FOURTH YEAR UNDER GRADUATE PROGRAM(NEP–2020)

Program: Bachelor of Science (2024-28)

DISCIPLINE– MATHEMATICS

Session–2024- 25

DSC -01 to08		DSE-01to12		DGE-01&02	
Code	**Title**	**Code**	**Title**	**Code**	**Title**
MASC-01	Elementary Calculus	MASE-01	Advanced Calculus	MAGE-01	Elementary Calculus
MASC-02	Algebra	MASE-02	Mechanics	MAGE-02	Algebra
MASC-03	Differential Equations	MASE-03	Numerical Methods		
MASC-04	Abstract Algebra	MASE-04	Number Theory	SEC	
MASC-05	Real Analysis	MASE-05	Integral Transforms	MASEC-01	Introduction to Latex
MASC-06	Metric Spaces	MASE-06	Topology	MASEC-02	Python
MASC-07	Advanced Real Analysis	MASE-07	Complex Analysis - I		
MASC-08	Advanced Abstract Algebra	MASE-08	Discrete Mathematics	VAC	
		MASE-09	Measure Theory	MAVAC-01	Basic Mathematics and Logic
		MASE-10	General and Algebraic Topology		
		MASE-11	Complex Analysis - II		
		MASE-12	Graph Theory		

Program Outcomes(PO):

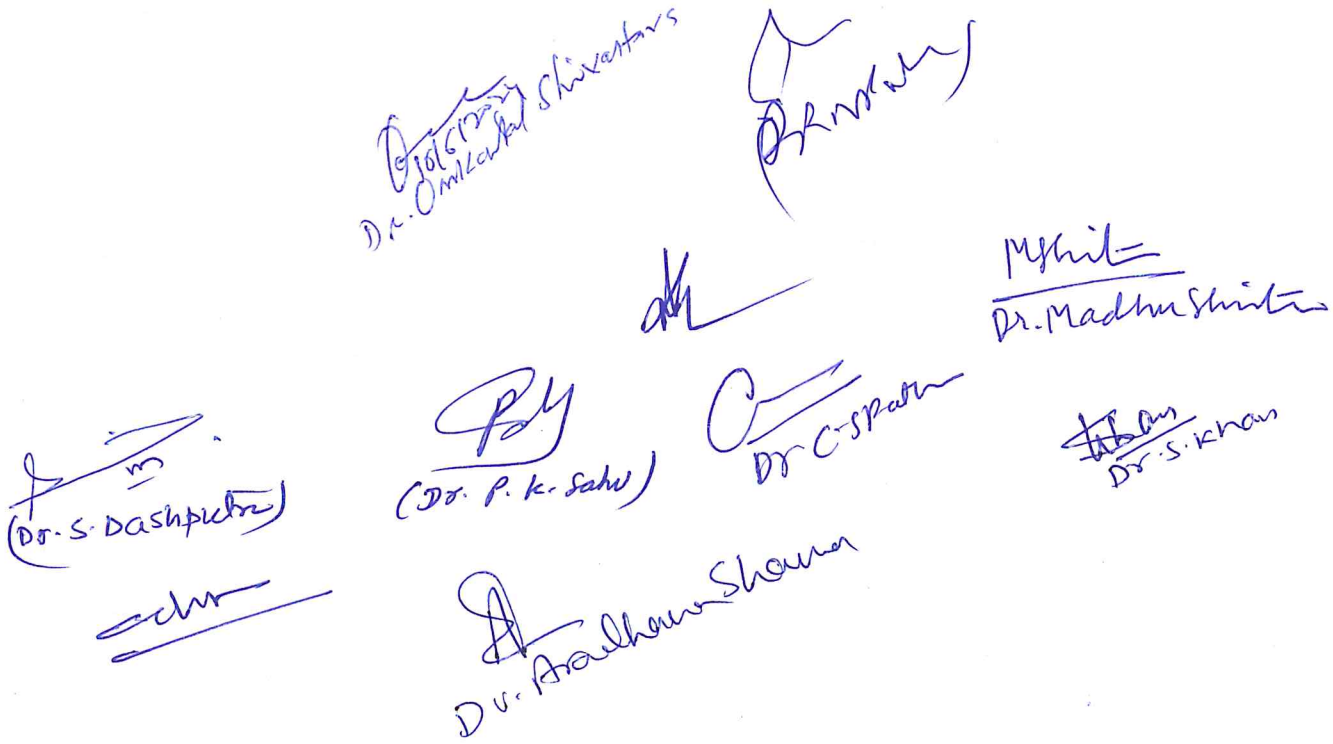
PO1: Ability to develop scientific temper and acquire in-depth knowledge of algebra, calculus, real analysis, complex analysis, topology and several other branches of mathematics. This program helps learners in building a solid foundation for higher studies in mathematics.

PO2: Utilize mathematics to solve theoretical and applied problems by critical thinking, understanding, analysis and synthesis.

PO3. The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilized in modeling and solving real life problems.

PO4. Ability to apply mathematical tools in Physics, Economics, Optimization and other subjects it will also develop understanding the architecture of curves and surfaces in plane and spaces etc.

PO5. This program will also enable the learners to join teaching profession in schools and this will help the students to enhance their employability for government jobs, jobs in banking insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.



FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction

Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		Semester - I	Session:2024-2025
1	Course Code	MASC-01	
2	Course Title	Elementary Calculus	
3	Course Type	DSC	
4	Pre-requisite(if any)	Knowledge of basic Differential and Integral calculus	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Know about ancient Indian Mathematicians and their contribution ➢ Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability. Apply various tests to determine convergence. ➢ Understand the consequences of various mean value theorems. ➢ Understand concepts of Curvature and Asymptotes . ➢ Draw curves in Cartesian and polar coordinate systems ➢ Understand the elementary integration of transcendental function and understand applications of reduction formulae.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course

Total no of teaching – learning period =60 Periods (60 Hours)

UNIT	Topics	No of Periods
I	**Contributions and Biography of Indian Mathematicians:** Bodhayan, Apasthamb, Katyayan, Mahaveeracharya, Brahmagupta and Bhaskarachaya in special context of Leelavati. **Sequences, Continuity and Differentiability** : Notion of convergence of sequences and series of real numbers, Definition of limit and continuity of a real valued function; Differentiability and its geometrical interpretation. Elementary Differentiation.	15
II	**Expansion of Functions:** Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and their geometrical interpretations, Successive differentiation and Leibnitz theorem, Maclaurin's and Taylor's theorems for expansion of a function.	15
III	**Curvature, Asymptotes , Curve Tracing:** Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves.	15

(Dr. S. Dashpute) Dr. Omkar Kolshivantaye Dr. Madhu Shinde

(Dr. P. K. Sahu) Dr. S. Kishan

IV	**Integration:** Elementary integration, Integration of Transcendental function, Reduction formulae, Definite integral.	**15**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Howard Anton, I. Bivens& Stephan Davis (2016). Calculus (10th edition). Wiley India.
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Wieslaw Krawcewicz & BindhyachalRai (2003). Calculus with Maple Labs. Narosa.
4. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.

Reference Books Recommended-

5. George B. Thomas Jr., Joel Hass, Christopher Heil& Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.
6. Jerrold Marsden, Anthony J. Tromba& Alan Weinstein (2009). Basic Multivariable Calculus, Springer India Pvt. Limited.
7. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.
8. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). Calculus (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.

E-resources: https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

(Dr. S. Dashputre) (Dr. Omkar Nath Shivastava) (Dr. P. K. Sahu) (Dr. S. Khan)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		**Semester - II**	**Session:2024-2025**
1	Course Code	**MASC-02**	
2	Course Title	**Algebra**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre requisite	Knowledge of basic algebra , determinants and matrices.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Learn about the Matrix algebra. ➢ Understand Set theory, Function and Relation ➢ Learn about the theory of equations. ➢ Learn about the fundamental concepts of groups, Subgroups. ➢ Understand cosets and normal subgroups	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Matrix Algebra :** Introduction, elementary operations of matrices, Inverse of a matrix. Special types of matrices: Transpose of a matrix, Symmetric and Skew symmetric matrices, Hermitian and Skew Hermitian matrix, Rank of a matrix, Echelon form of a matrix, Normal form, Application of matrices to a system of linear (both homogeneous and non-homogeneous) equations , Theorems on consistency of a system of linear equations.Eigen values and Eigen vectors, relation between Eigen values and Eigen vectors. Process of finding Eigen values and Eigen vectors, Cayley Hamilton theorem, and its use in finding inverse of a matrix.	**15**
II	**Sets Theory & Functions:**Sets, subsets Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of a set. Power set of a set. Difference and symmetric difference of two sets. Set identities, Generalized union and intersection. **Relations and Functions:** Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations. Function, Types of Function, Inverse Function, Composite of functions, Modular arithmetic and basic properties of congruences	**15**

Dr. S. Dashpute

(Dr. P. K. Sahu)

III	**Theory of equations:**Symmetric functions of the roots of an equation Root of a multiplicity, Synthetic division, Greatest common Divisors, Relation between the roots and coefficients of general polynomial equations in one variable. Transformation of equations. Descarte's rule of signs. Solutions of cubic equations (Cardon method) , Biquadrate equation.	**15**
IV	**Group Theory:**Definition and properties of a group, Abelian groups, Examples of groups, Subgroups and examples, Cosets and their properties, Lagrange's theorem and its applications, Normal subgroups and their properties, Simple groups, Factors groups .	**15**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. RamjiLal (2017). *Algebra 1: Groups, Rings, Fields and Arithmetic*. Springer.
2. Nathan Jacobson (2009). *Basic Algebra* I (2nd edition). Dover Publications
3. John B. Fraleigh (2007). *A First Course in Abstract Algebra* (7th edition). Pearson

Reference Books Recommended-

4. Michael Artin (2014). *Algebra* (2nd edition). Pearson.
5. Stephen H. Friedberg, Arnold J.Insel& Lawrence E. Spence (2003). *Linear Algebra* (4thedition). Prentice-Hall of India Pvt. Lt
6. Joseph A. Gallian (2017). *Contemporary Abstract Algebra* (9th edition). Cengage.
7. Kenneth Hoffman & Ray Kunze (2015). *Linear Algebra* (2nd edition). Prentice-Hall.
8. I. N. Herstein (2006). *Topics in Algebra* (2nd edition). Wiley India.

