DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM & MARKING SCHEME

B.Sc. V, VI, VII, VIII Semester

MATHEMATICS

(Based on Choice Based Credit System)

SESSION : 2025-26

ESTD : 1958

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A+, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

DEPARTMENT OF MATHEMATICS
GOVT. V. Y. T. AUTONOMOUS COLLEGE, DURG (C.G)

Approved syllabus for **B.Sc.** by the members of Board of studies for the session 2025-2026. The syllabus with the paper combinations is as under

B.Sc. Semester -V

Core Course	**Discipline Elective**
Metric Space	1. Partial Differential Equation 2. Numerical Methods
Skill Enhancement Course	
A. Introduction to Logic **B.** Vector Calculus	

B.Sc. Semester -VI

Core Course	**Discipline Elective**
Complex Variables and Trigonometry	1. Linear Algebra 2. Integral Transform
Skill Enhancement Course	
A. Set Theory **B.** Boolean Algebra	

The syllabus for B.Sc. is hereby approved by the members of Board of studies for the session 2025-26.

In case, any change or modification is prescribed by central Board of Studies orHigher Education Dept., Govt. of Chhattisgarh with respect to content or distribution ofmarks for Undergraduate syllabi, it will be implemented accordingly.

Name & Signature:

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members

- Dr. Anil Kashyap –
- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

Dr. Rakesh Tiwari –

Dr. (Smt.) Prachi Singh –

Dr. Shobha Rani –

Smt. Nidhi Sharma -

Ku. Ambalika Chouhan -

Ku. Bijma Kumari –

Ku. Deepak -

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

Examination Cell

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. (No Multiple choice questions. No 'fill in the blank' type Questions)
3. Section B shall contain short answer type questions.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely.
5. The scheme of marks should be as follows :

Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: **100 Marks** Continuous Internal Assessment (CIA): **20 Marks** End Semester Examination (ESE): **80 Marks**		
Continuous Internal Assessment (CIA) (Conducted by course teacher)	Test /Quiz – 20 Marks Assignment/Seminar- 20 Marks	Better marks out of two test And Assignment

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B. Sc. Semester-V

Paper – DSC (Metric Space)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Metric Spaces**		
3	Course Type	Discipline Specific Course **(DSC)**		
4	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. • Attain background for advanced courses in real analysis, functional analysis and topology.		
5	Credit Value	**3C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :80		Minimum Passing Marks:32

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
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.	**09**
II	**Complete Metric Spaces:** Convergent and Cauchy sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets, Baire's category theorem.	**09**
III	**Continuous Functions:** Continuous functions, Extension and Restriction Functions, Uniform Continuous Functions, Isometry, Open mapping, Homeomorphism, Contraction mapping, Fixed Point, Banach contraction principle.	**09**
IV	**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.	**09**
V	**Connectedness:** Separated sets, Disconnected and connected sets, Components, Connected subsets of $\mathbb{R}$, Continuous functions on connected sets.	**09**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

1. E. T. Copson (1988). Metric Spaces. Cambridge University Press.
2. P. R. Halmos (1974). Naive Set Theory. Springer.
3. P. K. Jain & Khalil Ahmad (2019). Metric Spaces. Narosa.
4. S. Kumaresan (2011). Topology of Metric Spaces (2nd edition). Narosa.
5. Satish Shirali & Harikishan L. Vasudeva (2006). Metric Spaces. Springer-Verlag.
6. Micheál O'Searcoid (2009). Metric Spaces. Springer-Verlag.
7. G. F. Simmons (2004). Introduction to Topology and Modern Analysis. McGraw Hill.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**	
Continuous Comprehensive Evaluation (CCE):	**20 Marks**	
Semester End Exam (SEE):	**80 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

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B. Sc. Semester-V

Paper – DSE (Partial Differential Equation)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Partial Differential Equations and Calculus of Variations**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Apply a range of techniques to solve first & second order partial differential equations. • Model physical phenomena using partial differential equations such as the heat and wave equations. • Understand problems, methods and techniques of calculus of variations.		
5	Credit Value	**4C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :80		Minimum Passing Marks:32

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**First Order Partial Differential Equations I**: Order and degree of Partial differential equations (PDE), Concept of linear and nonlinear partial differential equations, Partial differential equations of the first order, Lagrange's method	**12**
II	**First Order Partial Differential Equations II:** Some special type of equation which can be solved easily by methods other than the general method (Standard Form I,II,III, and IV), Charpit's general method.	**12**
III	**Second Order Partial Differential Equations with Constant Coefficients:** Classification of linear partial differential equations of second order, Homogeneous and nonhomogeneous equations with constant coefficients.	**12**
IV	**Second Order Partial Differential Equations with Variable Coefficients:** Partial differential equations reducible to equations with constant coefficient, Second order PDE with variable coefficients, Classification of second order PDE, Reduction to canonical or normal form.	**12**
V	**Application:** Monge's method; Solution of heat and wave equations in one and two dimensions by method of separation of variables.	**12**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

1. A. S. Gupta (2004). Calculus of Variations with Applications. PHI Learning.
2. Erwin Kreyszig (2011). Advanced Engineering Mathematics (10th edition). Wiley.
3. TynMyint-U & Lokenath Debnath (2013). Linear Partial Differential Equation for Scientists and Engineers (4th edition). Springer India.
4. H. T. H. Piaggio (2004). An Elementary Treatise on Differential Equations and Their Applications. CBS Publishers.
5. S. B. Rao & H. R. Anuradha (1996). Differential Equations with Applications. University Press.
6. Ian N. Sneddon (2006). Elements of Partial Differential Equations. Dover Publications.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Comprehensive Evaluation (CCE): **20 Marks**

Semester End Exam (SEE): **80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

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Ku. Deepak -

B. Sc. Semester-V

Paper – DSE (Numerical Methods)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Numerical Methods**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	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 a variety of problems occurring in daily life. • The main outcome will be that students will be able to handle problems and find approximated solutions. • 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.		
5	Credit Value	**4C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :80		Minimum Passing Marks:32

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**Fundamentals of Numerical Methods :** Round-off error and computer arithmetic, local and global truncation errors, algorithms and convergence.	**12**
II	**Root Finding Methods**: Bisection method, false position method, fixed point iteration method, Newton's method, secant method.	**10**
III	**Interpolation and Approximation:** Lagrange and Newton interpolations, piecewise linear interpolation, cubic spline interpolation, finite difference operators, Gregory Newton forward and backward difference interpolations.	**12**
IV	**Numerical Differentiation and Integration:** First order and higher order approximation for first derivative, approximation for second derivative. trapezoidal rule, Simpson's rule and its error analysis, Bulirsch-Stoer extrapolation methods, Richardson extrapolation.	**15**
V	**Numerical Solutions of Differential Equations:** Euler's method, Runge-Kutta methods, higher order one-step method, multi-step methods. Finite difference method, shooting method.	**11**

