, Tracing of curves.
CO6	Solve limit, normal, singular points, maxima minima.

CO- PSO-PO Mapping:

3: Highest Correlated, 2: Medium Correlated, 1: Lowest Correlated

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	1	1	2	1	2	1	2	1	2	3	2	2
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	2	1	1	1	1	1	1	2	1	1	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO6	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1

Course code	:	BMTC 201				
Course Name	:	Differential Equations				
Semester /Year	:	Second/First				
			L	T	P	C
			6	0	0	6

Course Objectives: The objectives of this course are

Student will be able to solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous. Student will be able to find the complete solution of a nonhomogeneous differential equation as a linear combination of the complementary function and a particular solution. Student will have a working knowledge of basic application problems described by second order linear differential equations with constant coefficients.

Course Contents

Unit 1
First order exact differential equations. Integrating factors, rules to find an integrating factor.
[No. of Hours:15]

Unit 2
First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian , and its properties. Solving a differential equation by reducing its order.
[No. of Hours: 15]

Unit 3
Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

[No. of Hours: 15]

Unit 4
Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

[No. of Hours: 15]

Text Books:

TB1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.

TB2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.

Reference Books:

RB1. Schaum's, Outlines of Differential Equations, McGraw-Hill, International Education Pvt Ltd.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Describe various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
CO2	Understand the genesis of ordinary differential equations.
CO3	Apply the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.
CO4	Classify mathematical models in the form of ordinary differential equations to suggest possible solutions of the day to day problems arising in physical, chemical and biological disciplines.
CO5	Evaluate differential equation of first order, Linear homogenous equations.
CO6	Solve Charpit's method based questions, Simultaneous differential equations.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	1	1	1	1	1	1	1	3	1	1	1
CO2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	1
CO3	2	1	2	2	1	2	1	2	2	1	2	2	1	1	1	2
CO4	2	1	1	2	1	1	1	2	1	1	1	1	1	2	1	1
CO5	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO6	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1

Course code	:	BMTC 301				
Course Name	:	Real Analysis				
Semester /Year	:	Three/Second				
			L	T	P	C
			6	0	0	6

Course Objectives: The objectives of this course are

Describe fundamental properties of the real numbers that lead to the formal development of real analysis. Comprehend rigorous arguments developing the theory underpinning real analysis. Demonstrate an understanding of limits and how they are used in sequences, series, Construct rigorous mathematical proofs of basic results in real analysis

Course Contents

Unit 1
Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

[No. of Hours:15]

Unit 2
Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

[No. of Hours:15]

Unit 3
Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series,

[No. of Hours: 15]

Unit 4
Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence. Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test.

[No. of Hours: 15]

Text Books:

TB1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

TB2. R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.

ReferenceBooks:

RB1. K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

RB2. S.C. Malik & Savita Arora, Mathematical Analysis, New age international publisher.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Select the limit superior, limit inferior, and the limit of a bounded sequence.
CO2	Understand many properties of the real line ℝ and learn to define sequence in terms of functions from ℝ to a subset of ℝ.
CO3	Apply the ratio, root and alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.
CO4	Classify some of the properties of Riemann integral functions and the applications of the fundamental theorems of integration.
CO5	Test the convergence of the infinite series by Ratio test, P test, Root test etc
CO6	Solve the questions based on M, Mn test and Leibnitz test etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	3	2	1	1	1	1	1	1	2	1	2	1	3
CO2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
CO3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1	1
CO6	1	1	2	1	1	2	1	1	2	1	2	1	1	1	1	1

Course code	:	**BMTS 302**				
Course Name	:	**Elementary algebra and Trigonometry**				
Semester /Year	:	**Third/Second**				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to solve the problems of equivalence relations, logical and binding variables. Sets problems, modulo relations. De Moivre's theorem and its applications.

Course Contents

Unit 1
Numbers: Natural numbers, Integers, Rational and Irrational numbers, Real numbers, Complex numbers, Mappings, Equivalence relation and partitions, Congruence modulo n.

[No. of Hours:10]

Unit 2
Roots of equations: Fundamental Theorem of Algebra, Relations between Roots and Coefficients, transformation of equations, Descartes rule of signs, Algebraic Solution of a Cubic equations (Carden method), Bi-quadratic Equation.

[No. of Hours: 10]

Unit 3
Elementary Matrices: Symmetric, skew-symmetric, Hermitian and skew-Hermitian matrices; Elementary operations on matrices, adjoint and inverse of a matrix.

[No. of Hours: 10]

Unit 4

Trigonometry: De Movire's Theorem and its applications, Exponential, Logarithmic, Circular and hyperbolic functions together with their inverses, Gregory's series, Summation of Trigonometric series.

