

DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM & MARKING SCHEME

B.Sc. VII & VIII Semester

MATHEMATICS

(Based on Choice Based Credit System)

SESSION : 2024-25



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. PG. AUTONOMOUS COLLEGE, DURG

SYLLABUS for B.Sc. Semester – VII

The syllabus with the paper combinations and Marking Scheme for the session 2024-2025.

Title	Paper Code	Title of the Paper	Theory	Credit
Core Course (DSC)		Advance Abstract Algebra I	100	4
Discipline Specific Elective (DSE)		Advance Real Analysis I	100	4
Discipline Specific Elective (DSE)		General Topology I	100	4
Discipline Specific Elective (DSE)		Complex Analysis I	100	4
Discipline Specific Elective (DSE)		Discrete Mathematics	100	4

The syllabus for B.Sc. Semester - VII is hereby approved by the members of Board of Studies for the session 2024-25.

In case any change or modification is prescribed by Central Board of Studies or Higher Education Dept., Govt. of Chhattisgarh with respect to content or distribution of marks 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 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami	Faculty members: Dr. M.A. Siddiqui - Dr. Rakesh Tiwari - Dr. (Smt.) Prachi Singh -
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSC

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	Advanced Abstract Algebra	
3	Course Type	Discipline Specific Course (DSC)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> Remember properties of group especially normal series and use of series in JordanHolder 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 theorem and Wedderburn Artin theorem. Analyze Linear transformation, canonical form and nilpotent transformation, understand Jordan blocks and Jordan forms, Smith normal form and rational canonical form. 	
5	Credit Value	4 Credits	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	Groups: Normal and Subnormal Series, Composition Series, Jordan-Holder Theorem, Solvable Groups, Nilpotent Groups.	12	
II	Group Automorphism, Conjugacy Relation, Class Equation of Finite Group, Cauchy Theorem and Sylow Theorem.	12	
III	Field Theory - Extensions: Extension Fields, Algebraic and Transcendental Extensions, Separable and Inseparable Extensions, Algebraically Closed Fields.	12	
IV	Specialized Fields and Elements: Perfect Fields, Finite Fields, Primitive Elements, Normal Extensions and Splitting Fields.	12	
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.	12	

[Signature] 16/07/24 [Signature] 6.7.24 [Signature] 6-07-24 [Signature] 6/7/24

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Padmavati</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>mmits/6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan</p> <p>Subject Expert - Dr. S. K. Bhatt <i>Shabnam 6.7.24</i></p> <p>Representative Members</p> <ol style="list-style-type: none">1. Dr. Anil Kashyap -2. Shri A. K. Pandey -3. Dr. Mayur Puri Goswami - <i>MPG</i>	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>MS</i></p> <p>Dr. Rakesh Tiwari - <i>RT</i></p> <p>Dr. (Smt.) Prachi Singh - <i>PS</i></p>
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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://epqp.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)	<p>Pattern -FOUR Question A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice.</p> <p>Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks</p> <p>Question-C: Short answer type questions 05 x 5 = 25 Marks</p> <p>Question-D: Long answer type questions 07 x 5 = 35 Marks</p> <p>Total = 80 Marks</p>	

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati Subject Expert - Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt Representative Members <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - 	Faculty members: Dr. M.A. Siddiqui - Dr. Rakesh Tiwari - Dr. (Smt.) Prachi Singh -
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GOVT. V.V.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

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	Advance Real Analysis I	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> 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
Part B: Content of the Course			
Total no. of Teaching/ Learning Periods = 60 Periods (60 Hours)			
Unit	Topics (COURSE CONTENTS)		No. of Periods
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

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Pad 6/7/24</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>MH 6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan</p> <p>Subject Expert - Dr. S. K. Bhatt <i>SB 6.7.24</i></p> <p>Representative Members</p> <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>MPG 6/07/24</i> 	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>MS</i></p> <p>Dr. Rakesh Tiwari - <i>RT</i></p> <p>Dr. (Smt.) Prachi Singh - <i>PS</i></p>
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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 Limited Published, New Delhi, 1986 Reprint 2000).
10. I. P. Natanson, Theory of Functions of a Real Variable. Vol. I, Frederick Ungar Publishing Co., 1961.