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 Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

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B.Sc. Semester-V
Paper (SEC) – Introduction to Logic

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Introduction to Logic**		
3	Course Type	Skill Enhancement Course **(SEC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember results of Prepositions, truth table, negation, conjunction and disjunction and equivalence relation. • Understand Logical equivalence, Predicates and Quantifiers.		
5	Credit Value	**2C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 30 Periods (30 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	Introduction, propositions, truth table, negation, conjunction and Disjunction, implications, bi-conditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.	**30**

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Ku. Bijma Kumari –

Ku. Deepak -

Part C - Learning Resource		
Text Books, Reference Books, Other Resources		
Reference: 1. **R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson education, 1998.** **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 1. https://onlinecourses.nptel.ac.in 2. https://swayam.gov.in 3. https://epgp.inflibnet.aci.in 4. https://www.mooc.org		
Part D: **Assessment and Evaluation**		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **Continuous Comprehensive Evaluation (CCE):** **05 Marks** **Semester End Exam (SEE):** **20 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Assignment/ Seminar – one of 05 Marks	Assignment shall be considered against 05 marks
Semester End Exam (SEE)	Pattern – Attempt any five questions out of given ten questions.	

Name & Signature

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B.Sc. Semester-V
Paper (SEC) – Vector Calculus

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Vector Calculus**		
3	Course Type	Skill Enhancement Course **(SEC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember scalar and vector product of three vectors and reciprocal vector. • Understand vector differentiation, Gradient, divergence and Curl. • Apply vector integration in various types of calculation.		
5	Credit Value	**2C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 30 Periods (30 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	Scalar and vector product of three vectors. Product of four vectors. Reciprocal vector. Examples and Applications. Vector differentiation, Gradient, divergence and curl. Vector integration. Examples and Applications.	**30**

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Ku. Deepak -

Part C - Learning Resource
Text Books, Reference Books, Other Resources
Reference: 1. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York. John Wiley and Sons, 1999. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 2 S Chand & Co. New Delhi. 3. Shanti Narayan, A Text book of Vector Calculus, Online Resources: (e-Resources/e-Books/e-Learning Portals) Online Resources: (e- Resources/ e- Books/ e- Learning Portals) 1.https://onlinecourses.nptel.ac.in 2.https://swayam.gov.in 3.https://epgp.inflibnet.aci.in 4.https://www.mooc.org

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	**25 Marks**	
Continuous Comprehensive Evaluation (CCE):	**5Marks**	
Semester End Exam (SEE):	**20 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Assignment/ Seminar – one of 5 Marks	Marks Assignment shall be considered against 5 marks
Semester End Exam (SEE)	Pattern -Attempt any five questions out of given ten questions.	

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B.Sc. Semester-V
DSC - Project

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – V		Session:2025-2026
1	Course Code			
2	Course Title	**Project**		
3	Course Type	Discipline Specific Course **(DSC)**		
4	Course Learning Outcome (CLO)	• Explore and comprehend the mathematical contributions of ancient Indian mathematicians. • Develop contextual understanding of historical and cultural influences on their works. • Fostering a deeper understanding of their impact on global mathematics.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks: 10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 15 Periods (15 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**Project Topic:** Examine the contributions and life stories of Indian mathematicians such as Baudhayana, Aryabhata, Bhaskara I. Hemachandra, Bhaskaracharya (Bhaskara II) (in special context of Lilavati), Madhava of Sangamagrama, Nilakantha Somayaji, and Srinivasa Ramanujan. Analyze their mathematical achievements in algebra, geometry, calculus, and other areas, exploring how their work has impacted mathematics globally.	**15**

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Part C - Learning Resource
Text Books, Reference Books, Other Resources
Reference: **1.** M. Chandra, History of Mathematics in India, Motilal Banarsidass Publishers, 2008. 2. B. L. Gupta, History of Indiah Maternatics Rich Traditions and Legacies, Springer, 2017 3. George Gheverghese Joseph. The Crest of the Peacock: Non-European Roots of Mathematics. Princeton University Press, 2000. 4. Robert Kanigel. The Man Who Knew Infinity: A Life of the Genius Ramanujan, Washington Square **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 1.https://onlinecourses.nptel.ac.in 2.https://swayam.gov.in 3.https://epgp.inflibnet.aci.in 4.https://www.mooc.org

Part D: **Assessment and Evaluation**	
Suggested Continuous Evaluation Methods:	
Maximum Marks:	**25 Marks**
Continuous Comprehensive Evaluation (CCE):	**5 Marks**
Semester End Exam (SEE):	**20 Marks**
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Quiz 5 marks
Project	Project Work 5 marks

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B. Sc. Semester-VI

Paper – DSC (Complex Variables and Trigonometry)

Part A: Introduction				
Program:		Class: B.Sc.	Semester – VI	Session:2025-2026
1	Course Code			
2	Course Title	**Complex Variables and Trigonometry**		
3	Course Type	Discipline Specific Course **(DSC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand concepts of Complex numbers and its properties. • Apply these concepts to key classes of spaces. • Learn to analyze mapping between spaces. • Identify the continuity of a function defined on complex spaces. • Attain background for advanced courses in complex analysis.		
5	Credit Value	**3C**	**1 credit =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 Periods = 45 Periods (45 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
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.	**10**
II	**Limit, Continuity and Differentiability of Complex Functions and Analytic Functions:** Limit, Continuity, Differentiability of functions of a Complex variable. Analytic function, Cauchy – Riemann equations, Conjugate function, Laplace's Differential equations, Harmonic functions, Orthogonal system and Construction of Analytic function.	**12**
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.	**10**
IV	**Trigonometry I:** De-Moivre's Theorem and its applications. Direct and inverse circular and hyperbolic functions.	**07**
V	**Trigonometry II:** Logarithm of a complex quantity. Expansion of Trigonometrical functions. Gregory's Series. Summation of series.	**06**

Part C - Learning Resource
Text Books, Reference Books, Other Resources

Reference:

