SYLLABUS FOR

THE FOUR-YEAR UNDERGRADUATE PROGRAMME (FYUGP)

As per provision of NEP-2020 to be implemented from Academic Year 2022 onwards

THIRD- SEMESTER

FOURTH- SEMESTER

Session 2024-25

DEPARTMENT OF MATHEMATICS

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE,

RAJNANDGAON (C.G.)

Department of Mathematics

List of members of Board of Studies

1. **Dr. (SMT) Shabnam Khan (Chairman)-**

   H.O.D. Department of Mathematics

   Govt. Digvijay Autonomous P.G. College, Rajnandgaon
2. **Dr. Rajesh Pandey (V.C. Nominee) –**

   Additional Director, Higher Education Department, Durg Division
3. **Dr. C.L. Dewangan (Principal Nominee) -** Online

   Additional Director, Regional Office, Raipur Division
4. **Dr. Pushpa Kaushik (Principal Nominee) -** 18.05.24

   Govt. J. Yoganandam Chhattisgarh College, Raipur
5. **Dr. K.K. Dewangan (Member)**
6. **Dr. Hemant Kumar Sao (Member)** 18/5/24
7. **Dr. Kavita Sakure (Member)** 18.5.24
8. **Mr. Rajkumar Jain (Industrialist)** 18/05/2024
9. **Miss Prakshi Nayak (Ex-student)** – Online

B. SC. (Multiple Major) - DIPLOMA COURSE (session 2023-24)
Major 1- Mathematics

	SEMESTER	COURSE TYPE	COURSE CODE	PAPER TITLE	CREDIT	Max Marks	ESE	IA
SECOND YEAR	III	DSC		Algebra and Mathematical Methods	4	100	80	20
		DSE		Numerical Methods	4	100	80	20
		SEC		Logic and Sets	2	50	40	10
	IV	DSC		Real Analysis	4	100	80	20
		DSE		Discrete Mathematics	4	100	80	20
		SEC		SCILAB (Project)	2	50	--	10

ESE- End Semester Exam, IE-Internal Assessment

Instruction for Question paper setting

End Semester Exam (ESE) for DSC and DSE

There will be 03 sections of question of 80 marks.

Section A- section A will be very short answer type questions consisting 8 questions of 2 marks, two question from each unit.

Section B- section B will be short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.

Section C- section B will be long answer (Descriptive) type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice.

End Semester Exam (ESE) for SEC

There will be 8 questions of 8 marks each, out of which any 5 question to be answer. Total marks will be 40.

Minimum Pass Marks 40%

Section	Maximum Marks (80)		Maximum Marks (40)	
A	2 x 8 = 16	Very short answer type questions consisting 8 questions of 2 marks, two question from each unit.	8 x 5 = 40	8 questions of 8 mark each, out of which any 5 question to be answer.
B	6 x 4 = 24	Short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.		
C	10 x 4 = 40	long answer (Descriptive) type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice		

SYLLABUS OF 4 YEARS UG PROGRAM (FYUGP) IN MATHEMATICS, GOVT. DIGVIJAY AUTONOMOUS P G COLLEGE, RAJNANDGAON, AS PER NEP 2020 (SEMESTER-III AND IV)

Program Objective

Po1- It is to give foundation knowledge for the students to understand basics mathematics including applied aspect for the same.

Po2- It is to develop enhanced quantative skills and pursuing higher mathematics and research as well as.

Po3- Students will be able to develop solution –oriented approach towards various issues related to their environment.

Po4– Students will become employable in various governments, public and private sectors.

Po5- Scientific tempers in general and mathematical temper in particular will the developed in students.

Po6- Sufficient subject matter competence and enable students to prepare for various competitive examinations such as IIT-JAM, GATE, GRE, UGC-CSIR, NET/JRF and Civil Services Examinations.