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https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

(Dr. S. Dashpute) (Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASC-03**	
2	Course Title	**Differential Equations**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic Differential and Integral calculus and differential equation.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Learn various techniques of getting exact solutions of certain solvable first order differential equations and linear differential equations of second order. ➢ Understand the genesis of ordinary as well as partial differential equations. ➢ Learn about solution of first order linear partial differential equations using Lagrange's method. ➢ Know how to solve second order linear partial differential equations with constant coefficients.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Contributions and Biography of Indian Mathematicians:** Aryabhatta, Varahmihir, Bhaskar-I, Shreedharacharya, Shreepati and Parmeshwar. **First Order and higher degree Differential Equations** : Differential equations of first order and first degree, Equations in which variables are separable, Homogeneous equations, Linear differential equations and equations reducible to linear form, Exact differential equations, Integrating factor, First order higher degree equations solvable for x, y and p, Clairaut's form and singular solutions, orthogonal trajectories.	15
II	**Linear and Ordinary simultaneous differential equations:** Linear differential equations with constant coefficients, Homogeneous linear ordinary differential equations. Linear differential equations of second order.Transformation of the equation by changing the dependent variable/the independent variable.Method of variation of parameters. Ordinary simultaneous differential equations.	15
III	**First order Partial differential equations:** Lagrange's solution, Some special types of equation which can be solved by methods other than general method, Charpit's general method of solution.	15

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IV	**Second and higher order Partial differential equations:** Classification of Linear partial differential equation of second order, Homogeneous and non- homogeneous equation with constant coefficients, Partial differential equation reducible to equation with constant coefficients. Monge's Method.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Dr. M. D. Rajsinghania, Ordinary and partial Differential Equation ,S. Chand and company Pvt.Ltd.
2. A.H. Siddiqi and P. Manchanda , A first course in Differential Equations with Applications, Macmillan India Ltd.

Reference Books Recommended-

3. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons
4. B. Rai& D. P. Choudhury (2006). *Ordinary Differential Equations - An Introduction*. Narosa Publishing House Pvt. Ltd. New Delhi.
5. Shepley L. Ross (2007). *Differential Equations* (3rd edition). Wiley.
6. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
7. Ian N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications.

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. Omkar Nath Srivastava

Dr. S Dashputre

(Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-25)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - IV**	**Session:2024-2025**
1	Course Code	**MASC-04**	
2	Course Title	**Abstract Algebra**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of algebra, vector space and inner product space.	
5	Course Learning Outcome (CLO)	➢ Understand of Homomorphism, Isomorphism of Group ➢ Understand Cyclic and Permutation Groups. ➢ Understand vector spaces, subspaces, basis, dimension and their properties. ➢ Learn about properties of linear transformation and isomorphism theorems. ➢ Understand the concept of linear transformations.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Isomorphism Theorems , Cyclic and Permutation Groups :** Group homomorphism and isomorphism with properties; First, second and third isomorphism theorems for groups, Cyclic groups and properties, Classifications of subgroup of cyclic groups, Permutation group and properties, Even and odd permutations, Cayley's theorem.	15
II	**Ring, Field and Integral Domain, Ideals:** Definition and properties of a ring, example of rings, Subrings, Integral domain and fields, characteristic of ring and field. Ring Homomorphism, Ideals and Quotient Rings. Field of Quotients of an Integral Domain, Euclidean Rings, Polynomial Rings, Polynomials over the Rational Field. The Eisenstein Criterion, Polynomial Rings over Commutative Rings, Unique factorization domain. R unique factorization domain implies so is R [x1, x2 ….. xn].	15
III	**Vector Spaces:** Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces, Linear span. Linear dependence, independence and their basic properties. Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.	15

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IV	**Linear Transformation:** Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bi-dual space and natural isomorphism. Adjoint of a linear transformation.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Nathan Jacobson (2009). *Basic Algebra* I (2nd edition). Dover Publications.
2. Nathan Jacobson (2009). *Basic Algebra* II (2nd edition). Dover Publications.

Reference Books Recommended-

3. I. M. Gel'fand (1989). *Lectures on Linear Algebra*. Dover Publications.
4. Kenneth Hoffman & Ray Kunze (2015). *Linear Algebra* (2nd edition). Prentice-Hall.
5. Serge Lang (2005). *Introduction to Linear Algebra* (2nd edition). Springer India.
6. Gilbert Strang (2014). *Linear Algebra and its Applications* (2nd edition). Elsevier

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Part D: Assessment and Evaluation

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End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

(Dr. S. Dashpreet)
Dr. Omkar Kulshreshtha
(Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Degree/Honors)		**Semester - V**	**Session:2024-2025**
1	Course Code	**MASC-05**	
2	Course Title	Real Analysis	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of algebra, real numbers, set theory, functions and elementary calculus.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Understand basic properties of real number system such as least upper bound property and Order property. ➢ Realize importance of bounded,convergent,Cauchy and monotonic sequences of real numbers,find their limit superior and limit inferior. ➢ Learn about Riemann integrability of bounded functions and algebra of R-integrable functions. ➢ Determine various applications of the fundamental theorem of integral calculus. ➢ Relate concepts of uniform continuity,differentiation,integration and uniform convergence..	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Contributions and Biography of Indian Mathematicians** Swami Bharati Krishna Tirth, Madhav, NeelkanthSomayaji and ShrinivaasAayangarRamanujan **Real Numbers :** The set of real numbers R as an ordered field, Least upper bound properties of R, Metric property and completeness of R, Archimedean property of R, Dense subsets of R, Nested intervals property; Neighborhood of a point in R, Open sets, limit point of a set, closed and perfect sets in R.	15
II	**Convergence of sequences in R:** Bounded and monotonic sequences, Convergent sequence and its limit, Limit theorems, Monotone convergence theorem, Subsequences, Bolzano-Weierstrass theorem, Limit superior and limit inferior, Cauchy sequence, Cauchy's convergence criterion.	15
III	**Infinite Series:** Convergence and divergence of infinite series of positive real numbers, Necessary condition for convergence, Cauchy criterion for convergence;Test for	15

Dr. S. Dashpute

(Dr. P. K. Sahu)

	convergence of positive term series; Basic comparison test, Comparison test,D'Alembert's Ratio test, Cauchy root test,Raabe's test, Logarithmic test, Cauchy Integral test, Alternating series, Leibnitz's test, Series of arbitrary terms,Absolute and conditional convergence,Rearrangement of series and Riemann's theorem.	
IV	**Riemann Integration and Improper Integrals:** Riemann integrability of bounded functions, Examples of R- integrable and non-integrable functions, Algebra of Riemann integrable functions, Integrability of continuous and monotonic functions, Darboux theorems, Fundamental theorem of integral calculus, Improper Integral.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. T.M.Apostol(2008).*MathematicalAnalysis:AModernApproachtoAdvancedCalculus*.Pearson Education.
2. Charalambos D.Aliprantis&)OwenBurkinshaw1998).*PrinciplesofReal Analysis*.AcademicPress

Reference Books Recommended-

3. RobertG.Bartle&DonaldR.Sherbert(2015).*IntroductiontoRealAnalysis*(4th edition).WileyIna.
4. GeraldG.Bilodeau,PaulR.Thie&G.E.Keough(2015).*AnIntroductiontoAnalysis* (2nd edition),JonesandBartlettIndiaPvt.Ltd.
5. E.Hewitt&K.Stromberg(2013).*RealandAbstractAnalysis*.Springer-Verlag.
6. K.A.Ross(2013).*ElementaryAnalysis*:*TheTheoryofCalculus*(2nd edition).Springer.
7. WalterRudin.*PrinciplesofMathematicalAnalysis*(3rd edition),TataMcGrawHill.

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

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End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Das Gupta
Dr. Omkar Nath Shivastava
(Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

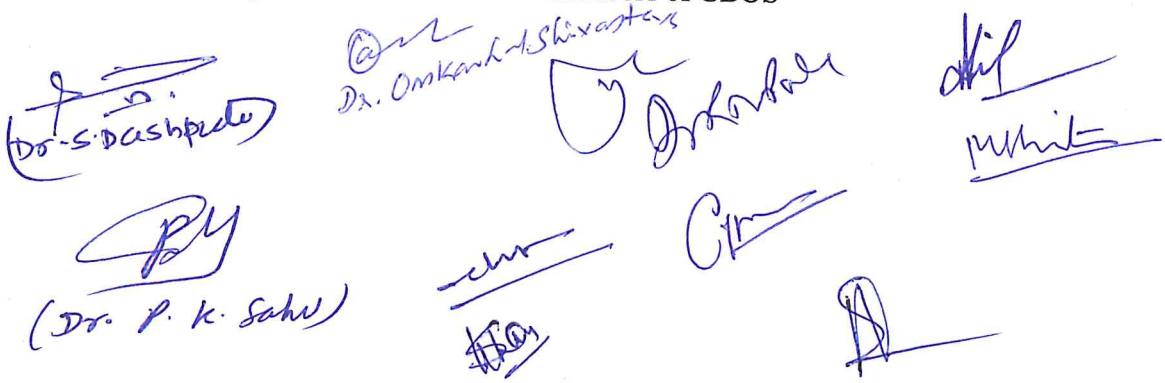
Part A: Introduction			
Program: Bachelor in Science (Degree/Honors)		**Semester - VI**	**Session:2024-2025**
1	Course Code	**MASC-06**	
2	Course Title	Metric Spaces	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic real analysis	
5	Course Learning Outcome (CLO)	**This Course will enable the students to-** ➢ Understand concepts of metric, distance, convergence, completeness, compactness, connectedness, Bolzano-Weierstrass property. ➢ Apply these concepts to key classes of spaces. ➢ Learn to analyze mapping between spaces. ➢ Identify the continuity of a function defined on metric spaces homeomorphism. ➢ Attain background for advanced courses in real analysis, functional analysis and topology.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Concepts in metric spaces:** Definition and examples of metric spaces, Open spheres and closed spheres, Neighborhoods, Open sets, Interior, exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set, Subspace of a metric space	15
II	**Complete Metric Spaces and Continuous Functions:** Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem, Continuous and uniformly continuous functions, Homeomorphism, Banach contraction principle.	15
III	**Compactness:** Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, Totally bounded sets, Equivalence of compactness and sequential compactness, Continuous functions on compact spaces.	15
IV	**Connectedness:** Separated sets, Disconnected and connected sets, Components, Connected subsets of $\mathbb{R}$, Continuous functions on connected sets.	15