[No. of Hours: 10]

Text Books:

TB1. Leonard E. Dickson: First Course in the Theory of Equations.

TB2. Burnside, William Snow,Panton and Arthur William: The Theory of Equations Vol I (1924).

Reference Books:

RB1. John Bird: Engineering Mathematics, Fifth edition.

RB2. Rajendra Kumar Sharma, Sudesh Kumari Shah and Asha Gauri Shankar: Complex Numbers and the Theory of Equations, Anthom Press India

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Knowledge of fundamental theorem of algebra.
CO2	Understand the different types of matrices.
CO3	Apply to solve the problems regarding matrices.
CO4	Distinguish exponential, logarithmic, circular and hyperbolic functions.
CO5	Evaluate the questions based on matrices, numbers etc.
CO6	Solve the matrices , Exponential, Logarithmic, Circular and hyperbolic functions etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1
CO3	1	1	1	2	1	1	1	1	1	1	3	1	2	1	1	1
CO4	1	1	1	1	1	1	1	2	1	1	1	1	2	1	2	1
CO5	2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
CO6	1	2	1	2	1	1	1	1	1	1	1	1	1	2	1	1

Course code	:	BMTS 303				
Course Name	:	Analytical Geometry				
Semester /Year	:	Three/Second				
			L	T	P	C
			4	0	0	4

Course Objectives: The objectives of this course are

Introduction to analytical geometry of 2 dimensional. Study of lines in 2 and 3 dimension. Finding equation in various form of line, circle, ellipse, sphere, cones etc. Give the knowledge of geometry using maxima software.

Course Contents

Unit 1

Introduction of parabola, techniques for sketching parabola.

[No. of Hours:10]

Unit 2
Ellipse and hyperbola, Reflection properties of parabola, ellipse and hyperbola, Classification of quadratic equations representing lines

[No. of Hours: 10]

Unit 3
Sphere, Cone, Cylindrical Surfaces, Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid. Central Conicoids.

[No. of Hours: 10]

Unit 4
General equation of second degree, Central conicoids, Tangent plane, Director sphere, Normal, Plane of contact, Polar plane, Conjugate plane and conjugate points.

[No. of Hours: 10]

Text Books:

TB1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

TB2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.

Reference Books:

RB1. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Gain knowledge of sketching different surfaces like parabola, ellipse etc.
CO2	Understand the quadratic equations representing lines etc.
CO3	Illustrate the graphing standard quadric surfaces like cone ellipsoid etc.
CO4	Distinguish the properties of various surfaces.
CO5	Evaluate the General equation of second degree, Central coincides, Tangent plane, Director sphere, Normal etc.
CO6	Write the techniques for sketching parabola, graphing standard quadric surfaces like cone, ellipsoid etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	2	1	2	3	1	1	2	1	1	1	1	1
CO2	1	1	2	1	1	1	1	1	1	1	2	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1
CO5	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1
CO6	1	1	1	1	1	1	2	1	2	1	1	1	3	1	1	2

Course code	:	BMTS 304				
Course Name	:	Integral Calculus				
Semester /Year	:	Third/Second				
			L	T	P	C
			4	0	0	4

Course Objectives: The objectives of this course are

Student will be able to solve the problems of integration of rational and irrational functions. Areas of curves in the plane, volumes and surfaces of solids of revolution. Double and Triple integrals.

Course Contents

Unit 1
Integration by Partial fractions, integration of rational and irrational functions.
                              [No. of Hours:10]

Unit 2
Properties of definite integrals. Reduction formulae for integrals of rational.
                              [No. of Hours: 10]

Unit 3

Trigonometric, exponential and logarithmic functions and of their combinations**.**
                              [No. of Hours: 10]
Unit 4
Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. Double and Triple integrals.
                              [No. of Hours: 10]

Text Books:

TB1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

Reference Books:

RB1. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Knowledge to integrate of rational and irrational functions.
CO2	Understand the trigonometric exponential and logarithmic functions and their combinations.
CO3	Interpret the problems regarding areas and volumes of surfaces of solids.
CO4	Distinguish the properties of definite integrals.
CO5	Evaluate Areas and lengths of curves in the plane, Double and Triple integrals, integration of rational and irrational functions etc
CO6	Integrate by Partial fractions ,Solve definite integrals etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	1	1	1	2	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
CO3	2	1	1	1	1	1	1	1	1	1	2	1	1	1	3	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO5	1	1	1	1	1	2	1	1	1	1	1	1	1	2	1	1
CO6	1	1	2	1	1	1	3	1	1	3	1	2	1	1	1	2

Course code	:	BMTC 401				
Course Name	:	Algebra				
Semester /Year	:	Fourth/Second				
			L	T	P	C
			6	0	0	6

Course Objectives: The objectives of this course are

Student will be able to solve the problems of abelian and non abelian groups. The definition of Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups etc.