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: 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	

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati <i>Padma 6.7.24</i> Subject Expert - Dr. Madhu Shrivastava <i>Mshrivast/6-07-24</i> Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt <i>S.K.Bhatt-6.7.24</i> Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>MAYUR 06/07/24</i>	Faculty members: Dr. M.A. Siddiqui - <i>MS</i> Dr. Rakesh Tiwari - <i>R.Tiwari</i> Dr. (Smt.) Prachi Singh - <i>Prachi</i>
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

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	Topology I	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> Remember the concept of topology and algebraic topology. Apply the concept of separation axioms, connectedness, compactness and related topics. Understand the product topology, embedding, metrization and paracompactness. Analyze Nets, Filters and ultra filters. Fundamental group and covering spaces. 	
5	Credit Value	4 Credits	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	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	

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Padmavati</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>Madhu/6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan</p> <p>Subject Expert - Dr. S. K. Bhatt <i>S.K.Bhatt 6.7.24</i></p> <p>Representative Members</p> <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>MPG</i> 	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>MA Siddiqui</i></p> <p>Dr. Rakesh Tiwari - <i>Rakesh Tiwari</i></p> <p>Dr. (Smt.) Prachi Singh - <i>Prachi Singh</i></p>
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Part C - Learning Resource**Reference:**

1. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.
2. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
3. George F. Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
4. J. Hocking and G Young, Topology, Addison-Wiley Reading, 1961.
5. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1995.

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

1. <https://onlinecourses.nptel.ac.in>
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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)	<p>Pattern -FOUR Question A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice.</p> <p>Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks</p> <p>Question-C: Short answer type questions 05 x 5 = 25 Marks</p> <p>Question-D: Long answer type questions 07 x 5 = 35 Marks</p> <p style="text-align: right;">Total = 80 Marks</p>	

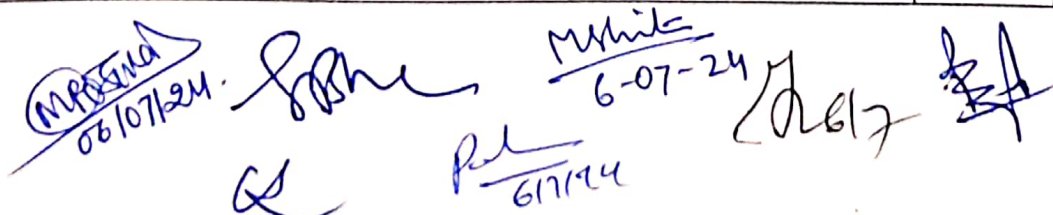
Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati Subject Expert - Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt Representative Members <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - 	Faculty members: Dr. M.A. Siddiqui - Dr. Rakesh Tiwari - Dr. (Smt.) Prachi Singh -
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

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	Complex Analysis I	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> 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, analyticcontinuation and its properties, canonical products, Little picard theorem, Monteltheorem etc. 	
5	Credit Value	4 Credits	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	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 Classification, Meromorphic Functions.		12
III	Advanced Topics in Complex Analysis: Argument Principle, Rouché'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^n).		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



 M.P.S.INDA 06/07/24
 M. White 6-07-24
 Pul 6/17/24

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Pl. Anil</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>MShrivast/6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan</p> <p>Subject Expert - Dr. S. K. Bhatt <i>SKB 6.7.23</i></p> <p>Representative Members</p> <ol style="list-style-type: none">1. Dr. Anil Kashyap -2. Shri A. K. Pandey -3. Dr. Mayur Puri Goswami - <i>MPG</i>	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>MS</i></p> <p>Dr. Rakesh Tiwari - <i>RT</i></p> <p>Dr. (Smt.) Prachi Singh - <i>PS</i></p>
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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)

1. <https://onlinecourses.nptel.ac.in>
2. <https://swayam.gov.in>
3. <https://epqp.inflibnet.aci.in>
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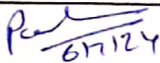
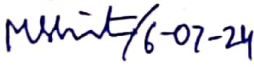


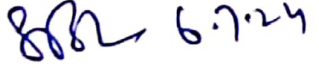

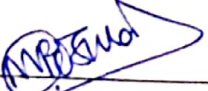
Part D: Assessment and Evaluation

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	

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati 	Faculty members:
Subject Expert - Dr. Madhu Shrivastava 	Dr. M.A. Siddiqui - 
Subject Expert - Dr. Shabnam Khan	Dr. Rakesh Tiwari - 
Subject Expert - Dr. S. K. Bhatt 	Dr. (Smt.) Prachi Singh - 
Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - 	

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG

FOUR YEAR UNDERGRADUATE PROGRAM

DEPARTMENT OF MATHEMATICS

COURSE CURRICULUM 2024-25

DSE

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)	<p>This Course will enable the students to:</p> <ol style="list-style-type: none"> 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 Turing machines. 				
5	Credit Value	4 Credits	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	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 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.	12

