

Government General Degree College, Chapra

LESSON PLAN 2022-23

JULY-DECEMBER

Department of Mathematics

B.Sc. Mathematics (GENERAL)

SEMESTER-I

Mode of teaching- Theory

Course Name	Topic Name	Teacher (with no. of classes)
GCC-T-01 Algebra & Analytical Geometry	• Complex Numbers: De Moivre's theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of az. Inverse circular and hyperbolic functions. • Polynomials: Fundamental theorem of algebra (Statement only). Polynomials with real coefficients, nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes rule of signs and its applications. Relation between roots and coefficients, transformations of equations. Cardan's method of solution of a cubic equation.	Biswajit Paul (30 lectures)
	• Rank of a matrix: Determination of rank either by considering minors	Asim Kumar Das (30 lectures)

	or by sweep-out process. Consistency and solution of a system of linear equations with not more than 3 variables by matrix method. ● Equivalence relations and partitions. Functions, composition of functions, invertible functions, one to one correspondence and cardinality of a set. ● Definition and elementary properties of groups. Concepts of permutation Group, alternating group, finite groups: S_n, A_n. The group of integers under addition modulo n. ● Order of an element, order of a group, subgroups and examples of subgroups.	
	● Transformations of rectangular axes: Translation, rotation and their combinations. Invariants. ● General equation of second degree in x and y: Reduction to canonical forms. Classification of conics. ● Pair of straight lines: Condition that the general equation of 2nd degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by Equation of bisectors. Equation of two lines joining the origin to the points in which a line	Aninda Chakraborty (35 lectures)

	meets a conic. ● Polar equation of straight lines and circles, polar equation of a conic refers to a focus as a pole, polar equation of chord joining two points, polar equations of tangents and normals.	
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SUGGESTED READINGS/REFERENCES:

1. Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser.
2. W. S. Burnstine and A.W. Panton, Theory of Equations, Nabu Press.
3. I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India.
4. K. B. Dutta, Matrix and Linear Algebra, Prentice-Hall of India Pvt. Ltd.
5. David C. Lay, Linear Algebra and its Applications, Pearson Education Asia, Indian Reprint.
6. P. K. Saikai, Linear Algebra, Pearson.
7. K. Hoffman, R. Kunze, Linear Algebra, Pearson.
8. John B. Fraleigh, A First Course in Abstract Algebra, Pearson.
9. P. R. Vittal, Analytical Geometry 2D and 3D, Pearson.
10. S. L. Loney, Co-ordinate Geometry, Arihant Publications.

Tutorial classes will be taken as pr requirement each week on Wednesday 2 P.M.

Total no. of Tutorial Classes = 14.

At the end of each month an Internal Assessment/Class Test/Home Assignment of 25 marks will be conducted.

After continuous evaluation based on class participation and Internal Assessment/Class Test/Home Assignment, remedial classes will be taken if necessary.

A parent teacher meeting will be arranged after every 3 months if required.

SEMESTER-III
Mode of teaching- Theory

Course Name	Topic Name	Teacher (with no. of classes)
GCC-T-03 Real Analysis	● Review of algebraic and order properties of $\mathbb{R}$. ● Idea of countable sets, uncountable sets and uncountability of $\mathbb{R}$. Countability of $\mathbb{Q}$. ● Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. ● Completeness property of $\mathbb{R}$ and its equivalent properties. ● The Archimedean property, density of rational (and Irrational) numbers in $\mathbb{R}$, intervals. ● Intervals, neighborhood of a point in $\mathbb{R}$, Interior points, Limit points of a set, isolated points, open set, closed set, union and intersection of open and closed sets. derived set, Closure of a set, Interior of a set. ● Bolzano-Weierstrass theorem for sets (statement only). ● Sequences, bounded sequence, convergent sequence, Sandwich	Aninda Chakraborty (75 lectures)

	theorem. ● Cauchy's convergence criterion for sequences. Cauchy's theorem on limits ● Monotone sequences, monotone convergence theorem (without proof). ● Infinite series, Convergence and divergence of infinite series, Cauchy's criterion. Series of positive terms, Geometric Series, p-Series. ● Tests for convergence: comparison test, limit comparison test, ratio test: D'Alembert's ratio test, Raabe's test, Cauchy's root test. ● Alternating series, Leibnitz test (without proof), definition and examples of Absolute and conditional convergence. ● Power series and radius of convergence (problems only).	
G-SEC-T-1A Logic & Sets	● Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contrapositive and inverse proportions and precedence of logical operators. ● Propositional equivalence: Logical equivalences. ● Predicates and quantifiers: Introduction, quantifiers, binding variables and negations.	Aninda Chakraborty (10 lectures)