Course Contents

Unit 1
Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity, circle group.

[No. of Hours:15]

Unit 2
The general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle,(iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions, Subgroups, cyclic subgroups.

[No. of Hours: 15]

Unit 3
The concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

[No. of Hours: 15]

Unit 4
Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C.

[No. of Hours: 15]

Text Books:

TB1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

TB2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.

Reference Books:

RB1.   Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.

RB2.   George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984**.**

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Definition of groups, subgroups, cyclic subgroups and rings.
CO2	Understand the theorems and problems regarding groups and rings etc.
CO3	Apply the properties of groups and rings to solve the problems.
CO4	Distinguish various problems regarding fields, integral domain, ideals.
CO5	Evaluate Cyclic groups from number systems, complex roots of unity, circle group, Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C etc.
CO6	Solve the commutator subgroup of group, examples of center of a group etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	1	1	1	1	1	1	2	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	2	1	2	2	2	1	1	2	1	1	2	1
CO5	1	2	1	1	1	1	1	1	1	1	1	1	1	3	1	1
CO6	2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	2

Course code	:	BMTS 402				
Course Name	:	Vector Calculus				
Semester /Year	:	Fourth/Second				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

After completion the course the student will able to solve the differentiation of vector function, dot and cross product of vectors.

Course Contents

Unit 1
Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors.

[No. of Hours:10]

Unit 2
Gradient, divergence and curl.

[No. of Hours: 10]

Unit 3
Vector identities, vector integration along line.

[No. of Hours: 10]

Unit 4
Simple application of Green's theorem, Gauss divergence theorem and Stokes theorem.

[No. of Hours: 10]

Text Books:

TB1.   G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

TB2.   H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.

Reference Books:

RB1. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Define Scalar and vector function, Vector Identities etc.
CO2	Explain the differentiation and integration of vector functions.
CO3	Apply the vector identities in Green's theorem Gauss divergence theorem and Stokes theorem etc.
CO4	Distinguish the vector identities in applying dot and cross product questions.
CO5	Evaluate Vector identities, Gradient, divergence and curl in given equations.
CO6	Solve the equations of partial differentiation of a vector function, vector integration along line etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	3	1
CO2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2
CO4	1	2	1	2	1	1	1	1	1	1	2	1	1	1	1	1
CO5	1	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1
CO6	2	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2

Course code	: BMTS 403			
Course Name	: Theory of Equations			
Semester /Year	: Fourth/Second			
		L	T	P	C
		4	0	0	4

Course Objectives: The objectives of this course are

Student will able to solve the problems of polynomials, maximum and minimum values of a polynomials. Descarte 's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations. Symmetric functions. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic.

Course Contents

Unit 1
General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials.

[No. of Hours:10]

Unit 2
General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

[No. of Hours: 10]

Unit 3
Symmetric functions, Applications symmetric function of the roots, Transformation of equations.

[No. of Hours: 10]

Unit 4
Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions.

[No. of Hours: 10]

Text Books:

TB1. W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.

Reference Books:

 RB1. C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Describe the general properties of polynomials, equations and Symmetric functions.
CO2	Understand the relations between the roots and the coefficient of equations.
CO3	Apply the relations in solutions of reciprocal and binomial equations.
CO4	Compare the properties of derived , symmetric functions etc.
CO5	Summarize the general properties of polynomials, Symmetric functions, Applications symmetric function of the roots etc.
CO6	Solve maximum and minimum values of a polynomials, Algebraic solutions of the cubic and biquadratic etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	2	1	1	1	1	1	1	2	1	1	2	1	3	2	1
CO4	1	1	1	1	2	1	1	3	1	1	1	1	1	1	2	2
CO5	1	1	1	2	1	1	1	1	1	1	1	1	2	2	1	1
CO6	1	1	2	1	1	1	2	1	1	2	1	1	1	1	1	1

Course code	:	BMTS 404				
Course Name	:	Number Theory				
Semester /Year	:	Fourth/ Second				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: <u>The objectives of this course are</u>

Find quotients and remainders from integer division. Apply Euclid's algorithm and backwards substitution. Understand the definitions of congruence, residue classes and least residues add and subtract integers, modulo n, multiply integers and calculate powers, modulo n. Determine multiplicative inverses, modulo n and use to solve linear congruence. Theory of quadratic residue.

Course Contents

Unit 1
Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem.

[No. of Hours:10]

Unit 2
Goldbach conjecture, binary and decimal representation of integers, linear congruences, complete set of residues.