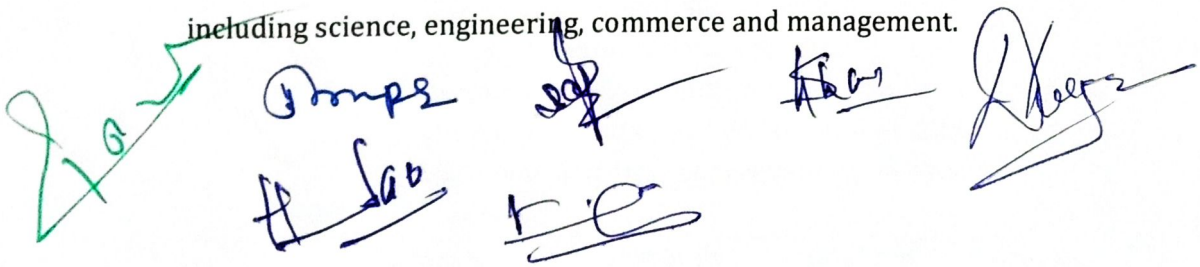
Program Specific Outcome (PSO)

PSO1- Student should be able to process recall basic idea about mathematics which can be displayed by them.

PSO2- Student should have adequate exposure to many aspects of mathematical sciences.

PSO3- Student is equipped with mathematical modeling ability, critical mathematical thinking and problem solving skill etc.

PSO4- Student should be able to apply their skills and knowledge in various fields of studies including science, engineering, commerce and management.



GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

B. SC. (Multiple Major) - DIPLOMA COURSE (session 2024-25)

Major 1- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **III**	Subject: **Mathematics**
Course Type: **DSC**	Course Code:
Course Title:	**Algebra and Mathematical Methods**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Algebra and Mathematical Methods**
Course Learning Outcome:	(i) Understand the concept of equivalence relations (ii) Learn about the fundamental concepts of groups, subgroups, normal subgroups, isomorphism theorems, cyclic and permutation groups. (iii) Compute limit and continuity of function of two variables (iv) Apply the formula that determines stationary paths of a functional to deduce the differential equations for stationary paths

Units	**Lectures**	**Lectures (15 x 4 = 60)**	**Credits**
		Part I : Algebra	
I	15	**Equivalence relations and Group:** Equivalence relations and partitions, Congruence modulo n, Definition of a group with examples and simple properties. Subgroups, Generators of a group, Cyclic group, Permutation groups, Even and odd permutations, The alternating group, Cayley's theorem, Direct products, Coset decomposition. Lagrange's theorem and its consequences, Fermat and Euler theorems	**1**
II	15	Normal subgroups. Quotient groups. Homomorphism and isomorphism. Fundamental theorem of homomorphism. Theorems on isomorphism. Rings, Subrings, Integral domains and fields, Characteristic of a ring, Ideal and quotient rings. Ring homomorphism, Field of quotient of an integral domain	**1**

		Part II : Mathematical Methods	
III	15	Limit and Continuity of functions of two variables, Differentiation of function of two variables, Necessary and sufficient condition for differentiability of functions two variables, Schwarz's and Young theorem, Taylor's theorem for functions of two variables with examples, Maxima and minima for functions of two variables, Lagrange multiplier method, Jacobians **Laplace transform** -Existence theorems for Laplace transform Linearity of Laplace transform and their properties. Laplace transform of the derivatives and integrals of a function, Convolution theorem inverse Laplace transforms, Solution of the differential equations using Laplace transforms	**1**
IV	15	**Fourier series** -Fourier series, Fourier expansion of piecewise monotonic functions. Half and full range expansions. Fourier transforms (finite and infinite), Fourier integral **Calculus of variations**-Variational problems with fixed boundaries Euler's equation for functionals containing first order derivative and one independent variable, Extremals, Functionals dependent on higher order derivatives, Functionals dependent on more than one independent variable, Variational problems in parametric form	**1**