	● Sets, subsets, set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. ● Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.	Asim Kumar Das (7 lectures)
	● Difference and Symmetric difference of two sets. Set identities, generalized union and intersections. ● Relation: Product set. Composition of relations, types of relations, partitions, equivalence Relations with example of congruence modulo relation. Partial ordering relations, -ary relations.	Biswajit Paul (8 lectures)
G-SEC-T-1B Vector Calculus	● Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors. ● Gradient, divergence and curl with applications. ● Vector integration: Line, surface and volume integrals. ● Green's theorem (statement only), surface integrals, integrals over parametrically defined surfaces. Stoke's theorem (statement only), divergence theorem (statement only). Applications of Green's,	Asim Kumar Das (25 lectures)

	Stoke's and divergence theorems.	
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SUGGESTED READINGS/REFERENCES:

GCC-T-03

1. T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd.
2. R. G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P.Ltd.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag.
4. S. K. Berberian, a First Course in Real Analysis, Springer Verlag, New York.
5. K. A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer.
6. V. Karunakaran, Real Analysis, Pearson.
7. Terence, Tao, Analysis I, Hindustan Book Agency.

G-SEC-T-1A

1. R. P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education.
2. P. R. Halmos, Naive Set Theory, Springer.
3. E. Kamke, Theory of Sets, Dover Publishers.
4. R. R. Stoll, Set Theory and Logic, Dover Publications.

G-SEC-T-1B

1. G. B. Thomas and R. L. Finney, Calculus, Pearson Education, Delhi.
2. H. Anton, I. Bivens and S. Davis, Calculus, John Wiley and Sons.
3. P. C. Matthew's, Vector Calculus, Springer Verlag London Limited.
4. J. E. Marsden, A. Tromba, Vector Calculus, McGraw Hill.
5. M. R. Spiegel, Schaum's outline of Vector Analysis.
6. P. K. Nayak, Vector Algebra and Analysis with Application, University Press.

Tutorial classes will be taken as pr requirement each week on Monday & Wednesday 2 P.M.

Total no. of Tutorial Classes = 14 (for credit 6), 6(for credit 2).

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SEMESTER-V
Mode of teaching- Theory

Course Name	Topic Name	Teacher (with no. of classes)
G-DSE-T-1A Matrices and Linear Algebra	• Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto four. • Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics. • Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces. • Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of	Asim Kumar Das (75 lectures)

	linear transformations. Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial. Isomorphisms, Isomorphism	
G-DSE-T-1B Complex Analysis	● Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy- Riemann equations, sufficient conditions for differentiability. ● Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions. ● Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula. ● Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. Laurent series and its examples, absolute and uniform convergence of power series.	Biswajit Paul (75 lectures)
G-SEC-T-3A Integral Calculus	● Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals. Reduction	Aninda Chakraborty (25 lectures)

	formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations. • Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. • Double and Triple integrals.	
G-SEC-T-3B Vector Calculus	• Differentiation and partial differentiation of a vector function. Derivative of sum, dot product and cross product of two vectors. • Gradient, divergence and curl with applications • Vector integration. Line, Surface and Volume integrals.	Biswajit Paul (25 lectures)

SUGGESTED READINGS/REFERENCES:

G-DSE-T-1A

1. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.
3. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
4. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

G-DSE-T-1B

1. James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

G-SEC-T-3A

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

G-SEC-T-3B

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

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LESSON PLAN 2022-23

JANUARY-JUNE

Department of Mathematics

B.Sc. Mathematics (GENERAL)

