PROPOSED UG SYLLABUS IN MATHEMATICS PROGRAMME COURSE UNDER CBCS SYSTEM TO BE INTRODUCED IN 2018

Credit Distribution

Course Type	Total Papers	Credits	Marks
1. Discipline Specific Core (DSC)	12	$(12 \times 5) + (12 \times 1) = 72$	75 (60+10+5),
2. Discipline Specific Elective (DSE)	6	$(6 \times 5) + (6 \times 1) = 36$	75 (60+10+5)
3. Skill Enhancement (SEC)	4	$4 \times 2 = 8$	75 (60+10+5)
4. Ability Enhancement Compulsory Course (AECC)	2	$2 \times 2 = 4$	80+15+5=100 (AE-I), 35+10+5=50 (AE-II)
	24	120	1800

SEMESTER-1

Subject Course No.	Syllabus Code	Course	Credit
MAT P14 AE-I	AE-I	Env.Sc.	2
MATP 11 DSC	DSC Paper 1	Calculus and Geometry	$5 + 1$
	DSC	Other Department	5+1
	DSC	Other Department	5+1

SEMESTER-2

Subject Course No.	Syllabus Code	Course	Credit
MAT P24 AE-I	AE-I	Env.Sc.	2
MATP 21 DSC	DSC Paper 2	Algebra	$5 + 1$
	DSC	Other Department	5+1
	DSC	Other Department	5+1

SEMESTER-3

Subject Course No.	Syllabus Code	Course	Credit
MATP 31 DSC	DSC Paper 3	Real Analysis	$5 + 1$
	DSC	Other Department	5+1
	DSC	Other Department	5+1
MATP33 SEC	SEC SEM 3 Paper 1	Logic & Sets/C++	2

SEMESTER-4

Subject Course No.	Syllabus Code	Course	Credit
MATP 41 DSC	DSC Paper 4	D.E & Vector Calculus	5 + 1
	DSC	Other Department	5+1
	DSC	Other Department	5+1
MATP43SEC	SEC SEM 4 Paper 2	Theory of Equations/Number Theory	2

SEMESTER-5

Subject Course No.	Syllabus Code	Course	Credit
MATP 52 DSE	DSE Paper 1	Mechanics/Group Theory and Linear Algebra	5 + 1
	DSE	Other Department	5+1
	DSE	Other Department	5+1
MATP 53 SEC	SEC SEM 5 Paper 1	Probability and Statistics / Differential Geometry	2

SEMESTER-6

Subject Course No.	Syllabus Code	Course	Credit
MATP 62 DSE	DSE Paper 2	Metric Spaces and Complex Analysis/ Linear Programming	5 + 1
	DSE	Other Department	5+1
	DSE	Other Department	5+1
MATP 63 SEC	SEC SEM 6 Paper 2	Graph Theory / Boolean Algebra and Automata Theory	2

DETAILED SYLLABUS

SEMESTER-1

Subject Course No.	Syllabus Code	Course	Credit
MAT P14 AE-I	AE-I	Env.Sc.	2
MATP 11 DSC	DSC Paper 1	Calculus and Geometry	$5 + 1$
	DSC	Other Department	5+1
	DSC	Other Department	5+1

MATP11DSC, Paper-1: CALCULUS AND GEOMETRY

6 Credits

Unit 1

Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to the problems of the type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule.

Unit 2

Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx$ dx, $\int \cos nx$ dx , $\int \tan nx$ dx, $\int \sec nx$ dx, $\int (log x)^n$dx, $\int sin^n$x sin^mx dx, parametric equations, parameterizing a curve arc length of a curve, arc length of parametric curves, area under a curve, area and volume of revolution.

Unit 3

Properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics.

Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics.

Reference Books

- G. B. Thomas and R. L. Finney, Calculus, 9th Ed., Pearson education, Delhi, 2005.
- M. J. Strauss, G. L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
- H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
- R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
- T. Apostol, Calculus, Volumes I and II.
- S. Goldberg, Calculus and mathematical analysis.

SEMESTER-2

Subject Course No.	Syllabus Code	Course	Credit
MAT P24 AE-I	AE-I	Env.Sc.	2
MATP 21 DSC	DSC Paper 2	Algebra	5 + 1
	DSC	Other Department	5+1
	DSC	Other Department	5+1

MATP24 DSC, Paper-2: ALGEBRA

6 Credits

Unit 1

Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications.