[No. of Hours: 10]

Unit 3
Number theoretic functions, sum and number of divisors, totally multiplicative functions.

[No. of Hours: 10]

Unit 4
Properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.

[No. of Hours: 10]

Text Books:

TB1. David M. Burton, Elementary Number Theory 6th Ed., Tata McGraw-Hill Edition, Indian reprint, 2007.

TB2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.

Reference Books:

RB1. Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Learn and gain knowledge about some important results in the theory of numbers including the prime number theorem and their consequences.
CO2	Understand about number theoretic functions, modular arithmetic and their applications.
CO3	Apply the properties of Dirchlet product in various problems.
CO4	Classify modular arithmetic and find primitive roots of prime and composite numbers.
CO5	Assess Goldbach conjecture, binary and decimal representation of integers, prime counting function etc.
CO6	Solve Number theoretic functions, totally multiplicative functions, linear congruences, complete set of residues etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	2	1
CO2	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
CO3	1	1	1	1	1	1	2	1	1	1	2	1	3	1	1	1
CO4	1	1	3	2	1	1	1	1	1	1	1	1	1	2	1	1
CO5	1	1	1	1	1	1	2	2	1	2	1	2	1	1	1	1
CO6	1	2	1	2	1	1	1	1	2	1	1	1	2	1	1	2

Course code	:	BMTD 501				
Course Name	:	Matrices				
Semester /Year	:	Fifth/Third				
				L	T	P	C
				6	0	0	6

Course Objectives: The objectives of this course are

Student will able to find types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four. Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix.

Course Contents

Unit 1
R, R2, R3 as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of R2, R3.

[No. of Hours:15]

Unit 2
Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

[No. of Hours: 15]

Unit 3
Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four.

[No. of Hours: 15]

Unit 4
Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices.

[No. of Hours: 15]

Text Books:

TB1.   A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.

TB2.   S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of 17 India Pvt. Ltd., New Delhi, 2004.

Reference Books:

RB1. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Definition of vector space, standard basis , subspaces etc.
CO2	Explain the types of matrices , eigen vector spaces and invariant spaces.
CO3	Apply in reduction to diagonal form upto matrices of order 3.
CO4	Distinguish R_1 , R_2, R_3 as vector spaces over R. Subspaces of R_2,R_3.
CO5	Evaluate rank under elementary transformations, eigen spaces as invariant subspaces etc.
CO6	Write Matrices in diagonal form, Matrix form of basic geometric transformations, eigen spaces as invariant subspaces etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	3	1	1	1	2	1	1	2	1	1	1	1	1
CO2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	3
CO3	1	1	1	1	1	1	1	1	2	1	3	1	1	1	1	2
CO4	1	2	1	1	1	1	1	1	1	2	1	2	1	1	1	1
CO5	2	1	2	1	2	1	1	2	1	1	1	1	1	2	2	1
CO6	2	1	1	1	1	2	1	1	2	1	1	1	2	1	2	2

Course code	:	BMTD 502				
Course Name	:	Mechanics				
Semester /Year	:	Fifth/Third				
			L	**T**	**P**	**C**
			6	**0**	**0**	**6**

Course Objectives: The objectives of this course are

Student will able to find the Centre of gravity, Work and potential energy. Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve), tangential and normal components (space curve). Laws of friction, Problems of equilibrium under forces including friction etc.

Course Contents

Unit 1
Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body.
                                                                    [No. of Hours:10]

Unit 2
Laws of friction, Problems of equilibrium under forces including friction.
                                                                    [No. of Hours: 10]

Unit 3
Centre of gravity, Work and potential energy. Velocity and acceleration of a particle along a curve: radial and transverse components (plane curve), tangential and normal components (space curve).
                                                                    [No. of Hours: 10]

Unit 4
Simple harmonic motion, Simple Pendulum.
                                                                    [No. of Hours: 10]

Text Books:

TB1.   A.S. Ramsay, Statics, CBS Publishers and Distributors (Indian Reprint), 1998.

