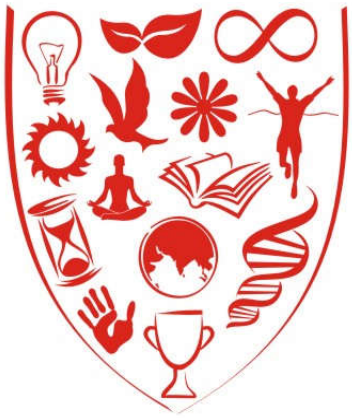

JECRC™
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Department of Mathematics

Course Structure and Syllabi

B.Sc. Mathematics (Major) course

Session 2020-23

Details of various subjects and their credits with contact hours are given below:

Semester I

S. No.	Subject Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA001D	Calculus-I	4	1	-	4	1		5	F
2.	BMA002D	Abstract Algebra-I	4	1	-	4	1		5	C
3.		Core 2 Minor	4	-	2	4		1	5	
4.		Core 3 Minor	4	-	2	4		1	5	
5.		Computer Applications	2	-	2	2		1	3	G
6.		Environment Studies	3	-	1*	3		1	4	C
									27	

***Field/Project Work and Report**

Semester II

S. No.	Subject Code	Subject	Lecture (Hr.)	Tutorials (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA003D	Calculus-II	3	1	-	3	1		4	F
2.	BMA004D	Abstract Algebra-II	4	1	-	4	1		5	C
3.	BMA005B	MATLAB I	-	-	2			1	1	S
4.		Core 2 Minor	4	-	2	4		1	5	
5.		Core 3 Minor	4	-	2	4		1	5	
6.		Computer Applications	-	-	2			1	1	G
7.		Communication Skills	3	-	-	3			3	F
									24	

Semester III

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA006C	Real Analysis -I	4	1	-	4	1		5	C
2.	BMA007C	Numerical Analysis	3	1	-	4			4	S
3.	BMA008B	MATLAB II	-	-	2			1	1	S
4.		Core 2 Minor	4	-	2	4		1	5	
5.		Core 3 Minor	4	-	2	4		1	5	
6.		Computer Applications	-	-	2			1	1	G
7.		Communication Skills	3	-	-	3			3	F
									24	

Semester IV

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA009C	Real Analysis -II	4	1	-	4	1		5	C
2.	BMA010B	Ordinary and Partial Differential Equations	4	1	-	4	1		5	S
3.		Core 2 Minor	4	-	2	4		1	5	
4.		Core 3 Minor	4	-	2	4		1	5	
5.		Computer Applications	2	-	2	2		1	3	G
6.		Communication Skills	3	-	-	3			3	F
									26	

Semester V

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA011C	Linear Algebra	4	1	-	4	1		5	C
2.	ELECTIVE (Any one of the following)*									
	BMA012C	Discrete and Combinatorial Mathematics	3	1	-	4			4	ID
	BMA017A	Statistics and Probability Theory	3	1	-	4			4	ID
3.	BMA013B	MATLAB III	-	-	2			1	1	S
4.		Core 2 Minor	4	-	2	4		1	5	
5.		Core 3 Minor	4	-	2	4		1	5	
6.		Communication Skills	3	-	-	3			3	F
7.		Value Education	3	-	-	3			3	G
									26	

Semester VI

S. No	Subject Code	Subject	Lecture (Hr.)	Tutorial (Hrs.)	Practical (Hrs.)	Credits			Total Credits	Paper Type
						L	T	P		
1.	BMA014B	Complex Analysis	4	1	-	4	1		5	C
2.	ELECTIVE (Any one of the following)*									
	BMA015C	Mechanics	4	1	-	4	1		5	ID
	BMA018A	Linear Programming and 3D Geometry	4	1	-	4	1		5	S
3.		Core 2 Minor	4	-	2	4		1	5	
4.		Core 3 Minor	4	-	2	4		1	5	
5.	BMA016B	Project		-	-				6	C
									26	

***** More Elective papers can be added subject to the availability of subject experts.

Semester-wise Distribution of Courses and Credits

Semester –I

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA001D	Calculus-I	**F**	5	4	1	0
2.	BMA002D	Abstract Algebra-I	**C**	5	4	1	0
			Total-10				

Semester –II

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA003D	Calculus-II	**F**	4	3	1	0
2.	BMA004D	Abstract Algebra-II	**C**	5	4	1	0
3.	BMA005B	MATLAB I	**S**	1	0	0	1
			Total-10				

Semester –III

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA006C	Real Analysis -I	**C**	5	4	1	0
2.	BMA007C	Numerical Analysis	**S**	4	3	1	0
3.	BMA008B	MATLAB II	S	1	0	0	1
			Total-10				

Semester –IV

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA009C	Real Analysis -II	**C**	5	4	1	0
2.	BMA010B	Ordinary and Partial Differential Equations	**S**	5	4	1	0
			Total-10				

Semester –V

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA011C	Linear Algebra	**C**	5	4	1	0
2.	**ELECTIVE (Any one of the following)***						
	BMA012C	Discrete and Combinatorial Mathematics	**ID**	4	3	1	0
	BMA017A	Statistics and Probability Theory	**ID**	4	3	1	0
3.	BMA013B	MATLAB III	**S**	1	0	0	1
			Total-10				

Semester –VI

S. No.	Course Code	Title	Paper Type	Credits	L	T	P
1.	BMA014B	Complex Analysis	**C**	5	4	1	0
2.	**ELECTIVE (Any one of the following)***						
	BMA015C	Mechanics	**ID**	5	4	1	0
	BMA018A	Linear Programming and 3D Geometry	**S**	5	4	1	0
3.	BMA016B	Project	**C**	6			

Total-16

Grand Total 66

C- Core
F- Foundation
S - Specialization
ID - Interdisciplinary

***** More Elective papers can be added subject to the availability of subject experts.

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Student can choose following subjects from "Swayam Portal" for fulfillment of their credits in the semester (depending upon the availability of the course on Swayam Portal).