List of Books	1. H.K.Dass, Rama Verma, Rajnish Verma, Mathematics: Algebra and Mathematical Methods, S.Chand and Company Limited. 2. Michael Artin (2014). *Algebra* (2nd edition). Pearson. 3. John B. Fraleigh (2007). *A First Course in Abstract Algebra* (7th edition). Pearson. 4. Stephen H. Friedberg, Arnold J.Insel& Lawrence E. Spence (2003). *Linear Algebra* (4th edition). Prentice-Hall of India Pvt. Ltd. 5. Joseph A. Gallian (2017). *Contemporary Abstract Algebra* (9th edition). Cengage. 6. I. N. Herstein (2006). *Topics in Algebra* (2nd edition). Wiley India. 7. Nathan Jacobson (2009). *Basic Algebra* I (2nd edition). Dover Publications. 8. Ramji Lal (2017). *Algebra 1: Groups, Rings, Fields and Arithmetic.* Springer. 9. Gabriel Klambauer (1986). Aspects of Calculus. Springer-Verlag. 10. James Stewart (2012). Multivariable Calculus (7th edition). Brooks/Cole.Cengage. 11. A. S. Gupta (2004). *Calculus of Variations with Applications.* PHI Learning.

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

B. SC. (Multiple Major) - DIPLOMA COURSE (session 2024-25)

Major 1- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **III**	Subject: **Mathematics**
Course Type: **DSE**	Course Code:
Course Title:	**Numerical Methods**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Numerical Methods**
Course Learning Outcome:	(i) Obtain numerical solutions of algebraic and transcendental equations. (ii) Find numerical solutions of system of linear equations and check the accuracy of the solutions. (iii) Learn about various interpolating and extrapolating methods. (iv) Solve initial and boundary value problems in differential equations using numerical methods.

Units	**Lectures**	**Lectures (15 x 4 = 60)**	**Credits**
I	**15**	**Numerical Methods for Solving Algebraic and Transcendental Equations** Absolute, relative and percentage errors, General error formula, Solutio of Algebraic and transcendental equations by iteration methods namely; Bisection, method, regula falsi method, iterative method and Newton-Raphson method, Solution of system of linear equations using direct methods such as matrix inversion, Gauss elimination and LU decomposition including some iteration methods namely: Jacobi and Gauss Seidel method.	**1**
II	**15**	**Interpolation:** Finite differences, Newton's interpolation formula, Newton's Backward interpolation formula, Forward difference, backward differences, Gauss's forward difference, Gauss backward difference, Stirling's formula, Bessel's formula and Langrage's interpolation formula, divided difference and their properties, Newton's general interpolation formula, inverse interpolation formula.	**1**

III	15	**Numerical Differentiation and Integration:** Numerical differentiation, Formula for derivatives,Maxima and minima of tabulated function, Numericalintegration using Gauss quadrature formula,Trapezoidal rule, Simpson's 1/3- and 3/8- rules,Weddle's rule, Principle of Least square, Method of least squares, Method of moments.	1
IV	15	**Numerical Methods of Ordinary DifferentialEquations:** Picard's method, Taylor series method , Euler's and modified Euler's method, Runge-Kutta methods of 2^{nd} and 4^{th} order, , Milne-Simpson method, Adams-Bashforth-Moulton method, Solution of Boundary value problem of ordinary differential equation using finite difference method .	1

List of Books	1. B.S. Grewal, *Higher Engineering Mathematics,* Khannna Publishers, Delhi 2. S.S. Shastry, Introductory methods of numerical analysis, Prentice Hall of India, New Delhi, 2012 *3.* Brian Bradie (2006), *A Friendly Introduction to Numerical Analysis.* Pearson. 4. F. B. Hildebrand (2013). *Introduction to Numerical Analysis*: (2nd edition). Dover Publications. 5. M. K. Jain, S. R. K. Iyengar & R. K. Jain (2012). *Numerical Methods for Scientific and Engineering Computation* (6th edition). New Age International Publishers. 6. C. F. Gerald & P. O. Wheatley (2008). *Applied Numerical Analysis* (7th edition), Pearson Education, India.

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

FYUGP (CBCS/LOCF Course)

Department- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **IV**	Subject: **Mathematics**
Course Type: **DSC**	Course Code:
Course Title:	**Real Analysis**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	Analysis
Course Learning Outcome:	(i) Learn the fundamental properties of the real numbers that underpin the formal development of real analysis. (ii) Define and recognize bounded, convergent, divergent, Cauchy, and monotonic sequences. (iii) Apply the ratio, root test, and alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers. (v) Understand the theory of sequences and series, continuity and differentiation.