SEMESTER-II

Mode of teaching- Theory

Course Name	Topic Name	Teacher (with no. of classes)
GCC-T-02 Calculus & Differential Equations	● Real-valued functions defined on an interval, limit and Continuity of a function (using ϵ). Algebra of limits. Differentiability of a function. ● Successive derivative: Leibnitz's theorem and its application to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$ ● Partial derivatives. Euler's theorem on homogeneous function of two and three variables. ● Indeterminate Forms: L'Hospital's Rule (Statement and Problems only). ● Statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's theorems with Lagrange's and Cauchy's forms of remainders. Taylor's and Maclaurin's infinite series of functions like e^x, $\sin x$, $\cos x$,	Biswajit Paul (35 lectures)

	$(1+x)^n$, $\log(1+x)$ with restrictions wherever necessary. • Application of the principle of maxima and minima for a function of a single variable.	
	• Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x dx$	Asim Kumar Das (15 lectures)
	• First order equations: (i) Exact equations and those reducible to such equations. (ii) Euler's and Bernoulli's equations (Linear). (iii) Clairaut's Equations: General and Singular solutions. • Second order differential equation: (i) Method of variation of parameters, (ii) Method of undetermined coefficients.	Aninda Chakraborty (25 lectures)

SUGGESTED READINGS/REFERENCES:

1. R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore.
2. T. Apostol, Mathematical Analysis, Narosa Publishing House.
3. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
4. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc.

5. G. B. Thomas and R.L. Finney, Calculus, Pearson Education.
6. Santi Narayan, Integral Calculus, S. Chand.

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SEMESTER-IV

Mode of teaching- Theory

Course Name	Topic Name	Teacher (with no. of classes)
GCC-T-04 Linear Programming Problems and Game Theory	● Introduction to linear programming problems, Graphical solution of LPP. ● Convex sets. Basic solutions and non-basic solutions. Reduction of B.F.S from B.S. ● Simplex method, two-phase method, Big-<i>M</i> method and their comparison. ● Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. ● Transportation problem and its mathematical formulation, northwest-corner method,	Aninda Chakraborty (75 lectures)

	least cost method and Vogel's approximation method for determination of initial basic solution. Algorithms for solving transportation problems. ● Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. ● Game theory: formulation of two-person zero sum games. ● Solving two-person zero sum games. Games with mixed strategies. Graphical solution procedure. ● Solving game Using Simplex Algorithm.	
G-SEC-T-2A Graph Theory	● Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs isomorphism of graphs. ● Eulerian circuits, Eulerian graphs, semi-Eulerian graphs, Hamiltonian cycles. ● Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph. ● Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.	Aninda Chakraborty (25 lectures)
G-SEC-T-2B Operating System (Linux)	● Linux – The operating system: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, overview of Linux	Asim Kumar Das (25 lectures)

	architecture, installation, startup scripts, system processes (an overview), Linux security. ● The Ext2 and Ext3 file systems: General characteristics of the Ext3 file system, file permissions. User management: types of users, the powers of root, managing users (adding and deleting): using the command line and GUI tools. ● Resource management in Linux: file and directory management, system calls for files process Management, signals, IPC: Pipes, FIFOs, System V IPC, message queues, system calls for processes, memory management, library and system calls for memory.	
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SUGGESTED READINGS/REFERENCES:

GCC-T-04

1. Hamdy A. Taha, Operations Research, An Introduction, Prentice-Hall India.
2. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi.
3. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, John Wiley and Sons, India.
4. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, Tata McGraw Hill, Singapore.
5. S.I. Gass, Linear Programming: Methods and Applications, Dover Publications.
6. T. Veerarajan, Operation Research, University Press.
7. K. Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultanchand.

G-SEC-T-2A

1. B. A. Davey, H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge.
2. R. J. Wilson, Introduction to Graph Theory, Pearson.
3. Rudolf Lidl, Gunter Pilz, Applied Abstract Algebra, Undergraduate Texts in Mathematics, Springer.
4. Edgar G. Goodaire, Michael M. Parmenter, Discrete Mathematics with Graph Theory, Pearson Education.

G-SEC-T-2B

1. Arnold Robbins, Linux Programming by Examples, The Fundamentals, Pearson Education.
2. Cox K, Red Hat Linux Administrator's Guide, PHI.
3. R. Stevens, UNIX Network Programming, PHI.
4. Sumitabha Das, UNIX Concepts and Applications, TMH.

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