1. **Partial Differential Equation**

Program Outcome (PO's)

Upon completion of B.Sc.(**Major**) Mathematics programme, students will be able to:

PO1.**Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.**Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. **Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO7. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio technological changes.

Program Specific Outcome: **B.Sc. (Major)** Mathematics programme

PSO1: The graduates will become successful professionals by demonstrating logical and analytical thinking abilities.(Professional Skills)

PSO2: The graduates will work and communicate effectively in inter-disciplinary environment, either independently or in a team, and demonstrate leadership qualities.(Problem-Solving Skills)

PSO3: The graduates will engage in life-long learning and professional development through self-study, continuing education or professional and doctoral level studies.(Successful Career and Entrepreneurship)

Semester –I

BMA001D	Calculus 1	Credits: 5:4+1

OBJECTIVE:

- To increase the student's appreciation of the basic role played by mathematics in Basic Sciences.
- To find curvature, radius of curvature, Centre of curvature and Chord of curvature.
- Use Calculus to compute quantities like Points of inflexion, Asymptotes.
- To develop the concepts of Partial differentiation, Chain rule of partial differentiation, Total Differentiation and applications of it as maxima and minima of two variables.
- To trace curves in Cartesian, parametric and polar co-ordinates.

UNIT 1	Derivative of the length of an arc. Pedal equations. Curvature – Various formulae, Centre of curvature and Chord of curvature.
UNIT 2	Tests for concavity and convexity, Points of inflexion. Asymptotes for Cartesian curves.
UNIT 3	Partial differentiation. Euler's theorem for homogeneous functions. Chain rule of partial differentiation. Total Differentiation. Differentiation of implicit functions.
UNIT 4	Envelopes and evolutes, Maxima and Minima of functions of two variables. Lagrange's method of undetermined multipliers.
UNIT 5	Multiple points, Cusps and their types, nodes and conjugate points. Tracing of curves in Cartesian, parametric and polar co-ordinates.

Recommended Books:

1. BANSAL , J L; AGARWAL, S M; BHARGAV, S L., Differential Calculus-
2. Jaipur publishing house, 1988.
3. Shanti Naryaan, Differential Calculus – (S. Chand & Co. Ltd.)
4. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd. Allahabad, 2000.
5. Maurice D. Weir and Joel Hass, Thomas Calculus, Pearson, 11th Edition, 2005.
6. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar Inc. New York 1975.
7. H. S. Dhami, Differential Calculus – (New Age International)
8. Courant & John, Differential & Integral Calculus (Vols. I & II).
9. N. Piskunov, Differential & Integral Calculus (Vol. I) – (CBS Publishers & Distributors)
10. J. Edwards, An elementary treatise on the Differential Calculus–(Radha Publishing House)
11. David V. Widder, Advanced Calculus – (Prentice Hall)

Course Outcomes

CO1 Understand the concepts of Calculus to compute quantities like derivative of the length of an arc, curvature, radius of curvature, Centre of curvature and Chord of curvature

CO2 Understand the concepts of concavity and convexity, Points of inflexion, Asymptotes.

CO3 Understand the functions of more than one independent variable and calculate partial derivatives along with their applications.

CO4 Will able to obtain an idea for Envelopes and evolutes, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

CO5 Understand tracing of curves in Cartesian, parametric and polar co-ordinates

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		M	H		M			L	M	H
CO2			L	M	H			M	M	H
CO3		L	L	M	H			L	L	M
CO4		M	M	L	H	L			M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

BMA002D	Abstract Algebra-I	Credits: 5:4+1

OBJECTIVE:

- To introduce Basic concept of Applications of Matrix and linear equations.
- Student will be able to the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
- Student will be study to concepts and the relationships between operations satisfying various properties (e.g. commutative property).
- To study concepts and properties of various algebraic structures.

UNIT 1	Matrix: Inverse of a matrix, Rank of a matrix, Application of matrices to the system of linear equations, Consistency of the system of linear equations.
UNIT 2	Definition and examples of groups including permutation groups and quaternion groups, elementary properties of groups. Subgroups and examples of subgroups.
UNIT 3	Centralizer, normalizer, center of a group, product of two subgroups. Properties of cyclic groups, classification of subgroups of cyclic groups.
UNIT 4	Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.
UNIT 5	External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Text Books

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.
2. D.T. Finkbeiner, Introduction to Matrices and Linear transformations, CBS Publishers, New Delhi, 1986.
3. K.B. Datta, Matrix and Linear Algebra, PHI Pvt. Ltd. New Delhi, 2000.
4. P. B. Bhattacharya, S. K. Jain, S. R. Nagpal, First Course in Linear Algebra, Wiley Eastern Ltd. New Delhi, 1983.
5. S. Singh, Modern Algebra, Vikas Publ. House, India

Reference Books:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.
2. S. D. Dummit and M. R. Foote: Abstract Algebra.
3. Sharma, Gokhroo, saini, Elements of Abstract Algebra, Jaipur Publishing House, S.M.S. Highway, Jaipur.
4 N. P. Chaudhuri, Abstract Algebra –(Tata Mc.Graw Hill).
5. A. R. Vasishtha, A. K. Vasishtha, Modern Algebra (Abstract Algebra), Krishna Prakashan Media (p) Ltd. 2011.

Course Outcomes

CO1:- Understand the Matrix, Type of Matrix and its Properties, Solution of Linear equations.
CO2:- Understand the fundamentals of the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
CO3:- Understand the cyclic group and its properties.
CO4:- Understand properties of Different Types of Groups and Normal Subgroup.
CO5:- Determine the Abelian Group and its applications.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L	H		M			L	M	H
CO2			L	M	H			M	M	H
CO3		L	L	M	H			L	L	M
CO4		M	M	L	H	L			M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

Semester –II

BMA003D	Calculus-II	Credits: 4:3+1

OBJECTIVE:

- To describe methods for solving Beta and Gamma Function
- To understand the Integral Problem formulation and solution method.
- Areas, Rectification, Volumes and Surfaces of solids of revolution.
- To understand vector calculus as derivation of vector or scalar point function, gradient, divergence and curl.
- This course introduces vector calculus and its applications, in both differential and integral forms.