Units	Lectures	Lectures (15 x 4 = 60)	Credits
I	15	Review of Algebraic and Order properties of R, Idea of countable and uncountable sets, Uncountability of R, bounded and unbounded sets, Completeness property and denseness property of R, Archimedean property, Intervals, Neighbourhood, Interior point, Open set, Limit Point, Illustration of Bolzano Weierstrass theorem for sets, Isolated Point, Derived Set, Closed Set, Adherent Point, Dense	1
II	15	**Sequences of Real Numbers:** Definition and examples, Bounded sequences, Convergence of sequences, Uniqueness of limit, Algebra of limits, Monotone sequences and their convergence, Sandwich rule, Subsequence, subsequential limit, characterisation of a compact set, upper limit and lower limit, Cauchy criterion, Cauchy's theorem on limits.	1

		Series of Real Numbers: Definition and convergence, Telescopic series, Series with non-negative terms. Tests for convergence (Comparison test, Cauchy n^{th} root test, Ratio test, Root test, Raabe's test, Logarithmic test, De Morgan and Bertrand's test), Abel's and Dirichlet's tests for series, Absolute and conditional convergence, Alternating series and Leibnitz test, Riemann rearrangement theorem.	
III	15	Limit of a function at a point, Sequential criterion for the limit of a function at a point. Algebra of limits, Continuity at a point and on intervals, Algebra of continuous functions, Discontinuous functions, Types of discontinuity, Intermediate value theorem, Monotone functions and continuity, Uniform continuity.	**1**
IV	15	**Differentiability:** Definition and examples, Geometric and physical interpretations, Algebra of differentiation, Chain rule, Darboux Theorem, Rolle's Theorem, Mean Value Theorems of Lagrange and Cauchy. Application of derivatives: Increasing and decreasing functions, Maxima and minima of functions. Higher order derivatives, Taylor's Theorem and expansion of functions, Leibnitz rule, L'Hopital rule.	**1**

List of Books	1. R. G. Bartle, D. R. Sherbert, Introduction to Real Analysis", John Wiley & Sons,1992. 2. W. Rudin, "Principles of Mathematical Analysis", McGraw Hill International 3. K. A. Ross, "Elementary Analysis", Undergraduate Texts in Mathematics, Springer, 2013. 4. S. K. Berberian, "A First Course in Real Analysis", Undergraduate Texts in Mathematics, Springer-Verlag, 1994.

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

FYUGP (CBCS/LOCF Course)

Department- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **IV**	Subject: **Mathematics**
Course Type: **DSE**	Course Code:
Course Title:	**Discrete Mathematics**
Credit: **4**	Lecture: **60**
M.M. 100 = **(ESE 80+IA 20)**	Minimum Passing Marks: **40%**

Title	**Discrete Mathematics**
Course Learning Outcome:	(i) Learn about partially ordered sets, lattices and their types. (ii) Understand Boolean algebra and Boolean functions, logic gates, switching circuits and their applications. (iii) Solve real-life problems using finite-state machines. (iv) Learn about recurrence relation and recursive algorithms.

Units	**Lectures**	**Lectures (15 x 4 = 60)**	**Credits**
I	**15**	**Sets and propositions:** Cardinality, Mathematical Induction, Principle of Inclusion and exclusion, Computability and formal Language, Languages, Phrase Structure Grammars, Types of Grammars andLanguages. **Relation and Function:** Equivalence Relation and Partition, Lattice. Chain and Antichains, Pigeon- Hole Principle.	**1**
II	**15**	**Graph:** Graphs and Planner Graphs, Basic Terminology, Multigraphs. Weighted Graphs. Path and Circuits. **Finite State Machine:** Equivalent Machines, Finite State Machines as Language Recognizers	**1**
III	**15**	Discrete Numeric Function and Generating Functions. **Recurrence Relation and RecursiveAlgorithms**: Linear Recurrence Relation with constant coefficients, Homogeneous solution. Particular solution, Total Solution	**1**

IV	15	**Boolean Algebras:** Lattices and Algebraic Structures, Distributive and Complemented Lattices and Boolean Algebra. Boolean Function and Expressions	**1**