(Dr. S. Dashpute) (Dr. P. K. Sahu)

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- . 1. Mathematical Analysis II- Metric Spaces, J N Sharma, Krishna Prakashan Mandir, Meerut		
Reference Books Recommended- 2. Metric Spaces, P K Jain and Khalil Ahmad, New Age International, NewDelhi. 3. An Introduction to Metric Spaces, D Gopal, A Deshmukh, A S Randive and S Yadav, CRC Press, London.		
E-resources: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-



FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VII**	**Session:2024-2025**
1	Course Code	**MASC-07**	
2	Course Title	Advanced Real Analysis	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of basic real analysis, sequence, series	
5	Course Learning Outcome (CLO)	**At the end of the course, the students will be able to :** ➢ Understand the concept of sequences and series of functions, power series apply the test for their convergence, divergence and apply Abel's and Tauber's theorems. ➢ Understand the concept of functions of several variables and properties of sets of vectors in R^n, maxima and minima of real valued functions from R to R and from R^n to R, concept of Integration theory that is closely related to the theory of Euclidean spaces and derivatives of functions of several variables. ➢ Understand the concept of Riemann-Stieltjes integral and apply it to evaluate definite integrals arising in different fields of science and engineering.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**The Riemann –Stieltjes Integral:** Definition and existence of Riemann-Stieltjes integral, Properties of the Integral, integration and differentiation, the fundamental theorem of Calculus, integration of vector-valued functions, Uniform convergence and Riemann-Stieltjes integration, Rectifiable curves.	15
II	**Sequence and Series of Functions:** Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration, Weierstrass approximation theorem.	15
III	**Functions of Several Variables:** Linear transformations, Derivatives in an open subset of R^n, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem.	15

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IV	**Jacobians, extremum problems and Power Series:** Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals. Uniqueness theorem for power series, Abel's theorem, Taylor's theorem Tauber's theorems	15

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- 1. Principle of Mathematical Analysis By Walter Rudin(3rd edition) McGrawHill, 1976, International student edition. 2. Real Analysis By H.L.Roydon, Macmillan Pub.Co.Inc.4th Edition, New York .1962.		
References Books Recommended- 1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985. 2. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975. 3. A.J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968. 4. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969. 5. I.P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick Ungar Publishing Co., 1961. 6.A. Friedman, Foundations of Modern Analysis, Holt, Rinehart and Winston, Inc., New York, 1970. 7. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969. 8..Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Co.Ltd. NewDelhi,1966.		
E-resources: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

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FOUR YEAR UNDER GRADUATE PROGRAM(2024-25)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VIII**	**Session:2024-2025**
1	Course Code	**MASC-08**	
2	Course Title	**Advanced Abstract Algebra**	
3	Course Type	**Discipline Specific Course (DSC)**	
4	Pre-requisite(if any)	Knowledge of Abstract Algebra	
5	Course Learning Outcome (CLO)	**At the end of the course, the students will be able to :** ➢ Demonstrate capacity for mathematical reasoning through analyzing, Proving and explaining concepts from advanced algebra. ➢ Understand the concept of Normal and subnormal series, solvable group, state and prove Jordan-Holder theorem. ➢ Understand the concepts of fields, extension of fields and splitting fields of polynomials ➢ . Create, select and apply appropriate algebraic structures such as Galois extensions, Automorphisms of groups and fixed fields, Fundamental theorem of Galois theory to understand and use the Fundamental theorem of Algebra, solvability of polynomials. ➢ Understand the concepts of modules, Noetherian and artinian modules. Prove Wedderburns theorem on finite division rings.	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Unit	Topics	No. of Hours
I	**Counting Principle and Sylow's Theorem** Group-Automorphism, inner automorphism, Automorphism groups and their computations. Conjugacy relation; Normalizer; Counting principle and the class equation of a finite group. Center for Group of prime order. Abelianizing of a group and its universal property ;Sylow's theorems. Sylow's subgroup; Structure theorem for finite Abelian groups.	15
II	**Field Theory** Extension fields; algebraic and transcendental extensions; Separable and inseparable extensions; Perfect fields; Finite fields; Algebraically closed fields.	15
III	**Group Series and Galois Theory** Normal and subnormal series; composition series; Jordan-Holder theorem. Automorphism of extensions; Galois extensions; Fundamental theorem of Galois Theory	15

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IV	**Modules** Modules. Submodules Quotient Modules. Homomorphism Isomorphism theorems.Cyclic modules; simple modules; Semi-simple modules; Schuler's lemma; free modules; Noetherian and Artinian modules and rings; Hilbert basis theorem; WedderburnArtin theorem; Uniform modules; primary modules; Noether-Laskar theorem.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended:

1. P.B. Bhattacharya, S. K. Jain, S.R. Nagpaul : Basic Abstract Algebra, Cambridge University press
2. I.N. Herstein : Topics in Albegra, Wiley Eastern Ltd.
3. VivekSahai and VikasBist, Algebra, Narosa Publishing House, 1999.

References Books Recommended:

1. M.Artin, Algeabra, Prentice -Hall of India, 1991.
2. P.M. Cohn, Algebra,Vols. I,II&III, John Wiley & Sons, 1982,1989,1991.
3. N.Jacobson, Basic Algebra, Vols. I , W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. S.Lang, Algebra, 3rd edition, Addison-Wesley, 1993.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I-Groups, Vol.II-Rings, Narosa Publishing House (Vol.I-1996,Vol. II-1999)
6. D.S.Malik, J.N.Mordeson, and M.K.Sen, Fundamentals of Abstract Algebra, McGraw-Hill, International Edition,1997.
7. QuaziZameeruddin and SurjeetSingh : Modern Algebra
8. I. Stewart, Galois theory, 2nd edition, chapman and Hall, 1989.
9. J.P. Escofier, Galois theory, GTM Vol.204, Springer, 2001..
10. Fraleigh , A first course in Algebra Algebra, Narosa,1982.
11. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi,2000.
12. S.K.jain,A. Gunawardena and P.B Bhattacharya, Basic Linear Algebra with MATLAB, Key College Publishing (Springer-Verlag),2001.
13. S.Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.
14. T.Y. Lam, lectures on Modules and Rings, GTM Vol. 189, SpringerVerlag,1999.

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https://epqp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

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Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

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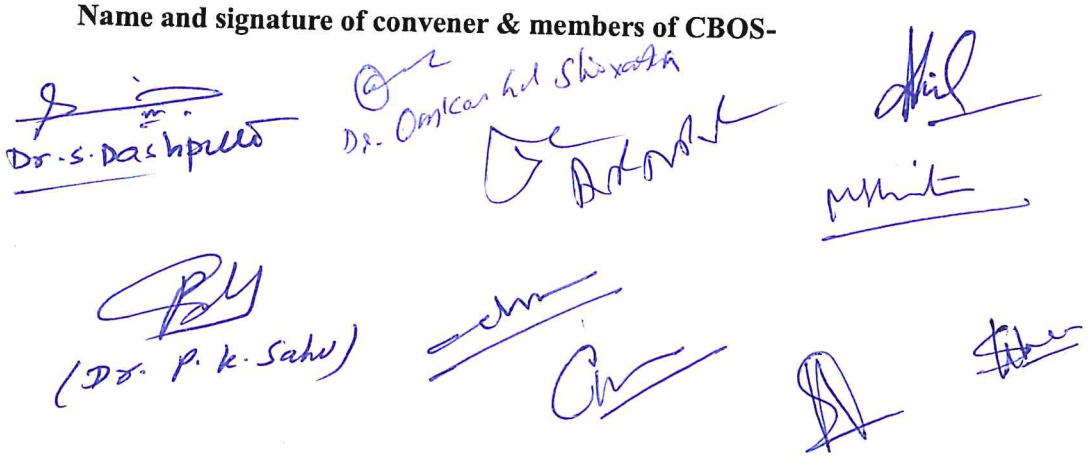

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction				
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		**Semester - I**	**Session:2024-2025**	
1	Course Code	**MAGE-01**		
2	Course Title	**Elementary Calculus**		
3	Course Type	**Generic Elective (GE)**		
4	Pre-requisite(if any)	Knowledge of basic Differential and Integral calculus		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Know about ancient Indian Mathematicians and their contribution ➢ Calculate the limit and examine the continuity and understand the geometrical interpretation of differentiability. Apply various tests to determine convergence. ➢ Understand the consequences of various mean value theorems. ➢ Understand concepts of Curvature and Asymptotes . ➢ Draw curves in Cartesian and polar coordinate systems ➢ Understand the elementary integration of transcendental function and understand applications of reduction formulae.		
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and observation	
7	Total Marks	Maximum Marks : 100		Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Contributions and Biography of Indian Mathematicians:** Bodhayan, Apasthamb, Katyayan, Mahaveeracharya, Brahmagupta and Bhaskarachaya in special context of Leelavati. **Sequences, Continuity and Differentiability** : Notion of convergence of sequences and series of real numbers, Definition of limit and continuity of a real valued function; Differentiability and its geometrical interpretation. Elementary Differentiation.	**15**
II	**Expansion of Functions:** Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and their geometrical interpretations, Successive differentiation and Leibnitz theorem, Maclaurin's and Taylor's theorems for expansion of a function.	**15**
III	**Curvature, Asymptotes , Curve Tracing:** Curvature; Asymptotes of general algebraic curves, Parallel asymptotes, Asymptotes parallel to axes; Symmetry, Concavity and convexity, Points of inflection, Tangents at origin, Multiple points, Position and nature of double points; Tracing of Cartesian, polar and parametric curves.	**15**
IV	**Integration:** Elementary integration, Integration of Transcendental function, Reduction formulae, Definite integral.	**15**

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Howard Anton, I. Bivens& Stephan Davis (2016). Calculus (10th edition). Wiley India.
2. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
3. Wieslaw Krawcewicz & BindhyachalRai (2003). Calculus with Maple Labs. Narosa.
4. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.