UNIT 1	Beta, Gamma functions and their properties, Reduction formulae (simple standard formulae).
UNIT 2	Double integrals in Cartesian and Polar Coordinates, Change of order of integration. Triple integrals. Dirichlet's integral.
UNIT 3	Areas, Rectification, Volumes and Surfaces of solids of revolution.
UNIT 4	Scalar and Vector point functions. Differentiation and integration of vector point functions. Directional derivative. Differential operators. Gradient, Divergence and Curl.
UNIT 5	Line, Surface and Volume Integrals. Theorems of Gauss, Green, Stokes and problems based on these theorems.

Recommended Books:

1. Gorakh Prasad, A text book on Integral Calculus, Pothishala Pvt .Ltd , Allahabad.
2. Sharma & Jain, Integral Calculus, Galgotia Publication, Dariyaganj, NewDelhi.
3. Shanti Narayan, Integral Calculus, S.Chand and Co., New Delhi.
4. Shanti Narayan, A text book of Vector Calculus, S.Chand and Co. New Delhi
5. Ray and Sharma, Vector algebra &Calculus, Students and Friends Co. Agra
6. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and sons.
7. Muray R. Spiegel ,Vector Analysis, Schaum Publishing Company , New York.
8. Saran and Nigam , Introduction to Vector Analysis, Pothisala Pvt. Ltd, Allahabad
9. Shanti Narayan & P. K. Mittal, Integral Calculus – (S. Chand & Co. Ltd.)
10. H. S. Dhami, Integral Calculus – (New Age International)
11. B. C. Das & B. N. Mukherjee ,Integral Calculus – (U. N. Dhur)
12. BANSAL, J L; AGARWAL, S M; BHARGAV, S L., Integral Calculus II Jaipur, JAIPUR PUBLISHING HOUSE 1991.

Course Outcomes:

CO1:-Understanding the difference between Beta and Gamma Function.

CO2:-Understanding the basics concepts of Integral calculus, Double integrals, Triple integrals

CO3:-Understanding the basics concepts of Areas, Rectification, Volumes and Surfaces of solids of revolution.

CO4:-Understanding the various techniques of vector calculus as vector or scalar point function, gradient, divergence and curl.

CO5:-Apply Fundamental Theorem of Line, Surface and Volume Integrals to evaluate Green's Theorem, Stoke's Theorem, or Divergence Theorem.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L			M		M	L	M	H
CO2				M	H	L	L	M	M	H
CO3		L		M	H	M	L	L	L	M
CO4		H		L	H	L	M		M	M
CO5	H	M		M	M	H	M	M	L	H

H = Highly Related; M = Medium L = Low

BMA004D	Abstract Algebra-II	Credits: 5:4+1

OBJECTIVE:

- To understand the group theory.
- To teach students Finite groups, Commutator subgroups. Rings, Integral Domains and Fields. Ring
- To focus on properties of external direct products and Fundamental Theorem of finite abelian group.

UNIT 1	Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.
UNIT 2	Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideals, ideal generated by a subset of a ring, factor rings, operations on ideals.
UNIT 3	Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients. Prime and maximal ideals.
UNIT 4	Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.
UNIT 5	Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups.

Text Books:

1. D.S.Malik,J.N.Mordeson and M.K.Sen,Fundamentals of Abstract Algebra, McGraw-Hill International Edition 1977.

2. Sharma, Gokhroo, saini,Elements of Abstract Algebra, Jaipur Publishing House, S.M.S. Highway, Jaipur.

3. A. R. Vasishtha, A. K. Vasishtha, Modern Algebra (Abstract Algebra), Krishna Prakashan Media (p) Ltd. 2011.

Reference Books:

1. I. N. Herstein , Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.
2. D.T. Finkbeiner, Introduction to Matrices and Linear transformations, CBS Publishers,New Delhi, 1986.
3. K.B. Datta, Matrix and Linear Algebra, PHI Pvt. Ltd. New Delhi, 2000.
4. P.B. Bhattacharya, S.K.Jain , S.R. Nagpal, First Course in Linear Algebra, WileyEastern Ltd. New Delhi, 1983.
5. S. D. Dummit and M. R. Foote: Abstract Algebra.
6. P.B. Bhatacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2nd Edition)Cambridge University Press, Indian Edition, 1977.
7. Sharma, Gokhroo, saini,Elements of Abstract Algebra, Jaipur Publishing House, S.M.S. Highway, Jaipur.
8. N. P. Chaudhuri, Abstract Algebra –(Tata Mc.Graw Hill).

Course Outcomes:

CO1:-Understand the basic concept of Group homomorphisms, properties of homomorphisms

CO2:-Understand the Definition and examples of rings, properties of rings, subrings,Ideals and operations on ideals .

CO3:-Understand Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients. Prime and maximal ideals.

CO4:-Determine Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups and its applications.

CO5:-Understand the Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L	L		M			M	M	H
CO2			M	M	L			L	L	H
CO3		L	M	H	H					M
CO4		M		L	M	L			M	H
CO5	H	M	M	M	L		M	H	H	L

H = Highly Related; M = Medium L = Low

BMA005B	MATLAB I	Credit(s): 1

Course objective:

- The aim of this lab is to introduce you to the software MATLAB for numerical computations and in particular familiarizing yourself with the Matlab Desktop, basic commands through the Command window and output through the Graph window.

Exercises Based on MATLAB and Mathematica.

Following topics given below will be taken up using Matlab and Mathematical Software's.