Theory of equations : relation between roots and coefficients, transformation of equation, Descartes rule of signs, cubic and biquadratic equation. Graphical representation of a polynomial and maximum, minimum of polynomial.

Inequality: The inequality involving AM≥ GM≥ HM, Cauchy-Schwartz inequality.

Unit 2

Equivalence relations. Functions, composition of functions, Invertible functions, one to one correspondence and cardinality of a set. Well-ordering property of positive integers, division algorithm, divisibility and Euclidean algorithm. Congruence relation between integers. Principles of mathematical induction, statement of Fundamental Theorem of Arithmetic.

Unit 3

Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence.

Unit 4

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n, dimension of subspaces of R^n, rank of matrix, Eigen values, Eigen vectors and characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.

Reference Books

- Titu Andreescu and Dorin Andrica, Complex Numbers from A to Z, Birkhauser, 2006
- Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
- David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
- K. B. Dutta, Matrix and linear algebra.
- K. Hoffman, R. Kunze, Linear algebra.
- W. S. Burnstine and A. W. Panton, Theory of equations.

SEMESTER-3

Subject Course No.	Syllabus Code	Course	Credit
MATP 31 DSC	DSC Paper 3	Real Analysis	$5+1$
	DSC	Other Department	5+1
	DSC	Other Department	5+1
MATP33 SEC	SEC SEM 3 Paper 1	Logic & Sets/C++	2

MATP31 DSC, Paper-3: REAL ANALYSIS

6 Credits

Unit 1

Review of Algebric and order properties of R, ε-neighborhood of a point in R. Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. Completeness property of R and its equivalent properties. The Archimedean property, density of rational (and irrational) numbers in R, intervals. Limit points of a set, isolated points, open set, closed set, derived set, illustrations of Bolzano-Weierstrass theorem for sets, compact sets in R, Heine-Boreal Theorem.

Unit 2

Sequences, bounded sequence, convergent sequence, limit of a sequence, lim inf, lim sup. Limit theorems. Monotone sequences, monotone convergence theorem. Subsequences, divergence criteria. Monotone subsequence theorem (statement only), Bolzano Weierstrass theorem for sequences. Cauchy sequence, Cauchy's convergence criterion.

Unit 3

Infinite series, convergence and divergence of infinite series, Cauchy criterion, tests for convergence: comparison test, limit comparison test, ratio test, Cauchy's nth root test, integral test. Alternating series, Leibniz test. Absolute and conditional convergence.

Reference Books

- R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
- Gerald G. Bilodeau, Paul R. Thie, G. E. Keough, An Introduction to Analysis, 2nd ed., Jones & Bartlett, 2010.
- Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.
- S. K. Berberian, a First Course in Real Analysis, Springer Verlag, New York, 1994.
- T.Apostol, Mathematical Analysis, Narosa Publishing House.
- Courant and John, Introduction to Calculus and Analysis, Vol I, Springer.
- W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill.
- Terence Tao, Analysis I, Hindustan Book Agency, 2006
- S. Goldberg, Calculus and mathematical analysis.

MATP33 SEC SEM-3 Paper-1: LOGIC AND SETS

2 Credits

Unit 1

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, quantifiers, binding variables and negations.

Unit 2

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.

Unit 3

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, n- ary relations.

Reference Books

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

OR

MATP33 SEC SEM-3 Paper-1: C++

2 Credits

Unit 1

Programming paradigms, characteristics of object oriented programming languages, brief history of C++, structure of C++ program, differences between C and C++, basic C++ operators, Comments, working with variables, enumeration, arrays and pointer.

Unit 2

Objects, classes, constructor and destructors, friend function, inline function, encapsulation, data abstraction, inheritance, polymorphism, dynamic binding, operator overloading, method overloading, overloading arithmetic operator and comparison operators.

Reference Books

- R. Venugopal, Rajkumar, and T. Ravishanker, Mastering C++, TMH, 1997.
- S. B. Lippman and J. Lajoie, C++ Primer, 3rd Ed., Addison Wesley, 2000.
- Bruce Eckel, Thinking in C++, 2nd Ed., President, Mindview Inc., Prentice Hall.

- D. Parasons, Object Oriented Programming with C++, BPB Publication.
- BjarneStroustrup, The C++ Programming Language, 3rd Ed., Addison Welsley.
- E. Balaguruswami, Object Oriented Programming In C++, Tata McGrawHill
- Herbert Scildt, C++, The Complete Reference, Tata McGrawHill.