Reference Books Recommended-

5. George B. Thomas Jr., Joel Hass, Christopher Heil& Maurice D. Weir (2018). Thomas' Calculus (14th edition). Pearson Education.
6. Jerrold Marsden, Anthony J. Tromba& Alan Weinstein (2009). Basic Multivariable Calculus, Springer India Pvt. Limited.
7. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.
8. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). Calculus (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.

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https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpute

Dr. Omkar Nath Shivastava

(Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		**Semester - II**	**Session:2024-2025**
1	Course Code	**MAGE-02**	
2	Course Title	**Algebra**	
3	Course Type	Generic Elective (GE)	
4	Pre requisite	Knowledge of basic algebra , determinants and matrices.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Learn about the Matrix algebra. ➢ Understand Set theory, Function and Relation ➢ Learn about the theory of equations. ➢ Learn about the fundamental concepts of groups, Subgroups. ➢ Understand cosets and normal subgroups	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Matrix Algebra :** Introduction, elementary operations of matrices, Inverse of a matrix. Special types of matrices: Transpose of a matrix, Symmetric and Skew symmetric matrices, Hermitian and Skew Hermitian matrix, Rank of a matrix, Echelon form of a matrix, Normal form, Application of matrices to a system of linear (both homogeneous and non-homogeneous) equations , Theorems on consistency of a system of linear equations.Eigen values and Eigen vectors, relation between Eigen values and Eigen vectors. Process of finding Eigen values and Eigen vectors, Cayley Hamilton theorem, and its use to finding inverse of a matrix.	**15**
II	**Sets Theory & Functions:**Sets, subsets Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of a set. Power set of a set. Difference and symmetric difference of two sets. Set identities, Generalized union and intersection. **Relations and Functions:** Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations. Function, Types of Function, Inverse Function, Composite of functions, Modular arithmetic and basic properties of congruences	**15**

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III	**Theory of equations:**Symmetric functions of the roots of an equation Root of a multiplicity, Synthetic division, Greatest common Divisors, Relation between the roots and coefficients of general polynomial equations in one variable. Transformation of equations. Descarte's rule of signs. Solutions of cubic equations (Cardon method) , Biquadrate equation.	**15**
IV	**Group Theory:**Definition and properties of a group, Abelian groups, Examples of groups, Subgroups and examples, Cosets and their properties, Lagrange's theorem and its applications, Normal subgroups and their properties, Simple groups, Factors groups .	**15**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. RamjiLal (2017). *Algebra 1: Groups, Rings, Fields and Arithmetic*. Springer.
2. Nathan Jacobson (2009). *Basic Algebra* I (2nd edition). Dover Publications
3. John B. Fraleigh (2007). *A First Course in Abstract Algebra* (7th edition). Pearson

Reference Books Recommended-

4. Michael Artin (2014). *Algebra* (2nd edition). Pearson.
5. Stephen H. Friedberg, Arnold J.Insel& Lawrence E. Spence (2003). *Linear Algebra* (4thedition). Prentice-Hall of India Pvt. Lt
6. Joseph A. Gallian (2017). *Contemporary Abstract Algebra* (9th edition). Cengage.
7. Kenneth Hoffman & Ray Kunze (2015). *Linear Algebra* (2nd edition). Prentice-Hall.
8. I. N. Herstein (2006). *Topics in Algebra* (2nd edition). Wiley India.

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https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

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FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - III**	**Session:2024-2025**
1	Course Code	**MASE-01**	
2	Course Title	Advanced Calculus	
3	Course Type	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	Basic idea of elementary differential and integral calculus	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Calculate the limit and examine the continuity and understand the concepts of limit , continuity and differentiability of functions of more than one variable with geometrical interpretation. ➢ To Understand the concepts of mean value theorems with their applications . ➢ To understand the concept of maxima and minima for functions of two and three variables with their uses and techniques ➢ Understand conceptual variations while advancing from one variable to severalvariables in calculus. ➢ Understand the concept of integration of functions of two and three variables and their evaluation technique with emphasis on beta and gamma functions .	
6	Credit Value	**4 C**	1Credit = 15 hours- Learning and observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	Limit and continuity of function of two and three variables. Mean value theorems of function of two variables- First mean value theorem and taylor's theorem. Partial Differentiation and Euler's theorem on homogeneous functions, Change of variables.	**15**
II	Partial Derivation and differentiability of function of two variables. Schwartz's theorem, Young's theorem, Implicit function theorem. Fourier series, Fourier expansion of piece wise monotonic function.	**15**
III	Jacobians , Maxima, Minima and saddle points of function of two variables. Lagrange's multipliers method. Envelopes, Evolutes	**15**
IV	Beta and Gamma function. Double and triple integrals .Dirichelet's integrals. Change of order of integration.	**15**

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Gorakh Prasad (2016). Differential Calculus (19th edition). Pothishala Pvt. Ltd.
2. Mathematical Analysis, S.C. malik and S. Arora, New age international,Delhi
3. Howard Anton, I. Bivens & Stephan Davis (2016). Calculus (10th edition).Wiley India.
4. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag.
5. Wieslaw Krawcewicz & Bindhyachal Rai (2003). Calculus with Maple Labs.
6. Principles of Mathematical analysis, W.Rudin,McGraw Hill Publication
7. Jerrold Marsden, Anthony J. Tromba & Alan Weinstein (2009). Basic
8. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole. Cengage.

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https://epgp.inflibnet.aci.in
https://swayam.gov.inhttps://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

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FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Diploma/Degree/Honors)		**Semester - IV**	**Session:2024-2025**
1	Course Code	**MASE-02**	
2	Course Title	**MECHANICS**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Basic idea of Statics and Dynamics	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces. ➢ Learn about a nul point, a nul line, and a nul plane with respect to a system of forces acting on a rigid body together with the idea of central axis. ➢ Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body. Determine the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight. ➢ Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles. Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton. ➢ Understand the reduction of force system in three dimensions to a resultant force acting at a base point and a resultant couple, which is independent of the choice of base of reduction.	
6	Credit Value	**4 C**	1Credit =15 hours-Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	Analytical conditions of equilibrium of Coplanar Forces. Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes.	**15**
II	Virtual work, Stable and Unstable equilibrium, Catenary.	**15**
III	Velocities and accelerations along and transverse directions, and along tangential and normal directions, Simple harmonic motion, Motion under other law of forces. Elastic strings.	**15**

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IV	Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves. Motion of particles of varying mass, Central orbit, Keplers laws of motion, Rocket motion, Motion of particle in three dimensions.	**15**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1.R.S. Verma (1962). a text books of statics Pothishala Pvt. Ltd.

2. P.L. Shrivastava (1964). Elementary dynamics. Ram Narayan Lal, Beni Prasad Publishers Allahabad

Reference Books Recommended-

3. A.S. Ramsey (2009), Statics, Cambridge University Press

4. A.S. Ramsey (2009), Dynamics, Cambridge University Press

5. S.L. Loney (2006) , An Elementary Treatise on the dynamics of a partical and of rigid bodies. .

6. J.L. Synge an Griffith (1949). Principal of Mechanics, McGraw-Hill.

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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

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FOUR YEAR UNDERGRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Degree/Honors)		**Semester - V**	**Session:2024-2025**
1	Course Code	**MASE-03**	
2	Course Title	**Numerical Methods**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite (if any)	Basic idea of Numerical solutions, Differential equation and theory of eqution.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ The aim of this course is to teach the student the application of various numerical techniques for variety of problems occurring in the daily life. ➢ The main outcome will be that student will be able to handle problems and finding approximated solution. ➢ Obtain numerical solutions of algebraic and transcendental equations. ➢ Find numerical solutions of system of linear equations and to check the accuracy of the solutions. ➢ Learn about various interpolating and extrapolating methods to find numerical solutions.	
6	Credit Value	**4 C**	1Credit =15 hours-Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	Numerical Methods for Solving Algebraic and Transcendental Equations Round-off error and computer arithmetic, Local and global truncation errors, Algorithms and convergence; Bisection method, false position method, fixed point iteration method, Newton's method and secant method for solving equations.	**15**
II	Lagrange and Newton interpolations, Piecewise linear interpolation, Cubic spline interpolation, Finite difference operators, Gregory Newton forward and backward difference interpolations.	**15**
III	First order and higher order approximation for first derivative, Approximation for second derivative; Numerical integration: Trapezoidal rule, Simpson's rule and its error analysis, BulirschStoer extrapolation methods, Richardson extrapolation.	**15**
IV	Euler's method, RungeKutta methods, Higher order one step method, Multi-step methods; Finite difference method, Shooting method, Real life examples: Google search engine, 1D and 2D simulations, Weather forecasting.	**15**