1. R. V. Churchill & J. W. Brown, Complex Variables and Applications, 5th Edition, Mc-Graw Hill, New-York, 1990.
2. Mark J. Ablowitz & A. S. Focas, Complex Variables: Introduction and Applications, Cambridge University Press South Asian Edition, 1998.
3. Shanti Narayan, Theory and Functions of a Complex Variable, S. Chand & Company New-Delhi. E.T. Copson. Metric Spaces Cambridge University Press, 1968.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Comprehensive Evaluation (CCE):** **20 Marks** **Semester End Exam (SEE):** **80 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members

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- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

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Dr. Shobha Rani –

Smt. Nidhi Sharma -

Ku. Ambalika Chouhan -

Ku. Bijma Kumari –

Ku. Deepak -

B. Sc. Semester-VI
Paper – DSE (Linear Algebra)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VI		Session: 2025-2026
1	Course Code			
2	Course Title	**Linear Algebra**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Understand the concepts of vector spaces, subspaces, bases, dimension and their properties. • Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations. • Learn properties of inner product spaces and determine orthogonality in inner product spaces. • Realize importance of adjoint of a linear transformation and its canonical form.		
5	Credit Value	**4C**	**1 credit =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 Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Periods**
I	**Vector Spaces** Definition and examples of Vector space and Subspace, Linear span, Quotient space and direct sum of subspaces, Linearly independent and dependent sets, Bases and dimension	**12**
II	**Linear Transformations** Definition and examples, Algebra of linear transformation, Matrix of a linear transformation, Change of coordinates, Rank and nullity of a linear transformation and rank-nullity theorem.	**12**
III	**Further Properties of Linear Transformations** Isomorphism of vector spaces, Isomorphism theorems, Transpose of a linear transformation, Eigen vectors and eigen values of a linear transformation, Characteristic polynomial and Cayley–Hamilton theorem.	**12**
IV	**Inner Product Spaces** Inner product spaces and orthogonality, Cauchy–Schwarz inequality, Gram–Schmidt orthogonalization, Diagonalization of symmetric matrices.	**12**
V	**Adjoint of a Linear Transformation and Canonical Forms** Adjoint of a linear operator; Hermitian, unitary and normal linear transformations; Jordan canonical form, Triangular form, Trace and transpose, Invariant subspaces.	**12**

26-04-25

Part C - Learning Resource
Text Books, Reference Books, Other Resources

Reference:

1. Stephen H. Friedberg, Arnold J. Insel & Lawrence E. Spence (2003). Linear Algebra (4thedition). Prentice-Hall of India Pvt. Ltd.
2. Kenneth Hoffman & Ray Kunze (2015). Linear Algebra (2nd edition). Prentice-Hall.
3. I.M. Gel'fand (1989). Lectures on Linear Algebra. Dover Publications.
4. Nathan Jacobson (2009). Basic Algebra I & II (2nd edition). Dover Publications.
5. Serge Lang (2005). Introduction to Linear Algebra (2nd edition). Springer India.
6. Vivek Sahai & Vikas Bist (2013). Linear Algebra (2nd Edition). Narosa Publishing House.
7. Gilbert Strang (2014). Linear Algebra and its Applications (2nd edition). Elsevier.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	**100 Marks**	
Continuous Comprehensive Evaluation (CCE):	**20 Marks**	
Semester End Exam (SEE):	**80 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

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Ku. Ambalika Chouhan -

Ku. Bijma Kumari –

Ku. Deepak -

B. Sc. Semester-VI
Paper – DSE-II (Integral Transform)

Part A: Introduction			
Program: Bachelor in Science		**Semester - VI**	**Session: 2025-2026**
1	Course Code		
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 Hours**
I	**LaplaceTransforms:** Integral transform, Kernel of an integral transform, Reduction of integral transform into Laplace transform, Linearity, Existence theorem..	12
II	**Applications Laplace Transforms :** Laplace transforms of derivatives and integrals, Shifting theorems, Change of scale property, Laplace transforms of periodic functions, Dirac's delta function, Differentiation and integration of transforms.	13
III	**Invers Laplace Transforms and Application:** 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.	10
IV	**Fourier Transforms**: Fourier and inverse Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier sine and cosine transforms, Linearity property, Change of scale property, Shifting property,	15
V	**Application of Fourier Transforms**: 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.	11

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Books Recommended-

1. JamesWardBrown&RuelV.Churchill.F*ourier 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 Comprehensive Evaluation (CCE):	**20 Marks**
Semester End Exam (SEE):	**80 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks Question-C: Short answer type questions 05 x 5 = 25 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 80 Marks**	

Chairperson / H.O.D - Dr. Padmavati –
Subject Expert - Dr. Madhu Shrivastava
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Ku. Bijma Kumari –
Ku. Deepak -

B. Sc. Semester-VI
Paper – SEC (Set Theory)

Part A: Introduction			
Program: Bachelor in Science		**Semester - VI**	**Session: 2025-2026**
1	Course Code		
2	Course Title	**Set Theory**	
3	Course Type	**Skill Enhancement Course (SEC)**	
4	Pre-requisite (if any)	Basic idea of differentiation and integration	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Apply concepts of Set, subsets, set operations and venn diagram in real life problem. ➢ Evaluate practical problems on counting principal and power set of set.	
6	Credit Value	2C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 25	Minimum Passing Marks : 10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 30 Periods (30 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**Set Theory**: Sets, subsets, set operations, the law 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 sets. Power set of a set. Difference and symmetric difference of two sets. Set identities, generalized union and intersections and applications of above topics. **Relations:** Product set, composition of relations. Types of relations and its applications, equivalence relations with examples of congruence modulo relation.	**30**

Chairperson / H.O.D - Dr. Padmavati –
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Subject Expert - Dr. S. K. Bhatt
26-04-25

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Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak -

Part C - Learning Resource
Text Books, Reference Books, Other Resources
Reference Books Recommended- 1. E. Kamke. Theory of sets, Dover Publishers, 1950. 2. P. R. Halmos, Naive set theory, Springer, 1974.
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:	**25 Marks**	
Continuous Comprehensive Evaluation (CCE):	**05 Marks**	
Semester End Exam (SEE):	**20 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Assignment/ Seminar – one of 05 Marks	Assignment shall be considered against 05 marks
Semester End Exam (SEE)	Pattern – Attempt any five questions out of given ten questions.	