Reference Books:

RB1. A.P. Roberts, Statics and Dynamics with Background in Mathematics, Cambridge University Press, 2003.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Identify the conditions of equilibrium under forces including friction.
CO2	Understand the centre of gravity, work and potential energy etc.
CO3	Use in simple harmonic motion and in simple pendulum.
CO4	Compare the radial and transverse components etc.
CO5	Discriminate Problems of equilibrium under forces including friction, Velocity and acceleration of a particle along a curve: radial and transverse components etc.
CO6	Write Conditions of equilibrium of a particle, tangential and normal components etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	2	1	3	1	1	1	1	1	1	1	2	1	3	1	1
CO4	1	1	1	1	2	1	2	1	1	1	1	1	2	1	1	1
CO5	1	1	2	1	1	1	1	2	1	1	1	1	1	1	2	2
CO6	2	1	2	1	1	2	1	1	1	1	2	2	1	1	1	1

Course code	: BMTD 503				
Course Name	: Linear Algebra				
Semester /Year	: Fifth/Third				
		L	T	P	C
		6	0	0	6

Course Objectives: The objectives of this course are

Introduction to vector space and subspace. Use computational techniques and algebraic skills essential for the study of systems of Linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, Orthogonality and Diagonalization. (Computational and Algebraic Skills).

Course Contents

Unit 1
Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces**.**
[No. of Hours:15]

Unit 2
Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation.
[No. of Hours: 15]

Unit 3
Algebra of linear transformations. Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

[No. of Hours: 15]

Unit 4
Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix**.**
[No. of Hours: 15]

Text Books:

TB1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed.,

Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.

TB2.   David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education
 20 Asia, IndianReprint, 2007.

Reference Books:

RB1. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

RB2. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Define linear transformations; compute eigen values and eigen vectors.
CO2	Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
CO3	Apply properties of inner product spaces and determine orthogonality in inner product spaces.
CO4	Compare the properties of Isomorphism, Homomorphism etcand use in change of coordinate matrix.
CO5	Evaluate Eigen values and Eigen vectors, Characteristic Polynomial , linear combination of vectors, linear independence etc.
CO6	Solve linear transformations, Characteristic Polynomial, linear combination of vectors etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1
CO2	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1
CO3	1	2	1	2	1	1	1	1	1	2	1	1	2	1	1	1
CO4	1	1	1	1	1	2	3	2	2	1	1	1	2	1	1	1
CO5	1	1	3	1	2	1	1	1	1	1	1	1	1	1	1	2
CO6	2	1	1	1	2	2	1	1	1	1	1	3	1	2	2	1

Course code	:	**BMTS 504**				
Course Name	:	**Probability and Statistics**				
Semester /Year	:	**Fifth/Sixth**				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to find the moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential. Marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables etc.

Course Contents

Unit 1
Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation.

[No. of Hours:15]

Unit 2
Moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential.

[No. of Hours: 15]

Unit 3
Joint cumulative distribution function and its properties, joint probability density functions**.**

[No. of Hours: 15]

Unit 4
Marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

[No. of Hours: 15]

Text Books:

TB1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.

TB2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application,* 7th Ed., Pearson Education, Asia, 2006.

Reference Books:
RB1. Sheldon Ross, *Introduction to Probability Model,* 9th Ed., Academic Press, Indian Reprint, 2007.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Knowledge of simple space, mathematical expectation etc.
CO2	Describe the characteristic function, discrete distributions etc.
CO3	Solve the problems related probability functions.
CO4	Distinguish the marginal and conditional distributions, joint cumulative and joint probability density function.
CO5	Justify Marginal and conditional distributions, independent random variables, moment generating function, characteristic function etc.
CO6	Write probability axioms, independent random variables, binomial, Poisson, continuous distributions etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1
CO2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	2	1	1	1	2	1	1	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	1	1	1	1	1	3	1	2	1	1	1
CO5	1	1	2	1	1	1	1	2	1	2	1	1	1	1	1	3
CO6	2	1	1	2	1	1	2	1	2	1	1	2	1	2	2	2

Course code	:	BMTS 505				
Course Name	:	Mathematical Finance				
Semester /Year	:	Fifth/Third				
			L	T	P	C
			4	0	0	4

Course Objectives: The objectives of this course are

Student will be able to find arbitrage and risk aversion, Interest, time value of money. Inflation, net present value, internal rate of return, comparison of NPV and IRR. Bonds, bond prices and yields. Floating-rate bonds, immunization.

Course Contents

Unit 1
Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money.

[No. of Hours:15]

Unit 2
Inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields. Floating-rate bonds, immunization.

[No. of Hours: 15]

Unit 3

Asset return, short selling, portfolio return, (brief introduction to expectation, variance,

covariance and correlation).   **[No. of Hours: 15]**

Unit 4
Random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set.

[No. of Hours: 15]

Text Books:

TB1. David G. Luenberger, Investment Science, Oxford University Press, Delhi, 1998.

TB2. John C. Hull, Options, Futures and Other Derivatives, 6th Ed., Prentice-Hall India, Indian reprint, 2006.