SEMESTER-4

Subject Course No.	Syllabus Code	Course	Credit
MATP 41 DSC	DSC Paper 4	D.E & Vector Calculus	5 + 1
	DSC	Other Department	5+1
	DSC	Other Department	5+1
MATP43SEC	SEC SEM 4 Paper 2	Theory of Equations/Number Theory	2

MATP41 DSC, Paper-4: D.E. & Vector Calculus

6 Credits

Unit 1

Lipschitz condition and Picard's Theorem (Statement only). General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian : its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit 2

Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients,

Basic theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions.

Unit 3

Power series solution of a differential equation about an ordinary point, solution about a regular singular point.

Unit 4

Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions.

Reference Books

- Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.
- C. H. Edwards and D. E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.
- S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- Martha L Abell, James P Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier Academic Press, 2004.
- Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
- Boyce and Diprima, Elementary Differential equations and boundary Value problems, Wiley.
- G. F. Simmons, Differential Equations, Tata McGraw Hill.
- Marsden, J., and Tromba, Vector Calculus, McGraw Hill.
- Maity, K. C. and Ghosh, R. K. Vector Analysis, New Central Book Agency (P) Ltd. Kolkata (India).
- M. R. Speigel, Schaum's outline of Vector Analysis.

MATP43SEC SEM 4 Paper 2: Theory of Equations

2 Credits

Unit 1

General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

Unit 2

Symmetric functions. Applications of symmetric function of the roots. Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic. Properties of the derived functions, , Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations.

Unit 3

Separation of the roots of equations, Strums theorem. Applications of Strum's theorem, conditions for reality of the roots of an equation. Solution of numerical equations.

Reference Books

- W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.
- C. C. MacDuffee, Theory of Equations, John Wiley & Sons Inc., 1954.

OR

MATP43SEC SEM 4 Paper 2: Number Theory

2 Credits

Unit 1

Diophantine equation, Gaussian integers, Euclidean Algorithm for gcd, linear representation of gcd, primes and factorizations, consequences of unique prime factorization, linear Diophantine equation.

Unit 2

Congruence arithmetic, inverse mod p, Fermat's little Theorem, congruence theorem of Wilson and Lagrange, inverse mod k, quadratic, Diophantine equations. Gaussian integers, Divisibility and primes in $\mathbb{Z}[i]$ and $\mathbb{Z}$. Conjugates, division in $\mathbb{Z}[i]$, Fermat's two square theorem, Pythagorean triples.

Unit 3

Linear congruence, Chinese remainder theorem, Euler's criterion, Legendre symbol, quadratic reciprocity.

Reference Books

- Elements of Number Theory, John Stillwell, springer, 2003.
- An introduction to theory of numbers, Niven and Zuckerman, Wiley 1991.
- David M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw-Hill, Indian reprint, 2007.
- Neville Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007.

SEMESTER-5

Subject Course No.	Syllabus Code	Course	Credit
MATP 52 DSE	DSE Paper 1	Mechanics/Group Theory and Linear Algebra	5 + 1
	DSE	Other Department	5+1
	DSE	Other Department	5+1
MATP 53 SEC	SEC SEM 5 Paper 1	Probability and Statistics / Differential Geometry	2

MATP52DSE Paper 1: Mechanics

6 Credits

Unit 1

Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve. Virtual work. Forces in three dimensions. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium.

Unit 2

Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Stability of nearly circular orbits. Motion under the inverse square law. Slightly disturbed orbits. Motion of artificial satellites. Motion of a particle in three dimensions. Motion on a smooth sphere, cone and on any surface of revolution.

Unit 3

Degrees of freedom. Moments and products of inertia. Momental Ellipsoid. Principal axes. D'Alembert's principle. Motion about a fixed axis. Compound pendulum. Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy.

Reference Books

1. I. H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4^{th} Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009.
2. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
3. Chorlton, F., Textbook of Dynamics.
4. Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press.
5. Loney, S. L., Elements of Statics and Dynamics I and II.
6. Ghosh, M. C, Analytical Statics.
7. Verma, R. S., A Textbook on Statics, Pothishala, 1962.
8. Matiur Rahman, Md., Statics.
9. Ramsey, A. S., Dynamics (Part I).

OR

MATP52DSE Paper 1: Group Theory and Linear Algebra

6 Credits

Unit 1

Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.

Unit 2

Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.

Unit 3

Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem.