1. Centre of gravity by integration: C.G of plane area, arc, surface and solid of revolution.

2. Solving Differential Equations obtained in planetary motions and Simple Harmonic Motions.

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

COURSE OUTCOMES: At the end of the lab, the student should be able to:

CO1: Determine the centre gravity of plane area.
CO2: Determine the centre gravity of plane surface area.
CO3: Determine the centre gravity of solids.
CO4: Solution of differential equations in case of planetary motion.
CO5: Solution of differential equations in case of simple Harmonic motion.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		M	H		M			L	M	H
CO2			L		H			M	M	L
CO3		L	L	M				L	L	M
CO4		M	M	L		L	M	M	M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

Semester –III

BMA006C	Real Analysis-I	Credits: 5: 4+1

OBJECTIVE:

- To define the real numbers, least upper bounds, and the triangle inequality.
- To recognize convergent, divergent, bounded, Cauchy and monotone sequences.
- Calculate the limit superior, limit inferior, and the limit of a sequence.
- Recognize alternating, convergent, conditionally and absolutely convergent series.
- To determine the continuity, differentiability, and integrability of functions defined on subsets of the real line
- To understand the Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis

UNIT 1	Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R, The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals. Limit points of set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.
UNIT 2	Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.
UNIT 3	Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.
UNIT 4	Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem. Differentiability of a function at a point & in an interval, Carathéodory's theorem, algebra of differentiable functions.
UNIT 5	Relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorem, intermediate value property of derivatives - Darboux's theorem. Applications of mean value theorem to inequalities & approximation of polynomials Taylor's theorem to inequalities. Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series & Maclaurin's series expansions of exponential & trigonometric functions

Text Books:

1. Shanti Narayan, A Course of Mathematical Analysis. S. Chand & Co. New Delhi, 2004.
2. Walter Rudin, Principle of Mathematical Analysis (3rd edition) McGraw-Hill Kogakusha, International Student Edition,1976.

Reference Books:

1. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis (3rd edition), John Wiley and Sons (Asia) Pvt. Ltd.., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition),2011.
4. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, Second Edition 2011.
5. G. F. Simmons, Introduction to Topology and Modern Analysis, Mcgraw-Hill, Edition 2004.

Course Outcomes

After the completion of the course, Students will be able to

CO1 Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
CO2 Comprehend rigorous arguments developing the theory underpinning real analysis.
CO3 Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.
CO4 Determine the continuity, differentiability, and integrability of functions.
CO5 Will be able to applythe Mean Value Theorem and the Fundamental Theorem of Calculus to problems in the context of real analysis

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M		L	L		L	M	M	M	L
CO2	M		L	L		L	M	L	M	M
CO3	M		L	L		L	M	M	M	M
CO4	M		L	L		L	M	H	M	M
CO5	M		L	L		L	M	M	M	M

H = Highly Related; M = Medium L = Low

BMA007C	Numerical Analysis	Credits: 4: 3+1

OBJECTIVE:

- Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science.
- Such methods include techniques for simple optimisation, interpolation from the known to the unknown, linear algebra underlying systems of equations, Integrals, ordinary differential equations to simulate systems, and stochastic simulation under random influences.

UNIT 1	Differences, Relation between differences and derivatives of polynomials, Factorial notation, Newton's forward and backward interpolation formula (including proof), Inverse Interpolation.
UNIT 2	Divided differences: Newton's and Lagrange's divided differences formulae. Central differences: Gauss's, Stirling's and Bessel's interpolation formulae, Numerical differentiation.
UNIT 3	Numerical integration: Quadrature formula, Trapezoidal rule, Simpson's 1/3 rd and 3/8 th formulae, Gaussian Integration , Newton cotes formula.
UNIT 4	Numerical solution of algebraic and transcendental equations- Bisection method, Regula-falsi method, Method of iteration and Newton Raphson's Method, Newton's iterative formula for obtaining square and inverse square root.
UNIT 5	Solution of system of linear equations: Gauss elimination method, Jacobi and Gauss Seidal method. Solutions of ordinary differential equations with initial boundary conditions: Picard's method, Euler's and modified Euler's method, Runge's Kutta Method.

Text Book:

1. Gupta and Malik, Calculus of Finite Differences and Numerical Analysis, Krishna Prakashan Mandir.

References Books:

1. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, 1999.
2. C.F. Gerald, P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.
3. S. D. Conte, C de Boor, Elementary Numerical Analysis, McGraw-Hill, 1980.
4. C.E. Froberg, Introduction to Numerical Analysis, (Second Edition), Addition-Wesley,1979.
5. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan Publishing Co. Inc. New York, 1982.

Course Outcomes:

CO1. To be familiar with the finite differences for interpolation, differentiation, etc.

CO2: Find the Lagrange Interpolation Polynomial for any given set of points. Use Unequal Interpolation

CO3: Apply several methods of numerical integration, including Romberg integration.

CO4: Find numerical approximations to the roots of an equation by Newton method, Bisection Method, Secant Method, etc.

CO5: Find numerical solution of a differential equation by Euler's, Modified Euler's, Predictor Corrector and Runge Kutta fourth order Methods.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	L	L	L	M	L	H	H	M	H
CO2	H	M	M	L	L	L	H	H	M	H
CO3	H	M	M	L	M	L	H	H	H	M
CO4	H	M	M	L	M	L	H	H	M	H
CO5	H	M	M	L	L	L	H	H	H	M

H = Highly Related; M = Medium L = Low

BMA008B	MATLAB-II	Credit(s): 01

OBJECTIVE:

- To understand the basic concept of Matlab.
- To understand Numerical integration.
- To develop programs for Differentiation and Integration of Vector point functions.
- To develop programs for 2-D and 3-Dgraphicsfor Spheres, Cone, Cylinder

Following topics given below will be taken up using Matlab and Mathematica Softwares.

1. Numerical integration

2. Finding Area and Volume using Integration

3. Differentiation and Integration of Vector point functions.

4. 2-D and 3-Dgraphics. (Spheres, Cone, Cylinder)

(MATLAB - High performance numeric computation and visualization software. MATHEMATICA-Stephen Wolfram.)