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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. Prentice Hall of India.
5. J. L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
6. Seymour Lipschutz, 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)

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

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati Subject Expert - Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami -	<i>Pad</i> 6/7/24 <i>Mushil</i> 6-07-24 <i>S.K. Bhatt</i> 6.7.24 <i>MPG</i>	Faculty members: Dr. M.A. Siddiqui - <i>MS</i> Dr. Rakesh Tiwari - <i>RT</i> Dr. (Smt.) Prachi Singh - <i>PS</i>
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DEPARTMENT OF MATHEMATICS
GOVT. V.Y. T. PG. AUTONOMOUS COLLEGE, DURG
SYLLABUS for B.Sc. Semester – VIII

The syllabus with the paper combinations and Marking Scheme for the session 2024-2025.

Title	Paper No.	Title of the Paper	Marks Allotted		Credit
			Theory	Practical / Project	
Core Course (DSC)	BMT101	Advance Abstract Algebra II	100		4
Discipline Specific Elective (DSE)		Advance Real Analysis II	100		4
Discipline Specific Elective (DSE)		General Topology II	100		4
Discipline Specific Elective (DSE)		Complex Analysis II	100		4
Discipline Specific Elective (DSE)		Graph Theory	100		4
Research Project/ Dissertation				100	12

The syllabus for **B.Sc. Semester - VIII** is hereby approved by the members of Board of Studies for the session 2024-25.

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

Name & Signature:

Chairperson / H.O.D - Dr. Padmavati <i>Pad 6/7/24</i>	Faculty members:
Subject Expert - Dr. Madhu Shrivastava <i>MShrivastava/6-07-24</i>	Dr. M.A. Siddiqui <i>MS</i>
Subject Expert - Dr. Shabnam Khan	Dr. Rakesh Tiwari - <i>Rakesh</i>
Subject Expert - Dr. S. K. Bhatt <i>S.K. Bhatt 6.7.24</i>	Dr. (Smt.) Prachi Singh - <i>Prachi</i>
Representative Members	
1. Dr. Anil Kashyap -	
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami - <i>MPG 6/6/24</i>	

GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSC

Part A: Introduction			
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)	Class: B.Sc.	Semester – VIII	Session:2024-2025
1	Course Code		
2	Course Title	Advanced Abstract Algebra II	
3	Course Type	Discipline Specific Course (DSC)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> 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	4 Credits	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	Modules: Cyclic modules, Simple modules, Semi-simple modules, Schur's Lemma, Free modules.		12
II	Rings: Noetherian and Artinian modules, Hilbert basis theorem, Wedderburn-Artin theorem, Uniform modules, Primary modules.		12
III	Linear Transformations: Algebra of linear transformations, Singular and non-singular transformations, Characteristic roots, Matrices and linear transformations.		12
IV	Canonical Forms: Similarity of linear transformations, Invariant subspaces, Reduction to triangular forms, Nilpotent transformations, Index of Nilpotency.		12
V	Advanced Forms: Invariants of a nilpotent transformation, The primary decomposition theorem, 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.		12

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Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Padma 07/12/24</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>MShriv/6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan</p> <p>Subject Expert - Dr. S. K. Bhatt <i>S.K.Bhatt 6.7.24</i></p> <p>Representative Members</p> <ol style="list-style-type: none">1. Dr. Anil Kashyap -2. Shri A. K. Pandey -3. Dr. Mayur Puri Goswami - <i>MPG</i>	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>M.A. Siddiqui</i></p> <p>Dr. Rakesh Tiwari - <i>Rakesh Tiwari</i></p> <p>Dr. (Smt.) Prachi Singh - <i>Prachi Singh</i></p>
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Part C - Learning Resource

Text Books, Reference Books, Other Resources

Reference:

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


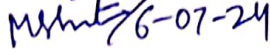


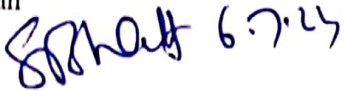


Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. <https://onlinecourses.nptel.ac.in>
2. <https://swayam.gov.in>
3. <https://epqp.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

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati 	Faculty members:
Subject Expert - Dr. Madhu Shrivastava  6-07-24	Dr. M.A. Siddiqui – 
Subject Expert - Dr. Shabnam Khan	Dr. Rakesh Tiwari – 
Subject Expert - Dr. S. K. Bhatt  6.7.24	Dr. (Smt.) Prachi Singh – 
Representative Members	
1. Dr. Anil Kashyap -	
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami - 	



GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

Part A: Introduction		Session: 2024-2025
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)	Class: B.Sc.	Semester – VIII
1 Course Code	Advance Real Analysis II	
2 Course Title	Discipline Specific Elective (DSE)	
3 Course Type		
4 Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> Recall sequences and series of functions, focusing on their convergence and various convergence tests. Analyze functions of several variables, including derivatives in open subsets, higher-order derivatives, partition of unity, and Stokes' Theorem. 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 :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	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 L_p -spaces, Convex functions, Jensen's inequality, Holder and Minkowski inequalities, Completeness of L_p , Convergence in measure, Almost uniform convergence.	12

Name & Signature of Members of Board of Studies:	
<p>Chairperson / H.O.D - Dr. Padmavati <i>[Signature]</i> 6/7/24</p> <p>Subject Expert - Dr. Madhu Shrivastava <i>[Signature]</i> 6-07-24</p> <p>Subject Expert - Dr. Shabnam Khan <i>[Signature]</i> 6.7.24</p> <p>Subject Expert - Dr. S. K. Bhatt <i>[Signature]</i> 6.7.24</p> <p>Representative Members</p> <p>1. Dr. Anil Kashyap - <i>[Signature]</i></p> <p>2. Shri A. K. Pandey - <i>[Signature]</i></p> <p>3. Dr. Mayur Puri Goswami - <i>[Signature]</i> 06/07/24</p>	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>[Signature]</i></p> <p>Dr. Rakesh Tiwari - <i>[Signature]</i></p> <p>Dr. (Smt.) Prachi Singh - <i>[Signature]</i></p>

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 Limited Published, New Delhi, 1986 Reprint 2000).
10. I. P. Natanson, Theory of Functions of a Real Variable. Vol. I, Frederick Ungar Publishing Co., 1961.

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

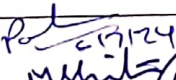
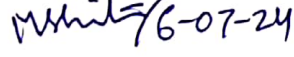
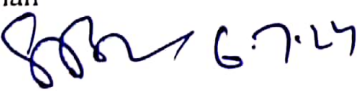


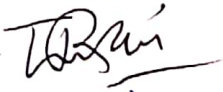

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2. <https://swayam.gov.in>
3. <https://epqp.inflibnet.aci.in>
4. <https://www.mooc.org>

Part D: Assessment and Evaluation**Suggested Continuous Evaluation Methods:**

Maximum Marks:	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

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati  Subject Expert - Dr. Madhu Shrivastava  6-07-24 Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt  6.7.24 Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - 	Faculty members: Dr. M.A. Siddiqui -  Dr. Rakesh Tiwari -  Dr. (Smt.) Prachi Singh - 
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

Part A: Introduction			
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc.	Semester – VIII Session:2024-2025
1	Course Code		
2	Course Title	Topology II	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> Recall the concepts of topology and algebraic 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, fundamental groups, covering spaces, and their related theorems in algebraic topology. 	
5	Credit Value	4 Credits	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	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

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati Subject Expert - Dr. Madhu Shrivastava Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami -</p>	<p>Faculty members: Dr. M.A. Siddiqui - Dr. Rakesh Tiwari - Dr. (Smt.) Prachi Singh -</p>
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Part C - Learning Resource**References:**

1. K. D. Joshi, Introduction to General Topology, Wiley Eastern Ltd., 1983.
2. J. Dugundji, Topology, Allyn and Bacon, 1966 (reprinted in India by Prentice Hall of India Pvt. Ltd.).
3. George F. Simmons, Introduction to Topology and modern Analysis, McGraw-Hill Book Company, 1963.
4. J. Hocking and G. Young, Topology, Addison-Wiley Reading, 1961.
5. J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1955.

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

1. <https://onlinecourses.nptel.ac.in>
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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)	<p>Pattern -FOUR Question A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice.</p> <p>Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks</p> <p>Question-C: Short answer type questions 05 x 5 = 25 Marks</p> <p>Question-D: Long answer type questions 07 x 5 = 35 Marks</p> <p>Total = 80 Marks</p>	

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati <i>Pad 6/17/24</i> Subject Expert - Dr. Madhu Shrivastava <i>MShriv/6-07-24</i> Subject Expert - Dr. Shabnam Khan Subject Expert - Dr. S. K. Bhatt <i>S.K.Bhatt 6.7.24</i> Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>M.P.Goswami</i>	Faculty members: Dr. M.A. Siddiqui - <i>M.A. Siddiqui</i> Dr. Rakesh Tiwari - <i>Rakesh Tiwari</i> Dr. (Smt.) Prachi Singh - <i>Prachi Singh</i>
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE

Part A: Introduction			
	Program Bachelor's in science (Certificate /Diploma / Degree Honors)	Class: B.Sc.	Semester – VIII Session:2024-2025
1	Course Code		
2	Course Title	Complex Analysis II	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> 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 :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	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	

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>[Signature]</i> Subject Expert - Dr. Madhu Shrivastava <i>[Signature]</i> 6-7-24 Subject Expert - Dr. Shabnam Khan <i>[Signature]</i> Subject Expert - Dr. S. K. Bhatt <i>[Signature]</i> 6.7.24 Representative Members 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>[Signature]</i></p>	<p>Faculty members: Dr. M.A. Siddiqui - <i>[Signature]</i> Dr. Rakesh Tiwari - <i>[Signature]</i> Dr. (Smt.) Prachi Singh - <i>[Signature]</i></p>
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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. Carathéodory, 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)

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| 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)	<p>Pattern -FOUR Question A, B, C, D from each unit. Question A and B are compulsory. Question C and D have internal choice.</p> <p>Question-A & B (Compulsory): Very short answer type question (2 each) 04 x 5 = 20 Marks</p> <p>Question-C: Short answer type questions 05 x 5 = 25 Marks</p> <p>Question-D: Long answer type questions 07 x 5 = 35 Marks</p> <p style="text-align: right;">Total = 80 Marks</p>	

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>Padmavati 6-7-24</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>MShrivastava/6-07-24</i></p> <p>Subject Expert - Dr. Shabnam Khan <i>Shabnam 6-7-24</i></p> <p>Subject Expert - Dr. S. K. Bhatt <i>S.K. Bhatt 6-7-24</i></p> <p>Representative Members</p> <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>M.P. Goswami</i> 	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>M.A. Siddiqui</i></p> <p>Dr. Rakesh Tiwari - <i>Rakesh Tiwari</i></p> <p>Dr. (Smt.) Prachi Singh - <i>Prachi Singh</i></p>
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GOVT. V.Y.T.PG AUTONOMOUS COLLEGE DURG
FOUR YEAR UNDERGRADUATE PROGRAM
DEPARTMENT OF MATHEMATICS
COURSE CURRICULUM 2024-25

DSE			
Part A: Introduction			
Program: Bachelor's in science (Certificate /Diploma / Degree/Honors)		Class: B.Sc.	Semester – VIII Session:2024-2025
1	Course Code		
2	Course Title	Graph Theory	
3	Course Type	Discipline Specific Elective (DSE)	
4	Course Learning Outcome (CLO)	<p>This Course will enable the students to:</p> <ul style="list-style-type: none"> 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 :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	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	

Name & Signature of Members of Board of Studies:

<p>Chairperson / H.O.D - Dr. Padmavati <i>[Signature]</i></p> <p>Subject Expert - Dr. Madhu Shrivastava <i>[Signature]</i> 12/4 06-07-24</p> <p>Subject Expert - Dr. Shabnam Khan <i>[Signature]</i></p> <p>Subject Expert - Dr. S. K. Bhatt <i>[Signature]</i> 07/21</p> <p>Representative Members</p> <ol style="list-style-type: none"> 1. Dr. Anil Kashyap - 2. Shri A. K. Pandey - 3. Dr. Mayur Puri Goswami - <i>[Signature]</i> 06/07/24 	<p>Faculty members:</p> <p>Dr. M.A. Siddiqui - <i>[Signature]</i></p> <p>Dr. Rakesh Tiwari - <i>[Signature]</i></p> <p>Dr. (Smt.) Prachi Singh - <i>[Signature]</i></p>
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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. Prentice Hall of India.
5. J. L. Gersting, Mathematical Structures for Computer Science, (3rd edition), Computer Science Press, New York.
6. Seymour Lipschutz, 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)

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:	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

Name & Signature of Members of Board of Studies:

Chairperson / H.O.D - Dr. Padmavati <i>Padmavati 21/7/24</i>	Faculty members:
Subject Expert - Dr. Madhu Shrivastava <i>M Shrivastava (6-07-24)</i>	Dr. M.A. Siddiqui - <i>[Signature]</i>
Subject Expert - Dr. Shabnam Khan	Dr. Rakesh Tiwari - <i>[Signature]</i>
Subject Expert - Dr. S. K. Bhatt <i>S.K. Bhatt 6.7.24</i>	Dr. (Smt.) Prachi Singh - <i>[Signature]</i>
Representative Members	
1. Dr. Anil Kashyap -	
2. Shri A. K. Pandey -	
3. Dr. Mayur Puri Goswami - <i>[Signature]</i>	