Dr. S. Pashpuli

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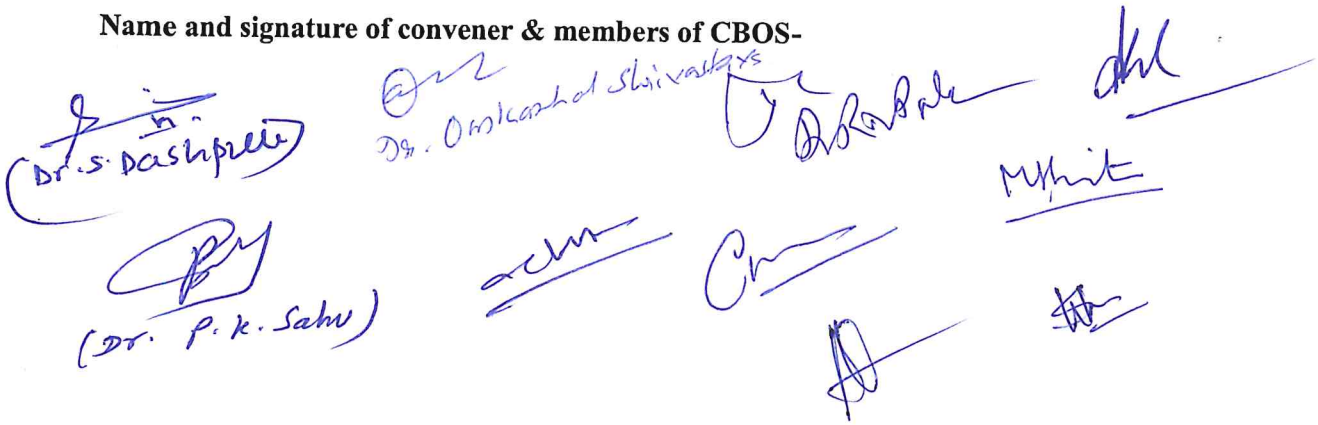
Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- 1. M.K. Jain, S. R. K. Iyengar& R. K. Jain (2012). Numerical Methods for Scientific and Engineering Computation (6th edition). New Age International Publishers. 2. C. F. Gerald & P. O. Wheatley (2008). Applied Numerical Analysis (7th edition), Pearson Education, India.		
Reference Books Recommended- 3. Brian Bradie (2006), A Friendly Introduction to Numerical Analysis. Pearson. 4. Robert J. Schilling & Sandra L. Harris (1999). Applied Numerical Methods for Engineers Using MATLAB and C. Thomson-Brooks/Cole.		
E-Recourses: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-



FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction				
Program: Bachelor in Science (Degree/Honors)		**Semester - VI**	**Session:2024-2025**	
1	Course Code	**MASE-04**		
2	Course Title	**Number Theory**		
3	Course Type	**Discipline Specific Elective (DSE)**		
4	Pre-requisite (if any)	Basic idea of theory of equation and congruence relations		
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Know about distribution of prime and congruence. ➢ Solve Number theoretic functions ➢ Learn primitive, Quadratic Reciprocity Law and Public Key Encryption		
6	Credit Value	4C	1Credit = 15 hours- Learning and observation	
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40	

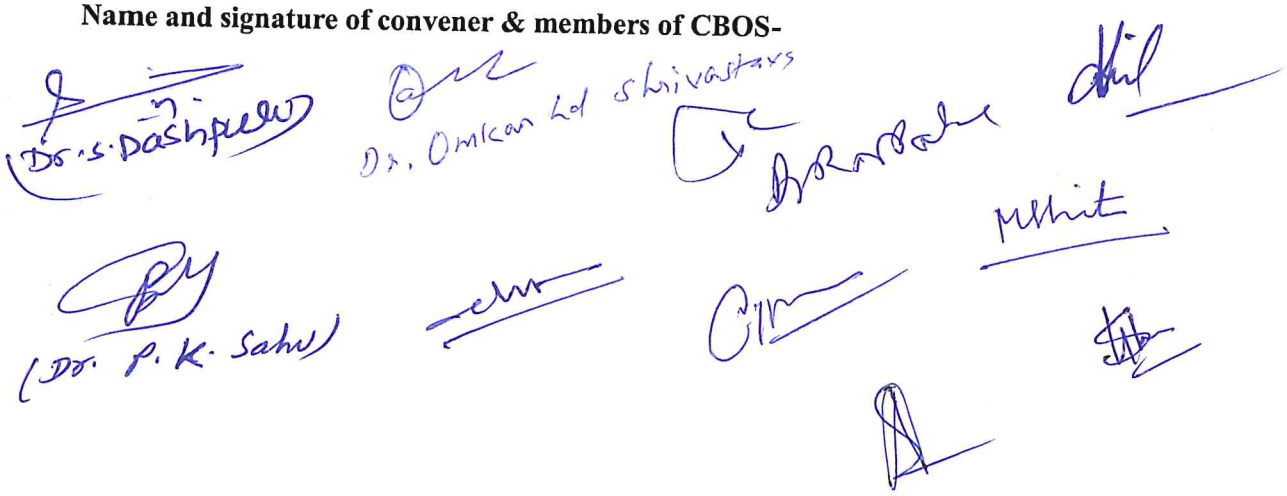
Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
UNIT	**Topics**	**No of Periods**
I	**Distribution of Primes and Theory of Congruences** Linear Diophantine equation, Prime Counting function, Prime number theorem, Goldbach conjecture, Fermat and Mersenne primes, Congruence relation and it's properties, Linear congruence and Chinese remainder theorem, Fermats' little theorem, Wilson's theorem.	15
II	**Number Theoretic Functions** Number theoretic functions for dum and number of divisors, Multiplicative function, The Mobius inversion formula, The greatest integer function. Euler's phi-function and properties, Euler's theorem.	15
III	**Primitive** The order of an integer modulo n, Primitive roots for primes, Composite numbers having primitive roots; Definition of quadratic residue of an odd prime, and Euler's criterion.	15
IV	**Quadratic Reciprocity Law and Public Key Encription** The Legendre symbol and it's properties, Quadratic reciprocity, Quadratic congruences with composite moduli; Public key encription, RSA encription and decription.	15

Dr. S. Dasgupta (Dr. P. K. Sahu)

Part C - Learning Resource
Text Books, Reference Books, Other Resources
Text Books Recommended- 1. Burton, David M. (2012) : Elementary Number Theory(7th ed.) Mc-Graw Hill Education Pvt. Ltd. Indian Reprint.
Reference Books Recommended- 2. Jones, G. A., & Jones, J. Mary. (2005) : Elementary Number Theory. Undergraduate Mathematics Series(SUMS). First Indian Print.
E-Recourses: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:		**100 Marks**
Continuous Internal Assessment (CIA):		**30 Marks**
End Semester Examination (ESE):		**70 Marks**
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-



FOUR YEAR UNDERGRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VII**	**Session:2024-2025**
1	Course Code	**MASE-05**	
2	Course Title	**Integral Transforms**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite (if any)	Basic idea of differentiation and integration	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Know about piece wise continuous functions,Dirac delta function,Laplace transforms and its properties. ➢ Solve ordinary differential equations using Laplace transforms. ➢ Explain Parseval's identity,Plancherel's theorem and applications of Fourier transforms to boundary value problems.	
6	Credit Value	4C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	**Topics**	**No. of Periods**
I	**LaplaceTransforms:** Integral transform, Kernel of an integral transform, Reduction of integral transform intoLaplace transform, Linearity, Existence theorem, Laplace transforms of derivatives andintegrals, Shifting theorems, Change of scale property, Laplace transforms of periodicfunctions,Dirac'sdeltafunction.	15
II	**Laplace Transforms (Continued) and Applications:** Differentiation and integration of transforms, Convolution theorem, Integral equations, Inverse Laplace transform, Lerch's theorem, Linearity property of inverse Laplace transform, Translations theorems of inverse Laplace transform, Inverse transform of derivatives, Applications of Laplace transform in obtaining solutions of ordinary differential equations and integral equations.	15
III	**FourierTransforms:** Fourier and inverse Fourier transforms, Fourier sine and cosine transforms, Inverse Fouriersine and cosine transforms, Linearity property, Change of scale property, Shifting property, Modulation theorem, Relation between Fourier and Laplace transforms.	15

(Dr. P. K. Sahu)

IV	**Solution of Equations by FourierTransforms :** Solution of integral equation by Fourier sine and cosine transforms,Convolution theorem for Fourier transform, Parseval's identity for Fourier transform, Plancherel's theorem, Fourier transform of derivatives, Applications of infinite Fourier transforms to boundary value problems, Finite Fourier transform, Inversion formula for finite Fourier transforms.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. JamesWardBrown&RuelV.Churchill.*Fourier Seriesand BoundaryValueProblems*.McGraw-HillEducation. 2011
2. CharlesK.Chui.*An Introduction to Wavelets*.AcademicPress 1992

Reference Books Recommended-

3. ErwinKreyszig.*Advanced Engineering Mathematics*(10th edition).Wiley. 2011
4. WalterRudin.*Fourier Analysison Groups*.DoverPublications. 2017
5. A.Zygmund.*TrigonometricSeries*(3rd edition).CambridgeUniversityPress. 2002

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epqp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpute

Dr. P. K. Sahu

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VII**	**Session:2024-2025**
1	Course Code	**MASE-06**	
2	Course Title	**Topology**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre requisite(if any)	Knowledge of basic ideas of set theory and analysis including metric spaces.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Understand the concept of countable and uncountable sets and its properties. Understand the concept of topological spaces and its examples, bases, sub-bases, subspaces and relative topology. ➢ Understand the concept of countable, separable spaces and separation axioms with their characterizations and basic properties. ➢ Understand the concept and properties of compactness, continuous functions. ➢ Understand the concept and properties of countable compactness in metric spaces. ➢ Understand the concept and properties of connectedness, continuous functions.	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks : 40