Reference Books:

RB1. Sheldon Ross, An Elementary Introduction to Mathematical Finance, 2nd Ed., Cambridge University Press, USA, 2003.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Knowledge of simple, compound interest, inflation etc.
CO2	Understand the portfolio return, asset return and random returns etc.
CO3	Use in portfolio diagram.
CO4	Comparison of NPV and IRR, bond prices and yields.
CO5	Estimate Inflation, net present value, internal rate of return, brief introduction to expectation etc.
CO6	Write Basic principles of Comparison, arbitrage and risk aversion, Interest, diversification, portfolio diagram, feasible set etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	2	2	3	2	1	1	1	1	1	1	1	1	1
CO2	2	1	1	1	1	1	2	3	2	1	1	1	1	1	1	1
CO3	2	1	1	2	1	1	2	1	2	2	1	1	1	1	1	3
CO4	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	1
CO5	1	1	1	2	1	1	1	1	1	1	1	2	1	1	2	2
CO6	1	2	2	1	1	2	2	2	1	2	1	1	1	3	1	2

Course code	:	BMTS 506				
Course Name	:	Mathematical Statistics				
Semester /Year	:	Fifth/Third				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

To apply Statistics Methods for Mathematical Problems.

Course Contents

Unit 1

Concept of Sample Space - Events - Definition of Probability (Classical, Statistical and Axiomatic) - Addition and Multiplication laws of Probability - Independence of Events - Conditional Probability - Baye's Theorem - Simple Problems.

[No. of Hours:10]

Unit 2

Random Variables (Discrete and Continuous) - Distribution Function - Expectation and Moments - Moment Generating Function - Probability Generating Function - Cumulant Generating Function - Simple Problems. **[No. of Hours:10]**

Unit 3

Characteristic Function - Properties - Uniqueness and Inversion Theorem (Statement only) Chebychev's Inequality - Simple Problems. **[No. of Hours:10]**

Unit 4

Concept of Bivariate Distribution - Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression. **[No. of Hours:10]**

Text books:

TB1. S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan & sons

TB2. Hogg, R.V. &Craig.A.T.(1998) : Introduction to Mathematical Statistics, Macmillan

Reference Books:

RB1.   Mood. A.M. Graybill. F.A.&Boes.D.G.(1974) : Introduction to theory of Statistics, McGraw Hill.

RB2. Snedecor.G.W. &Cochran.W.G.(1967) : Statistical Methods, Oxford and IBH

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Knowledge of sample space, definition of probability etc.
CO2	Understand the distribution function, probability generating function etc.
CO3	Apply Bay's theorem in simple problems, Moment Generating Function etc
CO4	Classify the Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression.
CO5	Justify Uniqueness and Inversion Theorem, Chebychev's Inequality - Simple Problems, Conditional Probability - Baye's Theorem etc.
CO6	Solve the simple problems like Cumulate Generating Function, Conditional Probability etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1
CO3	2	2	1	2	1	1	1	2	1	1	2	1	2	1	1	1
CO4	2	2	3	2	1	2	2	1	1	2	1	3	1	1	1	2
CO5	1	1	1	2	1	1	2	1	1	2	1	2	1	1	2	1
CO6	1	1	1	1	3	1	1	2	1	1	1	2	1	1	2	2

Course code	:	**BMTD 601**				
Course Name	:	**Numerical Methods**				
Semester /Year	:	**Sixth/Third**				
			L	**T**	**P**	**C**
			6	**0**	**0**	**6**

Course Objectives: The objectives of this course are

Student will be able to solve problems regarding Bisection method, False position method, Fixed point iteration method. finite difference operators. forward difference, backward difference and central Difference. Integration: trapezoidal rule, Simpson's rule, Euler's method etc.

Course Contents

Unit 1
Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method.

[No. of Hours:15]

Unit 2
Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

[No. of Hours:15]

Unit 3
Lagrange and Newton interpolation: linear and higher order, finite difference operators.

[No. of Hours: 15]

Unit 4
Numerical differentiation: forward difference, backward difference and central Difference. Integration: trapezoidal rule, Simpson's rule, Euler's method.

[No. of Hours: 15]

Text Books:

TB1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.