Unit 4

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit 5

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms.

Reference Books

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- I. Herstein, Abstract Algebra.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice- Hall of India Pvt. Ltd., New Delhi, 2004.
- Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
- S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
- Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
- S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
- Kenneth Hoffman, Ray Aiden Kunze, Linear Algebra, 2nd Ed., Prentice – Hall of India Pvt. Ltd., 1971.
- D. A. R. Wallace, Groups, Rings and Fields, Springer Verlag London Ltd., 1998.
- D. S. Malik, John M. Mordeson and M. K. Sen, Fundamentals of Abstract Algebra.

<u>MATP53SEC SEM 5 Paper 1</u>: Probability and Statistics

2 Credits

Unit 1

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

Unit 2

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.

Unit 3

Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central limit theorem for independent and identically distributed random variables with finite variance.

Reference Books

- Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007.
- Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia, 2006.
- Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007.
- Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw- Hill, Reprint 2007.
- A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers.

OR

<u>MATP53SEC SEM 5 Paper 1</u>: Differential Geometry

2 Credits

Unit 1

Theory of space curves: Space curves. Planer curves, curvature, torsion and Serret-Frenet formula. Osculating circles, osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit 2

Theory of surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue's formula. Conjugate and asymptotic lines. Developable associated with space curves and curves on surfaces. Minimal surfaces. Geodesics.

Reference Books

- T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
- B. O'Neill, Elementary Differential Geometry, 2nd Ed., Academic Press, 2006.
- C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press2003.
- D.J. Struik, Lectures on Classical Differential Geometry, Dover Publications, 1988.
- S. Lang, Fundamentals of Differential Geometry, Springer, 1999.
- B. Spain, Tensor Calculus: A Concise Course, Dover Publications, 2003

SEMESTER-6

Subject Course No.	Syllabus Code	Course	Credit
MATP 62 DSE	DSE Paper 2	Metric Spaces and Complex Analysis/ Linear Programming	5 + 1
	DSE	Other Department	5+1
	DSE	Other Department	5+1
MATP 63 SEC	SEC SEM 6 Paper 2	Graph Theory / Boolean Algebra and Automata Theory	2

MATP62DSE Paper 2: Metric Spaces and Complex Analysis

6 Credits

Unit 1

Metric spaces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces. Sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem.

Unit 2

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.

Unit 3

Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

Unit 4

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples.

Reference Books

- SatishShirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
- S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
- G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
- James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
- Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
- S. Ponnusamy, Foundations of Complex analysis.
- E. M. Stein and R. Shakrachi, Complex Analysis, Princeton University Press.

OR

MATP62DSE Paper 2:Linear Programming

6 Credits

Unit 1

Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.

Unit 2

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit 3

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games.

Reference Books

- Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
- F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
- Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice-Hall India, 2006.
- G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.

MATP63SEC SEM 6 Paper 2: Graph Theory

2 Credits

Unit 1

Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs, isomorphism of graphs. Trees and forests, paths and cycles.

Unit 2

Eulerian circuits, Eulerian graph, semi-Eulerian graph, theorems, Hamiltonian cycles,theorems Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph.

Unit 3

Travelling salesman's problem, shortest path, Tree and their properties, spanning tree.

Reference Books

- B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.
- Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2ndEdition, Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.
- Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
- Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India Ptv. Ltd., New Delhi.
- Reinhard Diestel, Graph Theory, Springer-Verlag, 2000.

OR

<u>MATP63SEC SEM 6 Paper 2</u>: Boolean Algebra and Automata Theory

2 Credits

Unit 1

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sublattices, products and homomorphisms.

Unit 2

Definition, examples and properties of modular and distributive lattices, Boolean algebra, Boolean polynomials, minimal and maximal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, Logic gates, switching circuits and applications of switching circuits.

Unit 3

Introduction: Alphabets, strings and languages. Finite automata and regular languages: deterministic and non deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages.

References Books

- B. A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge 1990.
- Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, (2nd Ed.), Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.
- Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Edition, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
- H. R. Lewis, C. H. Papadimitriou, C. Papadimitriou, Elements of the Theory of Computation, 2nd Ed., Prentice-Hall, NJ, 1997.
- J. E. Hopcroft, R. Motwani and J. D. Ullman, Introduction to Automata Theory, Languages and Computation, 2nd Ed., Addison-Wesley, 2001.
- J. A. Anderson, Automata Theory with Modern Applications, Cambridge University Press, 2006.

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