Part B: Content of the Course

Total no of teaching – learning period =60 Periods (60 Hours)

Unit	Topics	No. of Periods
I	**Topological Space :** Cardinal numbers and its arithmetic. Definition and examples of topological spaces. Neighbourhood Systems, Limit point. Derived sets and closed sets; Interior, Exterior and Frontier points ,Bases and sub-bases.. Alternate methods of defining a topology in terms of Kuratowski Closure Operator , Subspaces and relative topology.	**15**
II	**Continuous function of Topological space:** Continuous functions and homeomorphism. First and Second Countable spaces. Lindelof's theorems. Separable spaces. Second countability and separability.	**15**
III	**Compactness and Connectedness:** Compactness. Continuous functions and compact sets. Basic properties of Compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness, Connected spaces, Connectedness on the real line.Components, Locally connected spaces. Totally connected spaces.	**15**

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IV	**Separation axioms:** Separation axioms; T0, T1, T2, T3 ,T4; their Characterizations and basic properties. Urysohn's lemma, Tietze extension theorem. T5 spaces and Tychonoff spaces	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Introduction to General Topology By K.D.Joshi, Wiley Eastern Ltd., 1983.
2. Topology, A First Course By James R. Munkres, Prentice Hall of India Pvt. Ltd., New Delhi,2000.

References Books Recommended :

1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
2. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company
3. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
6. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966.
7. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964.
10. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966.
11. S. Willard, General Topology, Addison-Wesley, Reading, 1970.

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpute
Dr. Omkar Kel Shrivastava
Dr. P. K. Sahu

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VII**	**Session:2024-2025**
1	Course Code	**MASE -07**	
2	Course Title	**Complex Analysis - I**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Basic knowledge of complex analysis and calculus.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Understand Complex number and their properties. ➢ Learn about properties of linear transformation and isomorphism theorems. ➢ Understand the concept of Limit, Continuity, Differentiability of Complex and Analytic function. ➢ Obtain various variants of Mobius transformations. ➢ Obtain various Conformal mapping and types of transformations.	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks :100	Minimum Passing Marks :40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	**Topics**	**No. of Periods**
I	**Complex Numbers and Their Geometrical Representation:** Complex numbers as ordered pairs, Geometrical representation of complex numbers, Modulus and argument of complex numbers and its Properties, Equation of straight line and circle, Cauchy's inequality and Lagrange's identity.	15
II	**Continuity and Differentiability of Complex and Analytic Functions**: Limit, Continuity, Differentiability of functions of a Complex variables, Analytic function, Cauchy – Riemann equations, Conjugate function, Laplace's Differential equations, Harmonic functions, Orthogonal system and Construction of Analytic function.	15
III	**Mobius Transformation:** Jacobian of Transformation, Linear Transformation, Mobius Transformation, Linear Group, Fixed point of Mobius transformation, Cross ratio, Inverse Point, Properties of Mobius transformation.	15
IV	**Conformal Mappings:** Conformal mapping, Necessary and sufficient condition for $w = f(z)$ to represent a conformal mapping, Transformation $w = z^a$, Inverse, exponential, logarithmic and trigonometrical transformation.	15

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Complex Analysis By L.V.Ahlfors, McGraw - Hill, 1979.
2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student- Edition, Narosa Publishing House, 1980.
3. H.K. Pathak, Complex Analysis and Applications, ShikshaSahityaPrakashan , 2019

Reference Books Recommended :

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Complex Function Theory By D.Sarason
3. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
4. S. Lang, Complex Analysis, Addison Wesley, 1977.
5. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
6. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
7. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
8. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
9. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epqp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

(Dr. S. Dashpute) (Dr. Omkar and Srivastava) (Dr. P. K. Sahu)

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VII**	**Session:2024-2025**
1	Course Code	**MASE-08**	
2	Course Title	**Discrete Mathematics**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite (if any)	Basic idea of logic and order relations.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ The course aims at introducing the concepts of Lattices, sub Lattices and Homomorphisms between Lattices. ➢ Understand the uses ofBoolean algebra in daily life. ➢ Understand the uses of grammer and languages in daily life. ➢ Learn about the Finite state machines in different fields. ➢ Solve real-life problems using finite-state and Tuning machines.	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and observation
6	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	**Lattices**-Lattices as partially ordered sets-their properties. Lattices as Algebraic Systems. Sublattices. Direct products and Homomorphisms. Some special Lattices e.g. Complete, Complemented and Distributive Lattices.	15
II	**Boolean Algebras**: Boolean Algebras. Boolean Algebras as Lattices. Various Boolean Identities. Boolean Functions, The Switching Algebra example, Sub-algebras.	15
III	**Grammars, Languages and Regular sets.** Phrase-structure Grammars. Rewriting rules. Derivations. Sentential forms. Language generated by a Grammar. Regular, Context-Free and Context Sensitive Grammars and Languages. Regular expressions and the Pumping Lemma. Kleen's theorem. Notions of Syntax Analysis. Polish Notations. Conversion of Infix Expressions to Polish notation. The Reverse Polish notations.	15
IV	**Finite state machines** – Equivalent machines. Finite state machines as language recognizers. Finite Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power to that of Deterministic Finite Automata. Moore and mealy Machines. Turing Machine and Partial Recursive Functions.	15

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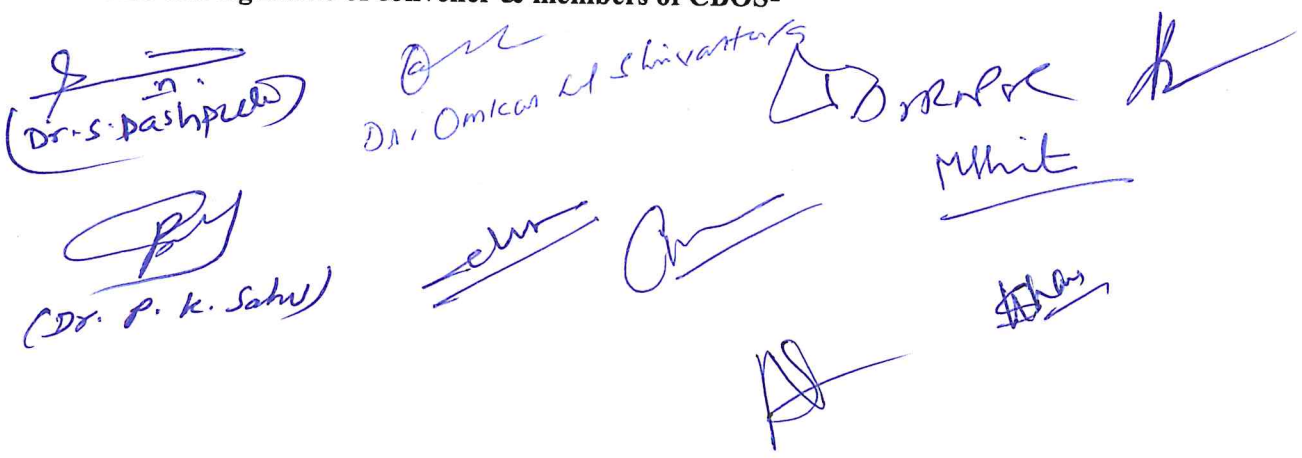
Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended : 1. M.K. Gupta.Discrete Mathematics.Krishna Prakashan Media(P) Ltd 2. J.P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co. New York.		
Reference Books Recommended : 1. C.L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co. 3. Seymour Lepschutz, Finite mathematics McGraw-Hill Book Co. New York. 4. S. Wiitala Discrete mathematics McGraw-Hill Book Co. New York		
E-Recourses: https://onlinecourses.nptel.ac.in https://epgp.inflibnet.aci.in https://swayam.gov.in https://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-



FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VIII**	**Session:2024-2025**
1	Course Code	**MASE-09**	
2	Course Title	**Measure Theory**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Knowledge of real analysis	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Understand development of measure and integration theory and Borel, Lebesgue measurability, and compare integration theory of Lebesgue and Riemann with examples and counter examples. ➢ Understand the concept and properties of functions of bounded variation. .	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 100	Minimum Passing Marks:40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	**Measurable Sets:** Lebesgue outer measure, Lebesgue measure, Properties of measurable sets, Borel sets and their measurability characterization of measurable sets, Non measurable set.	15
II	**Measurable Function:** Definition and properties, Simple, Step and characteristics function, Continuous function, sets of measure Zero. Sequence of functions, Egoroff's theorem structure of measurable function, Lusin theorem, Frechet theorem, Convergence in measure, Riesz theorem.	15
III	**Lebesgue Integral:** Lebesgue integral of a bounded function, Comparison of Riemann integral and Lebesgue integral, Bounded Convergence Theorem, Integral of non negative measurable functions, Fatou's lemma, Monotone convergence theorem, General Lebesgue integral, Lebesgue dominated convergence theorem.	**15**
IV	**Differentiation and Integration:** Dini derivatives, Differentiation of monotone functions, Lebesgue theorem, Function of bounded variation, Differentiation of an integral, Lebesgue sets, Absolutely Continuous Functions, Integral of the derivatives	**15**

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
2. P.K. Jain and V.P. Gupta, Lebesgue Measure and , New Age International (P) Limited Published, New Delhi, 1986 Reprint 2000).
3. Inder K. Rana, An Introduction to Measure and Integration, Norosa Publishing House, Delhi, 1997

Reference Books Recommended :

1. Richard L. Wheeden and AntoniZygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc.1977.
2. J.H. Williamson, Lebesgue Integration, Holt Rinehart and Winston, Inc. New York. 1962
5. P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.
6. T.G. Hawkins, Lebesgue's Theory, of Integration: Its Origins and Development, Chelsea, New York, 1979.
7. K.R. Parthasarathy, Introduction to Probability and Measure, Macmillan Company of India Ltd., Delhi, 1977.
8. R.G. Bartle, The Elements of Integration, John Wiley & Sons, Inc. New York, 1966.