List of Books	1. C.L. Liu, Elements of Discrete Mathematics, (second Edition), McGraw Hill, International Edition, Computer science series, 1986 2. Kenneth H. Rosen (2012). *Discrete Mathematics and its Applications: With Combinatorics and Graph Theory* (7th edition). McGraw-Hill. 3. Edgar G. Goodaire & Michael M. Parmenter (2018). *Discrete Mathematics with Graph Theory* (3rd edition). Pearson Education. 4. Swapan Kumar Sarkar, S Chand, Publications

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

FYUGP (CBCS/LOCF Course)

Department- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **III**	Subject: **Mathematics**
Course Type: **SEC**	Course Code:
Course Title:	**Logic and Sets**
Credit: **2**	Lecture: **30**
M.M. 50 = **(ESE 40+IA 10)**	Minimum Passing Marks: **40%**

Title	**Logic and Sets**
Course Learning Outcome:	(i) Implement Concepts of sets, subset, set operations and Venn diagram in real life. (ii) Able to solve practical problems on counting principal and power set of a set. (iii) Learn results of prepositions, truth table, negation, and conjunction and disjunction equivalence relation. (iv) Understand Logical equivalence, Predicates and quantifiers.

Units	**Lectures**	**Lectures (15 x 2 = 30)**	**Credits**
I	**8**	**Set-**Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite andinfinite 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.	**0.5**
II	**8**	**Relation-**Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, and binary relations.	**0.5**
III	**7**	**Logics-**Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, bi-conditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.	**0.5**
IV	**7**	Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers,Binding variables and Negations.	**0.5**

List of Books	1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998. 2. P.R. Halmos-Naive Set Theory, Springer, 1974. 3. E. Kamke-Theory of Sets, Dover Publishers, 1950.

GOVT. DIGVIJAY AUTONOMOUS P.G. COLLEGE, RAJNANDGAON (C.G.)

FYUGP (CBCS/LOCF Course)

Department- Mathematics

Session: **2024-25**	Program: B.Sc.
Semester: **IV**	Subject: **Mathematics**
Course Type: **SEC**	Course Code:
Course Title:	**SCILAB (Project)**
Credit: **2**	Lecture: **30**
M.M. 50 = **(IA 10)**	Minimum Passing Marks: **40%**

Title	**SCILAB**
Course Learning Outcome:	(i) Perform basic mathematical operations using Scilab software. (ii) Execute loops using Scilab software. (iii) Analyze different types of data using plotting functions in Scilab software. (iv) Develop skill to solve differential equations.

Units	**Lectures**	**Lectures (15 x 2 = 30)**	**Credits**
I	**15**	**The general environment and the console**: Console, file, variable browser and command history. **Simple numerical calculations:** for particular numbers, for not displaying results and to remind the name of function. **The menu bar:** Applications, Edit and Control. **The editor:** opening the editor, writing in the editor, saving and copying into the console , executing the program. **The graphics window** : opening graphics window, modifying plot and online help.	**0.5**
II	**15**	**Matrices and vectors :** accessing elements, operations, solving linear systems. **Some Useful Functions**: sort, length, sum and product, unique, find, det, inv, linspace, trace, spec.	**0.5**
III	**15**	**Loops:** for, while...end, if...then. **Tests**: Comparison operator **2 and 3D plots:** Basic Plots, To plot segments, Plots of plane of plane curves defined by functions y=f(x), Plots of sequence of points, Plots in 3 dimensions.	**0.5**
IV	**15**	**Polynomials in SCILAB :** Defining polynomials, Matrices of polynomials, Operations on polynomials or matrices of polynomials, Evaluation of polynomials.	**0.5**

18.5.24

List of Books	1. Sandeep Nagar, Introduction to Scilab: For Engineers and Scientists. Apress publisher, New York, USA, 2017. 2. A.S.Nair, SCILAB (A free software to MATLAB), S. Chand Publishing, New Delhi, India, 2012.
Web References	1. https://www.scilab.org/ 2. https://onlinecourses.swayam2.ac.in/aic20_sp38/preview