Chairperson / H.O.D - Dr. Padmavati –
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Ku. Bijma Kumari –
Ku. Deepak -

B. Sc. Semester-VI
Paper – SEC (Boolean Algebra)

Part A: Introduction			
Program: Bachelor in Science		**Semester - VI**	**Session: 2025-2026**
1	Course Code		
2	Course Title	**Boolean Algebra**	
3	Course Type	**Skill Enhancement Course (SEC)**	
4	Pre-requisite (if any)	Basic idea of differentiation and integration	
5	Course Learning Outcome (CLO)	**This Course will enable the students to:** ➢ Remember properties of ordered set, partial order sets, Hasse diagram, duality principle, maximal and minimal elements. ➢ Understand lattices as ordered sets, complete lattices, lattices as algebraic structures, sublattices, product and homomorphism. ➢ Apply concept of Karnaugh diagrams, switching circuits. ➢ Evaluate problems on Boolean algebras and its properties, Boolean polynomials, minimal forms of Boolean polynomials.	
6	Credit Value	2C	1Credit = 15 hours- Learning and Observation
7	Total Marks	Maximum Marks : 25	Minimum Passing Marks : 10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 30 Periods (30 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	Definition, examples and basic properties of ordered sets, maps between ordered sets. Partial ordered set, Hasse Diagram, duality principle. maximal and minimal elements. Lattices as ordered sets, complete lattices, lattices as algebraic structures, sub- lattices, products and Homomorphism. Definition, examples and properties of modular and distributive lattices, Complete lattice, complemented lattice, Bounded lattice and some theorems. Boolean Algebra and its properties, Boolean polynomials, minimal forms of Boolean polynomials. Quinn-Mccluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits.	**30**

Chairperson / H.O.D - Dr. Padmavati –
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Smt. Nidhi Sharma -
Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak -

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

1. B. A. Davey and H.A. Priestley, Introduction to lattices and order. Cambridge university press, Cambridge, 1990.
2. Rudolf Lidi and Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate texts in mathematics, Springer (SIE), Indian reprint, 2004.
3. C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill Publishing Company Limited.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

1.

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**25 Marks**
Continuous Comprehensive Evaluation (CCE):	**05 Marks**
Semester End Exam (SEE):	**20 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Assignment/ Seminar – one of 05 Marks	Assignment shall be considered against 05 marks
Semester End Exam (SEE)	Pattern – Attempt any five questions out of given ten questions.	

Chairperson / H.O.D - Dr. Padmavati –

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Ku. Bijma Kumari –
Ku. Deepak -

• Dr. Mayur Puri Goswami -	

B.Sc. Semester-VI
DSC - Project

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VI		Session: 2025-2026
1	Course Code			
2	Course Title	**Project**		
3	Course Type	Discipline Specific Course **(DSC)**		
4	Course Learning Outcome (CLO)	❖ Gain insight into significant advancements in algebra, geometry, calculus and related fields by Indian mathematicians throughout history. ❖ Understand the cultural and historical contexts influencing the development of mathematical ideas in india. ❖ Analyze the lasting impact of Indian mathematical achievements on global mathematics.		
5	Credit Value	**1C**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :25		Minimum Passing Marks:10

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 15 Periods (15 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**Project Topic**: Examine the contributions and life stories of Indian mathematicians such as Apastambha, Panini, Varahamihira, Brahmagupta, Parameshvara, Narayana Pandit, Kamalakara, and Jyeshtadeva. Analyze their achievements in algebra, geometry, calculus, and other areas, exploring how their work has left a lasting impact on mathematics worldwide.	**15**

Chairperson / H.O.D - Dr. Padmavati Subject Expert -Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt **Representative Members** • Dr. Anil Kashyap – • Shri A. K. Pandey – • Dr. Mayur Puri Goswami –	**Faculty Members** – Dr. Rakesh Tiwari – Dr. (Smt.) Prachi Singh – Dr. Shobha Rani – Smt. Nidhi Sharma - Ku. Ambalika Chouhan - Ku. Bijma Kumari – Ku. Deepak -

Part C - Learning Resource	
Text Books, Reference Books, Other Resources	
Reference: 1. M. Chandra, History of Mathematics in India, Motilal Banarsidass Publishers, 2008. 2. B. L. Gupta, History of Indiah Maternatics Rich Traditions and Legacies, Springer, 2017 3. George Gheverghese Joseph. The Crest of the Peacock: Non-European Roots of Mathematics. Princeton University Press, 2000. 4. Robert Kanigel. The Man Who Knew Infinity: A Life of the Genius Ramanujan, Washington Square press, 1991. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 1.https://onlinecourses.nptel.ac.in 2.https://swayam.gov.in 3.https://epqp.inflibnet.aci.in 4.https://www.mooc.org	
Part D: Assessment and Evaluation	
Suggested Continuous Evaluation Methods: **Maximum Marks:** **25 Marks** **Continuous Comprehensive Evaluation (CCE):** **5 Marks** **Semester End Exam (SEE):** **20 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Quiz 5 marks
Project	Project Work 5 marks

Chairperson / H.O.D - Dr. Padmavati Subject Expert -Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt **Representative Members** • Dr. Anil Kashyap – • Shri A. K. Pandey – • Dr. Mayur Puri Goswami -	**Faculty Members –** Dr. Rakesh Tiwari – Dr. (Smt.) Prachi Singh – Dr. Shobha Rani – Smt. Nidhi Sharma - Ku. Ambalika Chouhan - Ku. Bijma Kumari – Ku. Deepak -

DEPARTMENT OF MATHEMATICS

GOVT. V. Y. T. AUTONOMOUS COLLEGE, DURG (C.G)

Approved syllabus for **B.Sc.** by the members of Board of studies for the session 2025-2026. The syllabus with the paper combinations is as under

B. Sc. Semester VII

Core Course	**Generic Elective**
Advance Abstract Algebra I	1. Advance Real Analysis I 2. General Topology I 3. Complex Analysis I 4. Discrete Mathematics
Practical - Latex	

B.Sc. Semester -VIII

Core Course	**Generic Elective**
Advance Abstract Algebra II	1. Advance Real Analysis II 2. General Topology II 3. Complex Analysis II 4. Graph Theory
Research Project / Dissertation/ Internship	

The syllabus for B.Sc. is hereby approved by the members of Board of studies for the session 2025-26.

In case, any change or modification is prescribed by central Board of Studies orHigher Education Dept., Govt. of Chhattisgarh with respect to content or distribution ofmarks for Undergraduate syllabi, it will be implemented accordingly.