E-Recourses:

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https://swayam.gov.in
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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**
Continuous Internal Assessment (CIA): **30 Marks**
End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpalli
Dr. Omkar Lal Shivastava
Dr. P. K. Sahu

FOUR YEAR UNDER GRADUATE PROGRAM (2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VIII**	**Session:2024-2025**
1	Course Code	**MASE – 10**	
2	Course Title	**General and Algebraic Topology**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Knowledge of Topological spaces and related concepts	
5	Course Learning Outcome (CLO)	**At the end of the course, the students will be able to :** ➢ Understand the concept of products in different topological spaces. ➢ Understand embedding, metrization and its related theorems. ➢ Understand the concept of net, filter and its various topological properties and their inter-relations. ➢ Understand fundamental group and covering spaces.	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks :100	Minimum Passing Marks :40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	**Product Topology** Tychonoff product topology; Separation axioms and product spaces; Compactness and product spaces; Connectedness and product spaces; Countability and product spaces.	15
II	**Embedding and metrization** Embedding lemma and Tychonoff embedding. The Urysohnmetrization theorem. Metrization theorems and Paracompactness-Local finiteness. The Nagata-Smirnov metrization theorem. Para compactness. The Smirnov metrization theorem.	15
III	**Nets and filter** Topology and convergence of nets.Hausdorffness andnets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters and vice-versa. Ultra-filters and Compactness.	15
IV	**The fundamental group and Covering spaces** Homotopy of paths; The fundamental group; Covering Spaces; The fundamental group of the circle and the fundamental theorem of algebra.	15

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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

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2. George F.Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
3. J.Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
4. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York,1995.
5. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.
6. W.Thron, Topologically Structures, Holt, Rinehart and Winston, New York,1966.
7. N. Bourbaki, General Topology Part I (Transl.),Addison Wesley, Reading, 1966.
8. R. Engelking, General Topology, Polish Scientific Publishers, Warszawa, 1977.
9. W. J. Pervin, Foundations of General Topology, Academic Press Inc. New York,1964.
10. E.H.Spanier, Algebraic Topology, McGraw-Hill, New York,1966.
11. S. Willard, General Topology, Addison-Wesley, Reading, 1970.
12. Crump W.Baker, Introduction to Topology, Wm C. Brown Publisher, 1991.
13. Sze-Tsen Hu, Elements of General Topology, Holden-Day,Inc.1965.

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Examination (ESE):	**70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpute

Dr. Omkar Lokshivastav

Dr. P. K. Sahu

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VIII**	**Session:2024-2025**
1	Course Code	**MASE-11**	
2	Course Title	**Complex Analysis - II**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Basic discussion of complex numbers, complex variable functions and analytic functions.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Understand the fundamental Complex integration. ➢ Understand the concept of residues and apply Cauchy's residue theorem to evaluate integrals. Understand the concept of conformal mappings, bilinear transformations, their properties and classifications. Understand the concept about the spaces of analytic functions. ➢ Understand the concept of Weierstrass' factorization theorem, Riemann Zeta function, Gamma function and its properties. Understand the concept of Analytic Continuation and its properties. Gain knowledge of power series of analytic function. Understand the concept and properties of Harmonic functions on a disc. ➢ Understand the concept of Canonical products, entire function and exponent of Convergence. ➢ Understand the advanced concepts of Analytic functions and its properties.	
6	Credit Value	**4C**	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks :100	Minimum Passing Marks :40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	**Complex integration:** Complex integration, Cauchy-Goursat. Theorem. Cauchy's integral formula. Higher order derivatives. Morera's Theorem. Cauchy's inequality and Liouville's theorem. The fundamental theorem of algebra. Taylor's theorem. Laurent's series. Isolated singularities. Meromorphic functions. Maximum modulus principle. Schwarz lemma. The argument principle. Rouche'stheorem Inverse function theorem.	15
II	**Calculus of Residues:** Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to arg z, logz and z^a. Bilinear transformations, their properties and classifications. Definitions and	15

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	examples of Conformal mappings. Spaces of analytic functions. Hurwitz's theorem. Montel's theorem Riemann mapping theorem.	
III	**Entire Functions and Analytic Continuation:** Weierstrass' factorisation theorem. Gamma function and its properties. Riemann Zeta function. Riemann's functional equation. Runge's theorem. Mittag-Leffler's theorem. Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation Schwarz Reflection Principle. Monodromy theorem and its consequences.	15
IV	**Harmonic Functionand Canonical products:** Harmonic functions on a disk. Harnack's inequality and theorem. Dirichlet Problem. Green's function, Canonical products. Jensen's formula. Poisson-Jensen formula. Hadamard's three circles theorem. Order of an entire function. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. Complex Analysis By L.V.Ahlfors, McGraw - Hill, 1979.
2. J.B. Conway, Functions of one Complex variable, Springer-Verlag, International student-Edition, Narosa Publishing House, 1980.
3. H.K. Pathak, Complex Analysis and Applications, ShikshaSahityaPrakashan , 2019

References Books Recommended:

1. H.A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
2. Complex Function Theory By D.Sarason
3. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
4. S. Lang, Complex Analysis, Addison Wesley, 1977.
5. D. Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
6. Mark J.Ablowitz and A.S. Fokas, Complex Variables: Introduction and Applications, Cambridge University press, South Asian Edition, 1998.
7. E. Hille, Analytic Function Theory (2 Vols.) Gonn& Co., 1959.
8. W.H.J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D.VanNostrand Co., 1967.
9. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
10. M.Heins, Complex Function Theory, Academic Press, 1968.
11. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
12. S.Saks and A.Zygmund, Analytic Functions, MonograficMatematyczne, 1952.
13. E.C Titchmarsh, The Theory of Functions, Oxford University Press, London.
14. W.A. Veech, A Second Course in Complex Analysis, W.A. Benjamin, 1967.
15. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

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Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Internal Assessment (CIA):** **30 Marks** **End Semester Examination (ESE):** **70 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section**-A&B Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Honors/Honors with Research)		**Semester - VIII**	**Session:2024-2025**
1	Course Code	**MASE-12**	
2	Course Title	**Graph Theory**	
3	Course Type	**Discipline Specific Elective (DSE)**	
4	Pre-requisite(if any)	Basic discussion of Graph , Trees and matrices.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Appreciate the definition and basics of graphs along with types and their examples. ➢ Understand the definition of a tree and learn its applications to fundamental circuits. ➢ Know the applications of graph theory to network flows. ➢ Understand the notion of planarity of a graph. ➢ Relate the graph theory to the real-world problems.	
6	Credit Value	4C	1Credit = 15 hours- Learning and observation
7	Total Marks	Maximum Marks :100	Minimum Passing Marks :40

Part B: Content of the Course		
Total no of teaching – learning period =60 Periods (60 Hours)		
Unit	Topics	No. of Periods
I	**Paths, Circuits and Graph Isomorphisms :** Definition and examples of a graph, Subgraph, Walks, Paths and circuits; Connected graphs, disconnected graphs and components of a graph; Euler and Hamiltonian graphs, Graph isomorphisms, Adjacency matrix and incidence matrix of a graph, Directed graphs and their elementary properties.	15
II	**Planar Graphs :** Planar graph, Euler theorem for a planar graph, Various representations of a planar graph, Dual of a planar graph, Detection of planarity, Kuratowski's theorem. Weighted graph, Travelling salesman problem, shorted path Dijkstra's algorithm.	15

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Dr. Ankan Kr Shivastava

III	**Cut-Sets and Cut-Vertices :** Cut-set of a graph and its properties, Fundamental circuits and cut-sets, Cut-vertices, Connectivity and separability, Network flows, 1-isomorphism and 2- isomorphism.	15
IV	**Trees and Fundamental Circuits :** Definition and properties of trees, Rooted and binary trees, Cayley's theorem on a counting tree, Spanning tree, Fundamental circuits, Minimal spanning trees in a connected graph.	15

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended :

1. R. Balakrishnan & K. Ranganathan (2012). A Textbook of Graph Theory. Springer.
2. Narsingh Deo (2016). Graph Theory with Applications to Engineering and Computer Science. Dover Publications.