Reference Books:

RB1. 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

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Describe numerical solutions of algebraic and transcendental equations.
CO2	Interpret the numerical solutions of system of linear equations and check the accuracy of the solutions.
CO3	Solve initial and boundary value problems in differential equations using numerical methods.
CO4	Apply various numerical methods in real life problems.
CO5	Evaluate Lagrange and Newton interpolation, Numerical differentiation etc.
CO6	Solve the problems of differences by trapezoidal rule, Simpson's rule, Eulers method and problems of Fixed point iteration method etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	1
CO4	1	2	1	1	2	1	1	1	1	1	1	1	1	2	1	1
CO5	1	1	1	3	2	1	1	1	1	1	1	1	2	2	1	1
CO6	2	1	2	1	2	1	2	1	2	1	1	3	1	1	2	2

Course code	:	BMTD 602				
Course Name	:	Complex Analysis				
Semester /Year	:	Sixth/Third				
			L	T	P	C
			6	0	0	6

Course Objectives: The objectives of this course are

Compute sums, products, quotients, conjugate, modulus, and argument of complex numbers ·
Define and analyse limits and continuity for complex functions as well as consequences of
continuity. Conceive the concepts of analytic functions and will be familiar with the
elementary complex functions and their properties ·

Course Contents

Unit 1
Limits, Limits involving the point at infinity, continuity. Properties of complex numbers,
regions in the complex plane, functions of complex variable, mappings. Derivatives,
differentiation formulas,

[No. of Hours:15]

Unit 2
Cauchy-Riemann equations, sufficient conditions for differentiability. Analytic functions,
examples of analytic functions, exponential function, Logarithmic function, trigonometric
function, derivatives of functions.

[No. of Hours: 15]

Unit 3
Definite integrals of functions. Contours, Contour integrals and its examples, upper bounds
for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula.

[No. of Hours: 15]

Unit 4
Liouville's theorem and Taylor and Laurent series, and its examples.

[No. of Hours: 15]

Text Books:

TB1. Liouville's theorem and Taylor and Laurent series, and its examples.

Reference Books:

RB1. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Identify the isolated singularities of a function and determine whether they are removable, poles, or essential.
CO2	Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.
CO3	Apply the concept and consequences of analyticity and the Cauchy-Riemann equations.
CO4	Analyze functions as Taylor, power and Laurent series, find residues and Evaluating complex integrals using the residue theorem.
CO5	Discriminate Analytic functions, exponential function, limits, Liouville's theorem and mappings etc.
CO6	Solve Limits, continuity, derivatives of functions , upper bounds , Taylor and Laurent series and its examples.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	2	1	1	2	1	1	2	1	1	1	2	1
CO2	1	1	1	1	2	1	1	1	2	1	3	1	1	1	2	2
CO3	1	1	2	1	2	2	1	1	1	2	1	1	1	3	2	1
CO4	1	1	2	1	1	1	2	1	2	2	1	1	1	2	1	1
CO5	2	1	1	2	1	1	1	1	1	1	1	2	1	1	2	1
CO6	1	1	1	3	1	2	1	2	1	1	1	2	2	1	1	1

Course code	:	**BMTD 603**				
Course Name	:	**Linear Programming**				
Semester /Year	:	**Sixth/Third**				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to solve Linear Programming Problems, Convex Sets, Supporting and Separating Hyperplanes. Formulation of the dual problem, primal- dual relationships, economic interpretation of the dual etc.

Course Contents

Unit 1
Linear Programming Problems, Graphical Approach for Solving some Linear Programs. Convex Sets, Supporting and Separating Hyperplanes.

[No. of Hours:10]

Unit 2
Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format.

[No. of Hours:10]

Unit 3
Introduction to artificial variables, two-phase method, Big-M method and their comparison.

[No. of Hours: 10]

Unit 4
Duality, formulation of the dual problem, primal- dual relationships, economic interpretation ofthe dual.

[No. of Hours: 10]

Text Books:

TB1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.

TB2. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 8th Ed., Tata McGraw Hill, Singapore, 2004.

Reference Books:

RB1. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.

Course outcomes (COs):
Upon successful completion of the course a student will be able to

CO1	Describe the linear programming problems.
CO2	Explain the two phase method, Big M method etc.
CO3	Apply in formulation of the dual problem.
CO4	Classify the simplex algorithm, simplex method in tableau format.
CO5	Distinguish two-phase method, Big-M method, dual problem, primal- dual relationships etc.
CO6	Solve Linear Programming Problems, simplex method, Duality etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	1	2	1	1	1	2	2	1	2	1	1	1
CO2	1	1	1	2	1	2	1	1	1	2	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1
CO4	2	1	2	1	1	1	1	2	2	1	1	1	1	2	2	2
CO5	2	1	1	1	2	1	3	1	1	1	3	2	1	1	2	1
CO6	1	1	1	2	1	1	2	2	2	1	1	1	1	1	1	2

Course code	: **BMTS 604**				
Course Name	: **Boolean Algebra**				
Semester /Year	: **Sixth/Third**				
		L	**T**	**P**	**C**
		4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to solve the problems of modular and distributive lattices, Boolean algebras, Boolean polynomials. sublattices, products and homomorphisms etc.

Course Contents

Unit 1
Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements.

[No. of Hours:10]

Unit 2
Lattices as ordered sets, complete lattices, lattices as algebraic structures, sublattices, products and homomorphisms.