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

COURSE OUTCOMES:

CO1: Understanding the basic concepts of Matlab.
CO2: Understanding the Area using integration.
CO3: Understanding to find volume using integration.
CO4: 2-D graph formation.
CO5: 3-D graph formation.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		M	H		M			L	M	H
CO2			L		H			M	M	L
CO3		L	L	M				L	L	M
CO4		M	M	L		L	M	M	M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

Semester IV

BMA009C	Real Analysis-II	Credits-5: 4+1

OBJECTIVE:

- To determine the Riemann integrability of a bounded function
- To understand the convergence of improper integrals
- To illustrate the effect of uniform convergence on the limit function
- To Calculate the limit superior, limit inferior, and the limit of a sequence.
- To understand the basic theory of Metric space.

UNIT 1	Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.
UNIT 2	Convergence of improper integrals. Comparison tests, Abel's and Dirichlet's tests. Convergence of Beta and Gamma functions. Functions of bounded variations. Introduction, properties of functions of bounded variations, total variation.
UNIT 3	Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.
UNIT 4	Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.
UNIT 5	Metric space – Definition and examples, Open and Closed sets, Interior and Closure of a set, Limit point of a set in metric space. Subspace of metric space.

Text Books:

1. Shanti Narayan, A Course of Mathematical Analysis. S. Chand & Co. New Delhi, 2004.
2. Walter Rudin, Principle of Mathematical Analysis (3rd edition) McGraw-Hill Kogakusha, International Student Edition,1976.

Reference Books:

1. K.A. Ross, Elementary Analysis: The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
2. R.G. Bartle D.R. Sherbert, Introduction to Real Analysis (3rd edition), John Wiley and Sons (Asia) Pvt. Ltd.., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition), 2011.
4. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, Second Edition 2011.
5. G. F. Simmons, Introduction to Topology and Modern Analysis, Mcgraw-Hill, Edition 2004.

Course Outcomes

After the completion of the course, Students will be able to

CO1 To determine the Riemann integrability of a bounded function and prove a selection of theorems concerning integration

CO2 Develop the concept of the convergence of improper integrals.

CO3 Explain the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.

CO4 To Calculate the limit superior, limit inferior, and the limit of a sequence.

CO5 To understand Subspace of a Metric space and separable metric space.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	M	H		H		L	M	L	H
CO2	H	M	M	M	H			M	H	M
CO3	M	M	L	M	H	L		M	L	M
CO4	H	M	M	L	L			M	L	M
CO5	H	H	M	M	L	L		H	L	M

H = Highly Related; M = Medium L = Low

BMA010B	Ordinary and Partial Differential Equations	Credits: 5: 4+1

OBJECTIVE:

- To understand the concepts relating to the order and linearity of ODEs and PDEs, analytic and computational solution methods for ODEs and PDEs, and the real-world applications of ODEs.
- To teach students the formation of partial differential equations and types of solutions. PDEs of the first order.
- To expose students to the Classification of linear partial differential equation of second order.

UNIT 1	Ordinary differential equations of the first order and first degree of the form y'=f(x,y): initial and boundary conditions, Bernoulli's equation, exact differential equations, integrating factor, Orthogonal trajectories, Homogeneous differential equations-separable solutions.
UNIT 2	Linear differential equations of second and higher order with constant coefficients, First order higher degree equations solvable for x, y, p. Singular solution and envelopes.
UNIT 3	Second order linear differential equations with variable coefficients, homogeneous linear differential equations, method of variation of parameters. Cauchy- Euler equation.
UNIT 4	Formation of partial differential equations. Types of solutions. PDEs of the first order. Lagrange's solution, Non-linear PDE of first order: Charpit's method.
UNIT 5	Classification of linear partial differential equation of second order, Canonical forms, Cauchy's problem of first and second order partial differential equation. Partial differential equations of first order, Lagrange's solution. Charpit's method.

Recommended Books:

1. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. Allahabad.
2. S. Balachandra Rao & H.R. Anuradha, Differential Equations with Applications and Programmes, University Press, Hyderabad, 1996.
3. R.S. Senger, Ordinary Differential Equations with Integration, Prayal Publ. 2000.
4. D.A. Murray, Introductory Course in Differential Equations, Orient Longman (India),1967.
5. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall ofIndia, 1961.
6. B.Rai, D.P.Choudhary,Ordinary Differential Equations, Narosa Publ. 2004.
7. J.L. Bansal & H.S. Dhami : Differential Equations Vol. I & II, Jaipur House,Jaipur.
8. S. Balachandra Rao & H.R. Anuradha, Differential Equations with Applications and Programmes, University Press, Hyderabad, 1996.
9. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company, 1988.

Course Outcomes

CO1:- Determine solutions to first order differential equations

CO2:- Determine solutions to second order linear homogeneous and non-homogeneous differential equations with constant coefficients.

CO3:- Determine solutions to second order linear homogeneous and non-homogeneous differential equations with variable coefficients.

CO4:- To understand the fundamentals of the Formation of partial differential equations. Types of solutions. PDEs of the first order.

CO5:- To understand the classification and solution of linear partial differential equation of second order. Solution of partial differential equations of first order by Lagrange's solution and Charpit's method

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		L	H		M			L	M	H
CO2			L	M	H			M	M	
CO3		L	L	M	H			L	L	M
CO4		M	M	L	H	L			M	
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = Low

Semester –V

BMA011C	Linear Algebra	Credits: 5: 4+1

OBJECTIVE:

- To understand the basic theory of linear algebra.
- To understand the basic theory of vector space.
- To understand linear transformation and dual space.
- To develop an understanding of Cauchy-Schwarz inequality, orthogonal vectors. Orthonormal basis, Bessel's inequality.

UNIT 1	Vector spaces, subspaces and linear spans, linear dependence and independence.
UNIT 2	Finite dimensional vector spaces. Linear transformations and their matrix representations
UNIT 3	Algebra of linear transformations, the rank and nullity theorem. Change of basis.
UNIT 4	Dual spaces, bi dualspace and natural isomorphism. Eigen values and Eigen vectors of LT. Diagonalization, Cayley Hamilton theorem..
UNIT 5	Inner product spaces, Cauchy-Schwarz inequality, orthogonal vectors. Orthonormal basis, Bessel's inequality, Gram-Schmidt orthogonalization process.