References Books Recommended :

3. Reinhard Diestel (2017). Graph Theory (5th edition). Springer.
4. Edgar G. Goodaire & Michael M. Parmenter (2018). Discrete Mathematics with Graph Theory (3rd edition). Pearson.
5. Douglas West (2017). Introduction to Graph Theory (2nd edition). Pearson.:

E-Recourses:

https://onlinecourses.nptel.ac.in
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https://swayam.gov.in
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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**
Continuous Internal Assessment (CIA): **30 Marks**
End Semester Examination (ESE): **70 Marks**

Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20+20 Marks Assignment/Seminar- 10 Marks	Better marks out of two test/quiz + obtained marks in Assignment shall be considered against 30 marks
End Semester Examination (ESE)	**Two Section-A&B** Section-A: Q1.Objective- 10x1=10 marks Q2. Short answer type question-5x4=20marks Section-B: Descriptive answer type question, 1 out of 2 from each unit- 10x4= 40 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Dashpute

10/6/2024
Dr. Omkar M Shivantara

Dr. R. V. Bakal

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FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM -2024-25

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		SEMESTER-II/IV/V/VI	Session: 2024-2025
1	Course Code	**MASEC-1**	
2	Course Title	**Introduction to LATEX**	
3	Course Type	Skill Enhancement Course (SEC)	
4	Pre-requisite (if, any)	Basic understanding of document editing, familiarity with markup languages, and willingness to learn LaTeX syntax and formatting conventions.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Make different Alignments in a document and an Application for a job. ➢ Generate Bio-Data, and Table Structures. ➢ Create Mathematical Statements using LaTex. ➢ Prepare Articles and Inserting Pictures. ➢ Prepare Question paper and PowerPoint presentation in LaTeX format.	
6	Credit Value	2 Credits (1C + 1C)	*Credit = 15 Hours – Theoretical learning and = 30 Hours Laboratory or Field learning/Training*
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of the Course		
Total No. of Teaching–learning Periods: Theory – 15 Periods (15 Hrs) and Lab. or Field learning/Training 30 Periods (30 Hours)		
Unit	**Topics (Course contents)**	**No. of Period**
I	**Basics:** Introduction to LaTeX, Text, Symbols and Commands, Document layout and organization, displayed text. Mathematical formulas, Graphics inclusion and color. Floating tables and figures, User customizations. **Beyond the Basics:** Document management, Postscript and PDF, Beamer, Frames, Bibliographic data bases and BiBTeX, Presentation material.	15
II	**Practicals Based on-** **1.Introduction to TeX and LaTeX-** Creating and typesetting a simple LaTeX document, **2.Adding basic information to documents-** Environments, Footnotes, Sectioning, Displayed material. **3.Accents and symbols-** Mathematical typesetting (elementary and advanced): Subscript/ Superscript, Fractions, Roots, Ellipsis,	30

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	4.Mathematical symbols- Arrays, Delimiters, Multiline formulas, **5.Putting one thing above another**-Spacing and changing style in math mode. **6.Pictures and graphics in LaTeX**-Simple pictures using PSTricks, Plotting of functions. **7.Beamer, Frames**-Setting up beamer document, Enhancing beamer presentation **8.Bibliographic data bases and BiBTeX**-Create and manage bibliographic references using BiBTeX	

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Text Books Recommended- 1. Murugan Swaminathan, Latex For Beginners, Publisher: Notion Press		
Reference Books Recommended 2. Dilip Datta,Latex in 24 Hours A Practical Guide for Scientific Writing,Springer		
E-resources: Free Online LaTeX Editor- https://www.overleaf.com/		
PART -D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 50 Marks Continuous Internal Assessment (CIA): 15 Marks End Semester Exam (ESE): 35 Marks		
Continuous Internal Assessment (CIA): (By Course Coordinator)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on learned skill - 20 Marks B. Spotting based on tools (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

Name and signature of convener & members of CBOS-

FOUR YEAR UNDER GRADUATE PROGRAM(2024-25)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		Class: B.Sc. II/IV/V/VI Semester	Session: 2024-2025
1	Course Code	**MASEC-2**	
2	Course Title	**Python**	
3	Course Type	**Skill Enhancement Course (SEC)**	
4	Pre-requisite (if, any)	Basic understanding of programming concepts, familiarity with syntax.	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ To write python programs , develop a small application .and logic for problem solving. ➢ To be familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc. ➢ To be familiar with string and its operation. ➢ To develop basic concepts of function and terminology. ➢ To determine the methods to create and develop Python programs by ➢ Utilizing the data structures like lists and tuples.	
6	Credit Value	2 Credits (1C + 1C)	*Credit = 15 Hours – Theoretical learning and = 30 Hours Laboratory or Field learning/Training*
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

Part B: Content of the Course		
UNIT	Topics	No. of Hours
I	**(A) Python Basic and IDE** :- Introduction of Python, Installing Python, Running Simple Program, Removing Keys, Traversing a Dictionary . Basic of Python :-Data type of Python., Variable declaration rule, Python Identifier and reserved words, Input Output Function Operator of Python, Advanced Python operator(Membership and identity), Comments in Python, Line and Indentation, **(B) Conditional structure** :- if Statements, if -else and statement, Nested if , if-elif-else ladder Loop Control Structure, While loop, For loop, Nested loop, Break Statement, Continue Statement, Pass Statement - Practical 6 ,7& 8 **(C) String and Function** String Basics, Accessing and updating String, Built-in String Methods Function in Python, Declaration and Calling function, Function Argument, Anonymous Functions Python Lists, Accessing and updating List, Basic List Operation, Built-in List Methods, Python Tuple, Accessing and updating tuple, Basic tuple operation, Built-in tuple Method.	**15**

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II	**List of practicals based on Python :-** ▪ Practical 1 - Write a Python program that asks the user for their name and age, then prints a message greeting the user with their name and mentioning their age. ▪ Practical 2 - Define a list with at least three elements of different data types and print the list. ▪ Practical 3- Writeaprogram thattakestwonumberandprint thesumof thesenumbers. ▪ Practical 4 -Writeaprogramtocheckwhethertheinputnumberiseven orodd. ▪ Practical 5- Write a program to compare three numbers and print the largest one. ▪ Practical 6- Writeaprogramtoprintfactors ofagivennumber. ▪ Practical 7-Writeaprogram toprint tableusingwhileLoop. ▪ Practical 8 -Writeaprogramtocreatethe followingPattern ▪ Practical 9- Write a Python program that takes a lowercase string from the user and converts it to uppercase. ▪ Practical 10- Write a function that takes a string input and checks if it is a palindrome or not. ▪ Practical 11- Write a Python program that defines a function to calculate the sum of two numbers. ▪ Practical 12- Create a tuple representing the days of the week and update the last element with "Sunday". Print the updated tuple. ▪ Practical 13- Write a Python program that concatenates two tuples and prints the concatenated tuple. ▪ Practical 14- WAP to create a list of numbers and sort the list in ascending order. ▪ Practical 15- Write a list function to convert a string into a list, as in list (-abc) gives [a, b, c].	30

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Fundamentals of Python first programs, 2nd Edition, Kenneth A. Lambert.
2. Beginning Python from Novice to Professional, Third Edition, Magnus Lie Hetland

Reference Books Recommended-

3. Python for Science and Engineering, Hans-PetterHalvorsen.
4. Python Programming: An Introduction to Computer Science, Third Edition, John Zelle.
5. Introduction to Scientific Computing in Python, Continuum Analytics and Robert Johansson.

E-Recourses:

https://onlinecourses.nptel.ac.in
https://epgp.inflibnet.aci.in
https://swayam.gov.in
https://www.mooc.org

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	50 Marks
Continuous Internal Assessment (CIA):	15 Marks
End Semester Exam (ESE):	35 Marks

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Continuous Internal Assessment (CIA): (By Course Coordinator)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on learned skill - 20 Marks B. Spotting based on tools (written) – 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

Name and signature of convener & members of CBOS-

FOUR YEAR UNDER GRADUATE PROGRAM(2024-28)

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)		Class: B.Sc. I/III/V Sem	Session:2024-2025
1	Course Code	**MAVAC-1**	
2	Course Title	**Basic Mathematics and Logic**	
3	Course Type	**Value Addition Course**	
4	Course Learning Outcome (CLO)	**This Course will enable the students-** ➢ To orient them towards life-long learning, to develop power of concentration and to overcome the fear of mathematics from their mind. ➢ To cultivate scientific temper through systematic, critical and lateral thinking. ➢ To enhance their logical, analytical and reasoning skills useful for competitive exams. ➢ To make understand the relevance and need of quantitative methods for making business decisions.	
5	Credit Value	2 Credits	*Credit = 15 Hours - learning & Observation*
6	Total Marks	Max. Marks: 50	Min Passing Marks: 20

PART -B: Content of the Course		
Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)		
Unit	Topics (Course contents)	No. of Period
	Basic Mathematics	
I	Brief history of Vedic Mathematics (In Indian Knowledge Tradition), Sanskrit terminology involved in 16 Sutras and 13 Sub-Sutras and their meaning , Addition , Subtraction , Multiplication & Division using different techniques of Vedic Mathematics , Squaring numbers , Square roots of perfect squares , Cube roots of perfect cubes , Methods of quick verification of answers through Digit Sum Method	**8**
II	Problem based on Numbers, Decimal Fractions, Average, Simple Interest , Percentage ,Clocks	**8**
III	Problems on Profit & Loss , Discount, Ages, Speed, Time & Distance, Train , Ratio & Proportion, Mixture	**8**

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IV	**Logical Ability:** Problems on Series Completion , Coding- Decoding , Inserting the Missing Character , Problems on Mirror Image & Water Image Problems on Blood relations , Direction Sense Tests , Cubes & Dice , Logical Deductions based on Universal, Particular, Affermative & Negative Premises.	6

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. Dr. R.S. Aggarwal, Quantitative Aptitude, S. Chand and Company Ltd., New Delhi.
2. AbhijitGuha, Quantitative Aptitude, Tata McGraw Hill Publishing Company Limited.,New Delhi.
3. Dr. R.S. Aggarwal , Verbal & Non –Verbal Reasoning , S. Chand and Company Ltd., New Delhi

Reference Books Recommended-

4. Rajesh Kumar Singh , Tricky Mathematics , Success Mantra Publications , Patna
5. Govind Prasad Singh &Rakesh Kumar , Text Book of Quickest Mathematics (For all Competitive Examinations)
6. Vedic Mathematics Made Easy Published by Dhaval Bhatia

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	50 Marks
Continuous Internal Assessment (CIA):	15 Marks
End Semester Exam (ESE):	35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar +Attendance - 05 Total Marks - 15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 05 x1= 05 Mark; Q2. Short answer type- 5x2 =10 Marks Section B: Descriptive answer type qts.,1out of 2 from each unit- 4x05 =20 Marks	

Name and signature of convener & members of CBOS-

Dr. S. Das Mpred

Dr. Omkar Nath Shivastava

Dr. Madhu Shivastava

(Dr. P. K. Sahu)

Dr. S. Khan

Dr. Aradhana Shaw