[No. of Hours:10]

Unit 3
Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials.

[No. of Hours:10]

Unit 4
Minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.

[No. of Hours:10]

Text Books:

TB1.   . B A. Davey and H. A. Priestley, *Introduction to Lattices and Order,* Cambridge University Press,Cambridge, 1990.

Reference Books:

RB1. Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Definition of ordered sets, maximal and minimal elements.
CO2	Understand the minimal forms of Boolean polynomials.
CO3	Apply in switching circuits.
CO4	Compare Boolean algebra and Boolean polynomials.
CO5	Summarize Boolean polynomials, maximal and minimal elements.
CO6	Write properties of modular and distributive lattices, applications of switching circuits etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1	1	1	1	2	2	1	2	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	2	1	2	2	1	1	1	1
CO3	1	1	1	1	1	2	1	1	1	1	1	2	3	1	1	2
CO4	1	1	1	1	1	2	1	2	1	1	1	1	1	2	1	1
CO5	1	1	2	2	1	1	2	1	2	1	1	1	1	2	1	1
CO6	1	2	1	2	2	1	1	1	1	2	1	1	2	1	1	2

Course code	:	**BMTS 605**				
Course Name	:	**Transportation and Game Theory**				
Semester /Year	:	**Sixth/Third**				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to solve the transportation problem. Algorithmfor solving transportation problem, assignment problem and its mathematical formulation,Hungarian method. Game theory: formulation of two person zero sum games, solving two person zero sum games etc.

Course Contents

Unit 1
Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution.

[No. of Hours:10]

Unit 2
Algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

[No. of Hours: 10]

Unit 3
Game theory: formulation of two person zero sum games, solving two person zero sum games.

[No. of Hours: 10]

Unit 4
Games with mixed strategies, graphical solution procedure.

[No. of Hours:10]

Text Books:

TB1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and NetworkFlows, 2nd Ed., John Wiley and Sons, India, 2004.

TB2. F. S. Hillier and G. J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.

Reference Books:

RB1. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Define the transportation problems and its mathematical formulation.
CO2	Understand the formulation of two person zero sum games.
CO3	Use Hungarian method for solving assignment problem.
CO4	Compare the northwest – corner method, least cost method, vogel approximation method etc.
CO5	Evaluate Transportation problem and its mathematical formulation etc.
CO6	Solve Games with mixed strategies, two person zero sum games etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	2	1	1	1	1	1	2	1	2	1	1	1
CO2	1	1	1	1	2	1	1	1	1	2	1	1	2	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	3
CO4	1	2	2	2	1	2	2	1	1	3	1	1	1	2	2	2
CO5	1	1	1	1	1	1	1	2	2	1	2	2	1	2	1	1
CO6	2	1	1	1	2	2	2	1	1	2	1	1	1	1	2	1

Course code	:	BMTS 606				
Course Name	:	Graph Theory				
Semester /Year	:	Sixth/Third				
			L	**T**	**P**	**C**
			4	**0**	**0**	**4**

Course Objectives: The objectives of this course are

Student will be able to solve Eulerian circuits, Hamiltonian cycles, the adjacency matrix. Shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm etc.

Course Contents

Unit 1
Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partite graphs, isomorphism of graphs, paths and circuits.

[No. of Hours:10]

Unit 2
Eulerian circuits, Hamiltonian cycles, the adjacency matrix.

[No. of Hours:10]

Unit 3
Eulerian circuits, Hamiltonian cycles, the adjacency matrix.

[No. of Hours:10]

Unit 4
Shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm**.**

[No. of Hours: 10]

Text Books:

TB1. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory 2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.

Reference Books:
RB1. Rudolf Lidl and Günter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian Sreprint, 2004.

Course outcomes (COs):

Upon successful completion of the course a student will be able to

CO1	Identify vertices, edges and paths with specific properties such as cut vertices, bridges, Eulerian, etc.
CO2	Understand the concepts of Hamiltonian graphs and Planar graph.
CO3	Identify trees and their properties.
CO4	Illustrate the fundamental applications of Graph Theory in different walks of life.
CO5	Evaluate Shortest path, Eulerian circuits, Hamiltonian cycles etc
CO6	Solve the problems related to Dijkstra's algorithm, graphs, paths and circuits etc.

CO- PSO-PO Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	2
CO2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
CO3	1	2	2	1	2	1	1	1	1	1	1	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2	2	1	1	1	1
CO5	1	1	1	2	1	1	1	1	1	2	1	1	3	2	1	1
CO6	1	1	1	1	2	3	1	2	1	1	1	1	1	1	1	1