Recommended Books:

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition, Prentice-Hall of India, NewDelhi, 1971.
2. K.B. Dutta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd, New Delhi,2000.
3. David C. Lay, Linear Algebra and Its Applications, 4th Edition (Jan 20, 2011).
4. Georgi E. Shilov, Linear Algebra (Dover Books on Mathematics) (Jun 1, 1977).
5. Rajul Dutt, A. R. Vasishtha, J.N. Sharma, A. K. Vasishtha, Linear Algebra, Krishna Prakashan Media (p) Ltd., 2011.

Course Outcomes

CO1:-Understanding the basic concepts of Vector spaces, subspaces and linear spans, linear dependence and independence

CO2:-Understanding the basics concepts of Finite dimensional vector spaces, Linear transformations and their matrix representations.

CO3:-Understanding the basics concepts of Algebra of linear transformations, the rank and nullity theorem. Change of basis.

CO4:-Dual spaces, bi dualspace and natural isomorphism, eigen values and eigen vectors of LT. Diagonalization, CayleyHamilton theorem.

CO5:-Developing the ability to understand the Cauchy-Schwarz inequality, orthogonal vectors, Orthonormal basis,Bessel's inequality, Gram-Schmidt orthogonalization process

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M		L	L		L	M	L	M	L
CO2	M	L	L	L	L	M	M	M	M	L
CO3	L		M	L		L	M	L	H	M
CO4	M		L	L	M	L	M		M	L
CO5	M		L	L		L	M	M	M	H

H = Highly Related; M = Medium L = Low

BMA0012C	Discrete and Combinatorial Mathematics	Credits: 4: 3+1

OBJECTIVE:

- To introduce students to Basic concept of Discrete Mathematics.
- To focus on basic mathematical concepts in combinatorics.
- To focus on mathematical concepts in graph theory and trees.

UNIT 1	Proposition, Compound Proposition, Conjunction, Disjunction, Implication, Converse, Inverse & Contrpositive, Biconditional Statements, tautology, Contradiction & Contingency, Logical Equivalences, Quantifiers, Arguments, Boolean Algebra, Application of Boolean algebra to switching circuits(using AND, OR and NOT gates).
UNIT 2	Mathematical inductions-Strong induction and well ordering. The basics of counting Permutations, Combination, Pigeon-hole Principle, inclusion-exclusion principle, Recurrence relations-Solving, Linear recurrence relations-generating functions, derangements, Fundamental theorem of arithmetic.
UNIT 3	Graphs and Planar Graphs: Graph, Multigraph, Weighted Graphs, Directed graphs. Paths and circuits.
UNIT 4	Matrix representation of graphs. Eulerian Paths and Circuits. Planar graphs.
UNIT 5	Trees and their properties-Trees as graphs-spanning trees-Directed trees-Binary trees-Their traversals-Arithmetic and Boolean expressions as trees-height balanced trees.

Text Books:

1. Kenneth H Rosen, Discrete Mathematics and its applications with combinatorics and graph theory by (7th Edition), Tata McGraw-Hill Education private Limited, 2011.

Reference Books:

1. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, 1986.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 199
3. S. Wiitala, Discrete Mathematics: A Unified Approach, McGraw-Hill Book Co.
4. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India
5. B. Bollobas: Graph Theory (Chapters I - III).
6. P. J. Cameron and J.H. Van Lint: Graphs, codes and designs.
7. Edgar G. Goodaire, Michael M. Parameter, Discrete Mathematics with Graph Theory (3rd Edition), Pearson, 2005

Course Outcomes

CO1:- Understand the notion of mathematical logics and mathematical proofs to apply them in problem solving.

CO2:- Understand the fundamentals of combinatorics and counting principles.

CO3:- Understand basic properties of graphs and related discrete structures, and relate these to practical examples.

CO4:- Determine if a graph has an Euler or a Hamilton path or circuit. To understand various problems related with planar graphs.

CO5:- Demonstrate different traversal methods for trees and to find shortest paths on google maps etc.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	L	L	L	M	L	M	H	M	H
CO2	L		M	L	L	L	H	L	L	H
CO3	H	M	M	H			M	H	H	M
CO4	H	M		L	M	L		H	M	H
CO5	H	M	M		L		H	H	H	L

H = Highly Related; M = Medium L = Low

BMA017A	Statistics and Probability Theory	Credits: 4: 3+1

OBJECTIVE:

- To understand the Basic requirement of statistics to society
- To describe methods of Probability Theory and Distributions.
- To develop an understanding tools of statistics.

UNIT 1	Basics of probability: Random experiment, sample space, axiomatic definition of probability, elementary properties of probability, equally likely outcome problems. Conditional probability and Baye's theorem.
UNIT 2	Random Variables: Concept, cumulative distribution function, discrete and continuous random variables, Mathematical expectations and conditional expectations mean, variance, moment generating function. Independence of Random variables ,computing expectation by conditioning; some applications - a list model, a random graph, Polya's urn model.
UNIT 3	Bivariate random variables: Joint distribution, joint and conditional distributions, correlation coefficient. Discrete Probability Distributions: Bernoulli, Binomial, geometric and Poisson distributions.
UNIT 4	Continuous Probability Distribution: Uniform, exponential, Gamma, normal Distribution.
UNIT 5	Functions of random variables: Sum of random variables, the law of large numbers and central limit theorem, the approximation of distributions. Uncertainty, information and entropy, conditional entropy, solution of certain logical problems by calculating information.