Name & Signature:

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members

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Faculty Members –

Dr. ~~Padmavati~~ -

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Ku. Ambalika Chouhan -

Ku. Bijma Kumari –

Ku. Deepak

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

Examination Cell

Question Paper Format and Distribution of Marks for Under Graduate Examination

1. The question paper for UG Classes is to be divided into three Sections - A, B, C & D.
2. Section A & B shall contain very short answer type questions (answer in one or two sentences) orobjective type questions. (No Multiple choice questions. No 'fill in the blank' type Questions)
3. Section C shall contain short answer type questions.
4. Section D shall contain long answer/descriptive type questions. The students are required toanswer precisely.

Suggested Continuous Evaluation Methods: **Maximum Marks:** **100 Marks** **Continuous Comprehensive Evaluation (CCE):** **25 Marks** **Semester End Exam (SEE):** **75 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 20 Marks Assignment/ Seminar – one of 20 Marks	Best of Test and Assignment shall be considered against 20 marks
Total Marks	Maximum Marks :75	Minimum Passing Marks:30

Name & Signature

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava 26-04-25

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

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Discipline Specific Course (DSC)
B. Sc. Semester - VII (2025 - 2026)

Part A: Introduction			
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VII	Session:2025-2026
1	Course Code		
2	Course Title	**Advanced Abstract Algebra**	
3	Course Type	Discipline Specific Course **(DSC)**	
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember properties of group especially normal series and use of series in JordenHolder Theorem. • Understand field extension with types of extension as- algebraic, transcendental, separable, inseparable and normal extension, Galois theory and solvability. • Apply module, Noetherian, Artinian modules and examples, Hilbert basis theoremand Wedderzburn Artin theorem. • Analyze Linear transformation, canonical form and nilpotent transformation,understand Jorden blocks and Jorden forms, Smith normal form and rational canonical form.	
5	Credit Value	**3 Credits**	**1 credit =15 Hours – Learning and Observation**
6	Total Marks	Maximum Marks : 75	Minimum Passing Marks:30

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 45 Periods (45 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Hours
I	**Groups:** Normal and Subnormal Series, Composition Series, Jordan-Holder Theorem, Solvable Groups, Nilpotent Groups.	09
II	Group Automorphism, Conjugacy Relation, Class Equation of Finite Group, Cauchy Theorem and Sylow Theorem.	09
III	**Field Theory - Extensions:** Extension Fields, Algebraic and Transcendental Extensions, Separable and Inseparable Extensions, Algebraically Closed Fields.	09
IV	**Specialized Fields and Elements:** Perfect Fields, Finite Fields, Primitive Elements, Normal Extensions and Splitting Fields.	09
V	**Galois Theory:** Automorphism of Extensions, Galois Extension, Fundamental Theorem of Galois Theory, Solution of Polynomial Equations by Radicals, Insolvability of the General Equation of Degree 5 by Radicals.	09

Text Books, Reference Books, Other Resources		
Reference: 1. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul : Basic Abstract Algebra, Cambridge University press. 2. I. N. Herstein : Topics in Algebra, Wiley Eastern Ltd. 3. Quazi Zameeruddin and Surjeet Singh : Modern Algebra **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 1. https://onlinecourses.nptel.ac.in 2. https://swayam.gov.in 3. https://epgp.inflibnet.aci.in 4. https://www.mooc.org		
Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **75 Marks** **Continuous Comprehensive Evaluation (CCE):** **15 Marks** **Semester End Exam (SEE):** **60 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members

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- Shri A. K. Pandey –
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Faculty Members –

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Ku. Bijma Kumari –

Ku. Deepak -

Discipline Specific Elective (DSE- I)
B. Sc. Semester - VII (2025 – 2026)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc.	Semester – VII	Session: 2025-2026
1	Course Code			
2	Course Title	**Real Analysis I**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember sequences and series of functions and their convergence, various test for convergence. • Analyze Function of several variables, derivatives in open subsets, derivatives of higher order, partition of unity and Stock's Theorem. • Understand Riemman and Stieltjes integral and its properties. • Apply Idea of measures, measurable sets, Borel and Lebesgue measures.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

UNIT	Topics	No of Hours
I	**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.	13
II	**Power Series:** Uniqueness Theorem for Power Series, Abel's and Tauber's Theorems, Rearrangements of Terms of a Series, Riemann's Theorem.	11
III	**Functions of Several Variables:** Linear Transformations, Derivatives in an Open Subset of R^n, Chain Rule, Partial Derivatives.	10
IV	**Differentiation and Higher Orders:** Interchange of the Order of Differentiation, Derivatives of Higher Orders, Taylor's Theorem, Inverse Function Theorem, Implicit Function Theorem.	14
V	**Extremum Problems and Differential Forms:** Extremum Problems with Constraints, Lagrange's Multiplier Method, Differentiation of Integrals, Partitions of Unity, Differential Forms, Stoke's Theorem.	12

Text Books, Reference Books, Other Resources

Reference:

1. Principle of Mathematical Analysis By Walter Rudin McGraw-Hill, Kogakusha,1976, International student edition.
2. Real Analysis By H. L. Roydon Macmillan Pub.Co.Inc.4th Edition, New York .1962.
3. T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
4. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975.
5. A. J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968.
6. G. de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
7. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969.
8. P. K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International
9. Limited Published, New Delhi, 1986 Reprint 2000).
10. I. P. Natanson, Theory of Functions of a Real Variable. Vol. l, Frederick UngarPublishing Co., 1961.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –
Subject Expert - Dr. Madhu Shrivastava
Subject Expert - Dr. Shabnam Khan
Subject Expert - Dr. S. K. Bhatt

Representative Members

- Dr. Anil Kashyap –
- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

~~Dr. Padmavati~~ -
Dr. Rakesh Tiwari –
Dr. (Smt.) Prachi Singh –
Dr. Shobha Rani –
Smt. Nidhi Sharma -
Ku. Ambalika Chouhan –
Ku. Bijma Kumari –
Ku. Deepak -

Discipline Specific Elective (DSE-II)
B. Sc. Semester - VII (2025 – 2026)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VII		Session:2025-2026
1	Course Code			
2	Course Title	**Topology I**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember the concept of topology and algebraic topology. • Apply the concept of separation axioms, connectedness, compactness and related topics. • Understand bases relative topology, neighbourhood systems and derived sets. • Analyze homomorphism, countable spaces and separable spaces.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks:30