Text Books:

1. S.C. Gupta & V. K. Kapoor: Fundamental of Mathematical Statistics. Sultan Chand & Sons. First edition.
2. Yaglom, A. M.; Yaglom, I. M. In Probability and information; Hindustan Publishing Corporation: India

Reference Books:

1. Goon A. M., Gupta M. K., Dasgupta B. Fundamentals of Statistics, Volume I, The World Press Private Limited, Calcutta. Fifth edition.
2. Allan Bluman (2009) Introductory Statistics. A step by step approach (7th edition). McGraw-Hill
3. Meyer, P.: Introductory Probability and Statistical Applications. Addison Wesley
4. Stirzekar David (1994): Elementary Probability, Cambridge University Press.
5. Mukhopadhyay, P: Mathematical Statistics, New Central Book Agency.
6. Bratteli, O.; Robinson, D.W. In Operator algebras and quantum statistical mechanics 2 ;
7. Springer Verlag: New York, 1981.
8. Prem. S. Mann (2007). Introductory Statistics (6th edition) John Wiley & Sons.

Course Outcomes:

CO1:-Understanding the basic concepts about probability.
CO2:-Understanding the basics of Random variable and Mathematical Expectations.
CO3:-Understanding the basics of Discrete and Continuous Probability distribution.
CO4:-Understanding the basic concepts about law of large numbers and quantum statistics.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M	M	L	M	M	M	H	M	M	H
CO2	H	M	L	L	M	L	H	M	M	H
CO3	M	M	M	L	L	L	H	H	H	M
CO4	M	H	M	L	L	L	H	H	M	M

H = Highly Related; M = Medium L = Low

BMA013B	MATLAB-III	Credits: 1

OBJECTIVE:

- To understand the basic theory of stereographic projection.
- To understand linear transformation, contours, line integrals, Cauchy-Goursattheorem (without proof), Cauchy integral formula.
- To develop an understanding of Convergence of sequences and series, Residues, the residue theorem, the principle part of a function, poles, evaluation of improper real integrals, improper integrals.

Following topics given below will be taken up using Matlab and Mathematica Softwares.

1. Numerical differentiation

2. Numerical Integration

3. Solving simultaneous equations of more than three variables

Suggested Books

1. MATLAB (An Introduction with Application): Amos Gilat, Wiley India.
2. Getting Started with MATLAB: Rudra Pratap, Oxford University Press.
3. A Concise Introduction to MATLAB: William J. Palm III, Tata McGraw Hill Education Private Limited.

Course Outcome

CO1:- Understanding the basic concept of matlab.
CO2:- Understanding the basic commands of matlab.
CO3:- Understanding Numerical differentiation.
CO4:- Understanding Numerical integration.
CO5:- Understanding the programme for solution of simultaneous linear differential equations.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	M		L	L		L	H	M	M	L
CO2	M	L	L	M		L	M	L	L	M
CO3	M		M	L		L	M	M		
CO4	M	L	L	M	L	L	L	L	M	L
CO5	M		L	L		L	M	M	H	M

H = Highly Related; M = Medium L = Low

Semester –VI

BMA014B	Complex Analysis	Credits: 5: 4+1

OBJECTIVE:

- To understand the basic theory of stereographic projection.
- To understand linear transformation, contours, line integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula.
- To develop an understanding of Convergence of sequences and series, Residues, the residue theorem, the principle part of a function, poles, evaluation of improper real integrals, improper integrals.

UNIT 1	Complex Numbers**:** Stereographic projection. Functions of a complex variable, mappings, limits, theorems of limits without proof, continuity, derivatives, differentiation formula, Cauchy-Riemann equations, sufficient conditions, Cauchy-Riemann equations in Polar form, analytic functions, and harmonic functions.
UNIT 2	Conformal mapping, Bi-linear transformation, Linear functions, the function 1/Z, linear fractional transformations, the functions $w = z^n$, $w = \exp(Z)$, special linear fractional transformations.
UNIT 3	Definite integrals, contours, line integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula, derivatives of analytic functions, maximum modulo of functions.
UNIT 4	Convergence of sequences and series (theorems without proofs), Taylor's series, Laurent's series, zero's of analytic functions.
UNIT 5	Residues, the residue theorem, the principle part of a function, poles, evaluation of improper real integrals, improper integrals. integrals involving trigonometric function, definite integrals of trigonometric functions.

Recommended Books:

1. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co. New Delhi.
2. R.V. Churchil & J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990.
3. Mark J., Ablowitz & A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University Press. South Asian Edition, 1998.
4. Murray, R. Spiegel, Theory and Problems of Complex Variables-Schaum outline series, 2004.

Course Outcomes

CO1:-Understanding the basic concepts of Understanding the basic theory of stereographic projection.

CO2:-Understanding linear transformation, contours, line integrals, Cauchy-Goursattheorem, Cauchy integral formula.

CO3:-Understanding the various fundamental aspects of Convergence of sequences and series (theorems without proofs), Taylor's series, Laurent's series, zero's of analytic functions

CO4:-Understanding the concept of Convergence of sequences and series, Residues, the residue theorem, the principle part of a function, poles, improper real integrals, and improper integrals.

CO5:-Developing the ability to understand Residues, the residue theorem, the principle part of a function, poles, evaluation of improper real integrals, improper integrals, definite integrals of trigonometric functions

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H		L		H	L	M	M	M	L
CO2	M	L	L	M			H	L	L	M
CO3	L		M	L	M	M	M	M	M	
CO4	M		L	H		L		H		M
CO5		H	L		L	L	M	M	M	H

H = Highly Related; M = Medium L = Low

BMA015C	Mechanics	Credits: 5: 4+1

OBJECTIVE:

- Introduce rigorous kinematical analysis of particles and rigid bodies .
- Discuss creation of equations of motion for particles and rigid bodies in planar motion.
- Discuss orbital mechanics and general momentum conservation problems
- Introduce energy-based approaches to determining system motion
- Students will demonstrate that they can calculate the principal coordinates and the principal moments of inertia for arbitrary rigid bodies.