UNIT	Topics	No of Hours
I	**Set Theory and Order:** Countable and Uncountable Sets, Infinite Sets and the Axiom of Choice, Cardinal Numbers and Arithmetic, Schroeder-Bernstein Theorem, Cantor's Theorem and the Continuum Hypothesis, Zorn's Lemma, Well-Ordering Theorem.	12
II	**Topological Spaces:** Definition and Examples of Topological Spaces, Closed Sets, Closure, Dense Subsets, Neighborhoods, Interior, Exterior, Boundary, Accumulation Points and Derived Sets.	12
III	**Topological Structures:** Bases and Sub-bases, Subspaces and Relative Topology, Alternate Methods of Defining a Topology in Terms of Kuratowski Closure Operator and Neighborhood Systems.	12
IV	**Advanced Topological Concepts:** Continuous Functions and Homeomorphism, First and Second Countable Spaces, Lindelof's Theorems, Separable Spaces.	12
V	**Topological Properties and Applications:** Separation Axioms - Their Characterizations and Basic Properties, Urysohn's Lemma, Tietze Extension Theorem, Compactness and Its Basic Properties.	12

Text Books, Reference Books, Other Resources (Scheme of Autonomy)

Text Books:

K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

Reference:

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, 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. J. R. Munkres, Topology, Prentice Hall, 2000.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

6. https://onlinecourses.nptel.ac.in
9. https://swayam.gov.in
10. https://epgp.inflibnet.aci.in
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13. https://swayam.gov.in
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15. https://www.mooc.org

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

Representative Members

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- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

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Dr. Rakesh Tiwari –
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Dr. Shobha Rani –
Smt. Nidhi Sharma -
Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak -

Discipline Specific Elective (DSE-III)
B. Sc. Semester - VII (2025 - 2026)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VII		Session:2025-2026
1	Course Code			
2	Course Title	**Complex Analysis I**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Remember the concept and consequences of analyticity and the Cauchy Riemman equations and results on harmonic and entire functions including the fundamental theorem of algebra. • Understand the application of the power series, expansion of analytic functions. • Apply Conformal mapping and bilinear transformation and their properties. • Analyze the Cauchy residue theorem to evaluate integral and sum series, analytic continuation and its properties, canonical products, Little picard theorem, Montel theorem etc.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :100		Minimum Passing Marks:40

UNIT	Topics	No of Hours
I	**Complex Integration and Basic Theorems:** Complex Integration, Cauchy-Goursat Theorem, Cauchy's Integral Formula, Higher Order Derivatives, Morera's Theorem.	12
II	**Analytic Functions and Theorems:** Cauchy's Inequality and Liouville's Theorem, Taylor's Theorem, Laurent Series, Zeros of Analytic Functions, Singularities and its Classification, Meromorphic Functions.	12
III	**Advanced Topics in Complex Analysis:** Argument Principle, Rouche's Theorem, Fundamental Theorem of Algebra, Maximum Modulus Principle, Schwarz Lemma, Inverse Function Theorem.	12
IV	**Residue Theory and Integrals:** Residues, Cauchy's Residue Theorem, Evaluation of Integrals, Branches of Many-Valued Functions (Special Reference to arg z, log z, and z^a).	12
V	**Special Functions and Theorems:** Conformal Mappings: Definitions and Examples, Bilinear Transformations: Properties and Classifications, Special Bilinear Transformations, Transformation Examples $(w = z^2, z = \sqrt{w}, w = e^z, w = tan^2\left(\frac{\pi}{4}z\right))$, Spaces of Analytic Functions, Hurwitz's Theorem, Montel's Theorem, Riemann Mapping Theorem, Weierstrass Factorization Theorem.	12

Text Books, Reference Books, Other Resources

Reference:

1. L.V. Ahlfors: Complex Analysis, McGraw - Hill, 1979.
2. D. Sarason: Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
3. H. K. Pathak, Complex Analysis and Applications, Springer, 2019.
4. H. A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
5. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and BartlettPublishers International, London, 1996.
6. S. Lang, Complex Analysis, Addison Wesley, 1977.
7. W. H. J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D. Van Nostrand Co., 1967.
8. C.Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
9. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
10. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –
Subject Expert - Dr. Madhu Shrivastava
Subject Expert - Dr. Shabnam Khan
Subject Expert - Dr. S. K. Bhatt

Representative Members

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- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

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Smt. Nidhi Sharma -
Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak -

Discipline Specific Elective (DSE-IV)
B. Sc. Semester - VII (2025 - 2026)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VII		Session:2024-2025
1	Course Code			
2	Course Title	**Discrete Mathematics**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** 1. The course aims at introducing the concepts of Lattices, sub Lattices and Homomorphisms between Lattices. 2. Understand the uses of Boolean algebra in daily life. 3. Understand the uses of grammar and languages in daily life. 4. Learn about the Finite state machines in different fields. 5. Solve real-life problems using finite-state and Tuning machines.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks:30

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Hours
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.	12
II	**Boolean Algebra**: Boolean Algebra, Boolean Algebra as Lattice. Various Boolean Identities. Boolean Functions, The Switching Algebra example, Sub-algebras.	12
III	**Grammars, Languages**: Phrase-structure Grammars. Rewriting rules. Derivations. Sentential forms. Language generated by a Grammar. Regular, Context-Free and Context Sensitive Grammars and Languages.	12
IV	**Regular sets:** 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.	12
V	**Finite state machines** –Equivalent machines. Finite state machines as language reco Automata. Acceptors. Non-deterministic Finite Automata and equivalence of its power of Deterministic Finite Automata. Moore and mealy Machines. Turing Machine and Pa Functions.	12

Text Books, Reference Books, Other Resources
Reference: 1. Elements of Discrete Mathematics By C. L. Liu. 2. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997. 3. C. L Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co. 4. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. Prentice Hall of India. 5. J. L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York. 6. Seymour Lepschutz, Finite Mathematics (International) edition 1983), McGraw-Hill Book Company, New York. 7. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co. **Online Resources: (e- Resources/ e- Books/ e- Learning Portals)** 16. https://onlinecourses.nptel.ac.in 17. https://swayam.gov.in 18. https://epgp.inflibnet.aci.in 19. https://www.mooc.org

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: **Maximum Marks:** **75 Marks** **Continuous Comprehensive Evaluation (CCE):** **15 Marks** **Semester End Exam (SEE):** **60 Marks**		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati
Subject Expert - Dr. Madhu Shrivastava
Subject Expert - Dr. Shabnam Khan
Subject Expert - Dr. S. K. Bhatt
Representative Members

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- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty Members –

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Dr. Rakesh Tiwari –
Dr. (Smt.) Prachi Singh –
Dr. Shobha Rani –
Smt. Nidhi Sharma -
Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak -

B. Sc. Semester – VII
Practical – Latex

Part A: Introduction			
Program: Bachelor in Science (Certificate/Diploma/Degree/Honors)			Session: 2025-2026
1	Course Code		
2	Course Title	**Introduction to LATEX**	
3	Pre-requisite (if, any)	Basic understanding of document editing, familiarity with markup languages, and willingness to learn LaTeX syntax and formatting conventions.	
4	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	1 Credits	*Credit = 15 Hours – Theoretical learning and = ~~15~~ Hours Laboratory or Field learning/Training*
7	Total Marks	Max. Marks: 25	

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 Hours**
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, 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	15

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/		
Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 25 Marks		
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on learned skill - 05 Marks B. Spotting based on tools (written) – 15 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Coordinator as per skilling

Chairperson / H.O.D - Dr. Padmavati – Subject Expert - Dr. Madhu Shrivastava 26-04-25 Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt- **Representative Members** • Dr. Anil Kashyap – • Shri A. K. Pandey – • Dr. Mayur Puri Goswami -	**Faculty Members** Dr. Rakesh Tiwari – Dr. (Smt.) Prachi Singh – Dr. Shobha Rani – Smt. Nidhi Sharma - Ku. Ambalika Chouhan - Ku. Bijma Kumari – Ku. Deepak-

DEPARTMENT OF MATHEMATICS

B. Sc. Semester VIII (DSC)

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VIII		Session: 2025-2026
1	Course Code			
2	Course Title	**Advanced Abstract Algebra II**		
3	Course Type	Discipline Specific Course **(DSC)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Recall group properties, focusing on normal series and their role in the Jordan-Hölder Theorem. • Understand field extensions including algebraic, transcendental, separable, inseparable, and normal extensions. • Apply Galois theory to solve equations by radicals, emphasizing general equation evaluation. • Analyze linear transformations, including canonical forms, nilpotent transformations, Jordan blocks, and Jordan forms. • Study modules, Noetherian and Artinian modules with examples, Hilbert basis theorem, and Wedderburn-Artin theorem.		
5	Credit Value	**3 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks: 30

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Hours
I	**Modules:** Cyclic modules, Simple modules, Semi-simple modules, Schur's Lemma, Free modules.	09
II	**Rings:** Noetherian and Artinian modules, Hilbert basis theorem, Wedderburn-Artin theorem, Uniform modules, Primary modules.	09
III	**Linear Transformations:** Algebra of linear transformations, Singular and non-singular transformations, Characteristic roots, Matrices and linear transformations.	09
IV	**Canonical Forms:** Similarity of linear transformations, Invariant subspaces, Reduction to triangular forms, Nilpotent transformations, Index of Nilpotency, Invariants of a nilpotent transformation, The primary decomposition theorem,	09
V	**Advanced Forms:** Jordan blocks and Jordan forms, Smith normal form over a principal ideal domain and rank, Fundamental structure theorem for finitely generated modules over a Principal ideal domain and its applications to finitely generated abelian groups.	09

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

1. P. B. Bhattacharya, S. K. Jain, S. R. Nagpaul : Basic Abstract Algebra, Cambridge University press.
2. I. N.Herstein : Topics in Algebra, Wiley Eastern Ltd.
3. Quazi Zameeruddin and Surjeet Singh : Modern Algebra

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava 26-04-25

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

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Faculty members –

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Ku. Bijma Kumari –

Ku. Deepak -

B. Sc. Semester VIII
Paper – DSE – I

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VIII		Session:2025-2026
1	Course Code			
2	Course Title	**Real Analysis II**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Recall sequences and series of functions, focusing on their convergence and various convergence tests. • Understand the Riemann and Stieltjes integrals, emphasizing their properties and applications. • Explore the concepts of measures, measurable sets, Borel measures, and Lebesgue measures, highlighting their significance in analysis.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks:30

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**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.	**12**
II	**Lebesgue Measure and Integration:** Lebesgue outer measure, Measurable sets, Regularity, Measurable functions, Borel and Lebesgue measurability.	**12**
III	**Integration Theory:** Non-measurable sets, Integration of non-negative functions, The general integral, Integration of series, Measures and outer measures.	**12**
IV	**Measure Spaces:** Extension of a measure, Uniqueness of extension, Completion of a measure, Measure spaces, Integration with respect to a measure.	**12**
V	**Advanced Differentiation and Integration:** The four derivatives, Functions of bounded variation, Lebesgue differentiation theorem, Differentiation and integration, The Lp-spaces, Convex functions, Jensen's inequality, Holder and Minkowski inequalities, Completeness of Lp, Convergence in measure, Almost uniform convergence.	**12**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

1. Principle of Mathematical Analysis By Walter Rudin McGraw-Hill, Kogakusha,1976, International student edition.
2. Real Analysis By H.L. Roydon Macmillan Pub.Co.Inc.4th Edition, New York .1962.
3. T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.
4. Gabriel Klambauer, Mathematical Analysis, Marcel Dekkar,Inc. New York,1975.
5. A. J. White, Real Analysis; an introduction, Addison-Wesley Publishing Co.,Inc.,1968.
6. G. de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.
7. E. Hewitt and K. Stromberg. Real and Abstract Analysis, Berlin, Springer, 1969.
8. P. K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International
9. Limited Published, New Delhi, 1986 Reprint 2000).
10. I. P. Natanson, Theory of Functions of a Real Variable. Vol. I, Frederick UngarPublishing Co., 1961.

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –
Subject Expert - Dr. Madhu Shrivastava
Subject Expert - Dr. Shabnam Khan 26-04-25
Subject Expert - Dr. S. K. Bhatt

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Ku. Ambalika Chouhan -
Ku. Bijma Kumari –
Ku. Deepak-

B. Sc. Semester VIII
Paper – DSE – II

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VIII		Session:2025-2026
1	Course Code			
2	Course Title	**Topology II**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Recall the concepts of topology, focusing on fundamental principles and applications. • Apply separation axioms, connectedness, compactness and related topics in topological spaces. • Understand the product topology, embedding theorems, metrization theorems and paracompactness. • Analyze advanced topics including nets, filters, ultrafilters.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks:30

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
I	**Product Topology:** Product spaces, Projection maps, Tychonoff product topology in terms of standard sub-base and its characterizations, Connectedness and product spaces, Compactness and product spaces (Tychonoff's theorem), Countability and product spaces.	**12**
II	**Embedding and Metrization:** Embedding and metrization, Embedding lemma and Tychonoff embedding, The Urysohn metrization theorem, Local finiteness.	**12**
III	**Nets:** Directed Set, Nets, Topology and convergence of nets, Hausdorffness and nets, Compactness and nets, Finite Intersection Property.	**12**
IV	**Filters:** Filters and their convergence, Canonical way of converting nets to filters and vice-versa, Ultrafilters and compactness.	**12**
V	**Advanced Topological Theorems:** Paracompactness, The Nagata-Smirnov metrization theorem, The Smirnov metrization theorem.	**12**

Part C - Learning Resource

Text Books, Reference Books, Other Resources

Text Book:

K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.