UNIT 1	Velocity and acceleration along radial and transverse directions, along tangential and normal directions. S.H.M., Hooke's law, motion along horizontal and vertical elastic strings.
UNIT 2	Motion in resisting medium—Resistance varies as velocity and square of velocity. Work and Energy. Motion on a smooth curve in a vertical plane. Motion on the inside and outside of a smooth vertical circle.
UNIT 3	Central orbits-p-r equations, Apses, Time in an orbit, Kepler's laws of planetary motion.
UNIT 4	Moment of inertia of rods, Circular rings, Circular disks, Solid and Hollow spheres, Rectangular lamina, Ellipse and Triangle. Theorem of parallel axis. Product of inertia.
UNIT 5	Virtual work, Lagrange's Equation of holonomic system, Hamiltonian equation.

Suggested Books

1. S.L. Loney - An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Kalyani Publishers, New Delhi, 2004.
2. J. L. Synge & B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill, 1959.
3. Ray, M., Dynamics of Rigid Bodies, Students Friends and Co. 1998.
4. Bansal, J. L., Dynamics of a Rigid Body, Jaipur Publishing Co., 2004.

COURSE OUTCOMES: At the end of the course, the student should be able to:

CO1: Determine the component of velocity and acceleration in different coordinate systems.Also able to explain Simple Harmonic Motion and motion along horizontal andvertical elastic strings.
CO2: Understand motion in resisting medium and motion on a smooth curve in vertical plane. Work and Energy.
CO3: Explain orbital motion and Kepler's laws of planetary motion.
CO4: Demonstrate that they can calculate the principal coordinates and the principal moments of inertia for arbitrary rigid bodies, theorem of parallel axis and product of inertia.
CO5: Understand the Virtual Work and Lagrange's Equation of holonomic system, Hamiltonian equation.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		M	H		M			L	M	H
CO2			L	M	H			M	M	H
CO3		L	L	M	H			L	L	M
CO4		M	M	L	H	L			M	M
CO5	H	H	M	M	L		L	M	L	H

H = Highly Related; M = Medium L = L

BMA018A	Linear Programming Problems and 3D Geometry	Credits: 5: 4+1

OBJECTIVE:

- To introduce students to Basic concept of Linear Programming Problems and 3D Geometry
- To focus on basic mathematical concepts in LP & 3D.
- To focus on real problem solution of problems based on LP & 3D.

UNIT 1	Linear Programming problem, formulation, Graphical method. Simplex method and Duality. Transportation and Assignment Problems.
UNIT 2	**Plane:** Definition, direction cosine and direction ratios, Equation of a plane, Angle between two planes, planes through two planes, Distance of a point from a plane, Area of a triangle, Volume of Tetrahedron.
UNIT 3	**Straight lines:** Introduction, Equations of coordinate axes, Symmetrical form & Non Symmetrical form, Angle between a line and a plane, Perpendicular distance, Intersecting lines, Skew lines, Shortest distance and equation of line of shortest distance, Intersection of three planes.
UNIT 4	**Sphere:** Definition, Equation of a sphere, General equation of a sphere, Centre and radius of a sphere, Great circle, Equation of circle, Diameter form of the equation of a sphere, Tangent line and tangent plane of a sphere, Condition of tangency for a line and equation of tangent plane, Angle of intersection of two spheres, Condition of orthogonality of two spheres.
UNIT 5	**Cone:** Cone, Quadratic Cone, Equation of a cone, Enveloping cone, Condition for general equation of second degree to represent a cone, Intersection with a line, Tangent plane, Reciprocal Cone, Right Circular Cone. **Cylinder:** Definition, Equation of a cylinder, Enveloping cylinder, Equation of enveloping cylinder, Right circular cylinder, Equation of right circular cylinder.

Text Books:

1. G. Hadley, Linear Programming, Narosa Publishing House, 1995.
2. S.I. Gass, Linear Programming: Methods and Applications (4th edition) McGraw-Hill,New York, 1975.
3. KantiSwaroop, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi, 1998.
4. Hamdy A. Taha, Operations Research, Prentice-Hall of India, 1997.
5. Sharma S. D., Operations Research : Theory, Methods & Applications, KEDAR NATH RAM NATH-MEERUT, 2011.
6. N.Saran and R.S.Gupta , Analytical Geometry of Three Dimensions , PothisalaPvt.Ltd , Allahabad, 2001.
7. Gorakh Prasad and H.C.Gupta ,Text book on Coordinate Geometry , Pothisala Pvt. Ltd., Allahabad, 2004.
8. Sharma & Jain, Co-ordinate Geometry, Galgotia Publication, Dariyaganj , New Delhi, 1998.

Reference Books:

1. P.K.Jain and Khalil Ahmad , A text book of Analytical Geometry of Three Dimensions , Wiley Eastern Ltd, 2008.
2. S.L.Loney, The Elements of Coordinate Geometry , Macmillan and Co., London, 2001.
3. R.J.T.Bell, Elementary Treatise on Coordinate Geometry of Three Dimensions, Macmillan

India Ltd, 1998.
4. Bansal J.L., Bhargva S.L., Agarwal S.M., 3-D Coordinate Geometry II, Jaipur Publishing House 2004.
5. Susan J. Colley, Vector Calculus (4th Edition) (Featured Titles for Vector Calculus)Pearson; 4 edition (October 8, 2011) (Oct 8, 2011).
6. Susan J. Colley, Vector Calculus (3rd Edition) Pearson; 3 edition (March 26, 2005) (Mar 26, 2005)
9. J N Sharma, Vector Calculus, Krishna Prakashan Media.

Course Outcomes

CO1:- Understand the concept and uses of LPP, Assignment problems, and Transportation problems.
CO2:- Understand the concept of plane.
CO3:- Understand basic concepts and properties of straight line.
CO4:- Understand the concept of sphere.
CO5:- Understand basic concepts of cone.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome							Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	H	L		L	M	L	M	H	M	H
CO2	L	L	M		L	L	H	M	L	
CO3	H	M	M	H		H		H	H	M
CO4	H	M		L	M	L	M	H		H
CO5	H	M	L	M	L		H	H	H	L

H = Highly Related; M = Medium L = Low

BMA016B : Project
Credits : 6