Reference:

1. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall ofIndia Pvt. Ltd.).
2. George F. Simmons, Introduction to Topology and modern Analysis, McGraw-Hill BookCompany, 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.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

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

Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**75 Marks**
Continuous Comprehensive Evaluation (CCE):	**15 Marks**
Semester End Exam (SEE):	**60 Marks**

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

Chairperson / H.O.D - Dr. Padmavati –

Subject Expert - Dr. Madhu Shrivastava

Subject Expert - Dr. Shabnam Khan

Subject Expert - Dr. S. K. Bhatt

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- Shri A. K. Pandey –
- Dr. Mayur Puri Goswami -

Faculty members –

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Smt. Nidhi Sharma -

Ku. Ambalika Chouhan -

Ku. Bijma Kumari –

Ku. Deepak -

B. Sc. Semester VIII
Paper – DSE – III

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VIII		Session:2025-2026
1	Course Code			
2	Course Title	**Complex Analysis II**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	Course Learning Outcome (CLO)	**This Course will enable the students to:** • Recall the concept of analyticity, focusing on the Cauchy-Riemann equations and their consequences, including results on harmonic and entire functions and the fundamental theorem of algebra. • Understand the application of power series, particularly in the expansion of analytic functions. • Analyze conformal mapping, bilinear transformations, and their properties in complex analysis. • Apply the Cauchy residue theorem to evaluate integrals and sum series, explore analytic continuation and its properties, and study canonical products in complex analysis.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks : 75		Minimum Passing Marks:30

Part B: Content of the Course

Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)

Unit	Topics (COURSE CONTENTS)	No. of Hours
I	Gamma function and its properties, Riemann Zeta function, Riemann's functional equation, Runge's theorem, Mittag-Leffler's theorem.	12
II	Analytic Continuation, Uniqueness of direct analytic continuation, Uniqueness of analytic continuation along a curve, Power series method of analytic continuation, Schwarz Reflection principle.	12
III	Monodromy theorem and its consequences, Harmonic functions on a disk, Harnack's inequality and theorem.	12
IV	Dirichlet Problem, Green's function, Canonical products, Jensen's formula, Poisson-Jensen formula, Hadamard's three circles theorem.	12
V	Order of an entire function, Exponent of Convergence, Borel's theorem, Hadamard's factorization theorem, The range of an analytic function, Bloch's theorem, The Little Picard theorem, Schottky's theorem, Montel Caratheodory and the Great Picard theorem, Univalent functions, Bieberbach's conjecture (Statement only) and the "1/4-theorem".	12

Part C - Learning Resource

Reference:

1. L.V. Ahlfors: Complex Analysis, McGraw - Hill, 1979.
2. D. Sarason: Complex Function Theory, Hindustan Book Agency, Delhi, 1994.
3. H. K. Pathak, Complex Analysis and Applications, Springer, 2019.
4. H. A. Priestly, Introduction to Complex Analysis, Clarendon Press, Oxford 1990.
5. Liang-shin Hahn & Bernard Epstein, Classical Complex Analysis, Jones and Bartlett Publishers International, London, 1996.
6. S. Lang, Complex Analysis, Addison Wesley, 1977.
7. W. H. J. Fuchs, Topics in the Theory of Functions of one Complex Variable, D. Van Nostrand Co., 1967.
8. C. Caratheodory, Theory of Functions (2 Vols.) Chelsea Publishing Company, 1964.
9. Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.
10. S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

5. https://onlinecourses.nptel.ac.in
6. https://swayam.gov.in
7. https://epgp.inflibnet.aci.in
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Part D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:		
Maximum Marks:	**75 Marks**	
Continuous Comprehensive Evaluation (CCE):	**15 Marks**	
Semester End Exam (SEE):	**60 Marks**	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Internal Test – 15 Marks + Assignment/ Seminar – one of 15 Marks	Best of Test and Assignment shall be considered against 15 marks
Semester End Exam (SEE)	Pattern -**FOUR Question** A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice. Question-A & B (Compulsory): Very short answer type question (2 each) 02 x 5 = 10 Marks Question-C: Short answer type questions 03 x 5 = 15 Marks Question-D: Long answer type questions 07 x 5 = 35 Marks **Total = 60 Marks**	

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Ku. Bijma Kumari –
Ku. Deepak -

B. Sc. Semester VIII
Paper – DSE – IV

Part A: Introduction				
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc. Semester – VIII		Session:2025-2026
1	Course Code			
2	Course Title	**Graph Theory**		
3	Course Type	Discipline Specific Elective **(DSE)**		
4	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.		
5	Credit Value	**4 Credits**	**1 credit =15 Hours – Learning and Observation**	
6	Total Marks	Maximum Marks :75		Minimum Passing Marks:30

Part B: Content of the Course		
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)		
Unit	**Topics (COURSE CONTENTS)**	**No. of Hours**
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.	**12**
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.	**12**
III	**Weighted Graphs and Algorithms** Weighted graph, travelling salesman problem, shortest path. Dijkstra's algorithm.	**12**
IV	**Cut-Sets and Connectivity** Cut-set of a graph and its properties. Fundamental circuits and cut-sets. Cut-vertices, connectivity and separability. Network flows.	**12**
V	**Trees and Spanning Trees** Definition and properties of trees. Rooted and binary trees. Cayley's theorem on counting trees. Spanning tree. Minimal spanning trees in a connected graph.	**12**

Part C - Learning Resource

Reference:

1. Elements of Discrete Mathematics By C. L. Liu.
2. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1997.
3. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Book Co.
4. N. Deo. Graph Theory with Application to Engineering and Computer Sciences. PrenticeHall of India.
5. J. L. Gersting, Mathematical Structures for Computer Science, (3rd edition), ComputerScience Press, New York.
6. Seymour Lepschutz, Finite Mathematics (International) edition 1983), McGraw-HillBook Company, New York.
7. S.Wiitala, Discrete Mathematics-A Unified Approach, McGraw-Hill Book Co.

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26-04-25

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