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 (SE)	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-1	DSC-1 Paper 1	Cal, Geo & D.E.	$5 + 1$
MAT 11 DSC-2	DSC-2 Paper 1	Algebra	$5 + 1$
MAT 11 DSC-3	DSC-3 Paper 1	Real Analysis	$5 + 1$

SEMESTER-2

Subject Course No.	Syllabus Code	Course	Credit
MATP 24 AE-II	AE-II	English	2
MATP 21 DSC-1	DSC-1 Paper 2	Theory of Real Functions and Introduction to Metric Spaces	$5 + 1$
MATP 21 DSC-2	DSC-2 Paper 2	D.E & Vector Calculus	$5 + 1$
MATP 21 DSC-3	DSC-3 Paper 2	Group Theory	$5 + 1$

SEMESTER-3

Subject Course No.	Syllabus Code	Course	Credit
MATP 31 DSC-1	DSC-1 Paper 3	Numerical Methods	$5 + 1$
MATP 31 DSC-2	DSC-2 Paper 3	Ring Theory and Linear Algebra	$5 + 1$
MATP 31 DSC-3	DSC-3 Paper 3	Riemann Integration & Series of functions	$5 + 1$
MATP 33 SE-I	SE-I Paper 1		2

SEMESTER-4

Subject Course No.	Syllabus Code	Course	Credit
MATP 41 DSC-1	DSC-1 Paper 4	Mechanics	5 + 1
MATP 41 DSC-2	DSC-2 Paper 4	Partial Differential Equations and Applications	5 + 1
MATP 41 DSC-3	DSC-3 Paper 4	Metric Spaces and Complex Analysis	5 + 1
MATP 43 SE-I	SE-I Paper 2		2

SEMESTER-5

Subject Course No.	Syllabus Code	Course	Credit
MATP 52 DSE-1	DSE-1 Paper 1		5 + 1
MATP 52 DSE-2	DSE-2 Paper 1		5 + 1
MATP 52 DSE-3	DSE-3 Paper 1		5 + 1
MATP 53 SE-II	SE-II Paper 1		2

SEMESTER-6

Subject Course No.	Syllabus Code	Course	Credit
MATP 62 DSE-1	DSE-1 Paper 2		5 + 1
MATP 62 DSE-2	DSE-2 Paper 2		5 + 1
MATP 62 DSE-3	DSE-3 Paper 2		5 + 1
MATP 63 SE-II	SE-II Paper 2		2

Course no indexing

First digit ≡ Semester in which course is offered.

Second digit ≡ Course type (as per indexing)

Followed by syllabus code.

Example: MATP 31 DSC-2 represents the course on Ring Theory and Linear Algebra in Semester-3 in Mathematics programme course.

DETAILED SYLLABUS

SEMESTER-1

Subject Course No.	Syllabus Code	Course	Credit
MAT P14 AE-I	AE-I	Env.Sc.	2
MATP 11 DSC-1	DSC-1 Paper 1	Cal, Geo & D.E.	5 + 1
MAT 11 DSC-2	DSC-2 Paper 1	Algebra	5 + 1
MAT 11 DSC-3	DSC-3 Paper 1	Real Analysis	5 + 1

MATP11DSC-1, Paper-1: CALCULUS, GEOMETRY AND DIFFERENTIAL EQUATION

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, $\int(logx)^n$dx, $\int sin^n x\, sin^m x$ 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.

Unit 4

Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

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.
- S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
- Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.
- G. F. Simmons, Differential Equations, Tata Mcgraw Hill.
- T. Apostol, Calculus, Volumes I and II.
- S. Goldberg, Calculus and mathematical analysis.

MATP11DSC-2, Paper-1: 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.

MATP11DSC-3, Paper-1: 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.

SEMESTER-2

Subject Course No.	Syllabus Code	Course	Credit
MATP 24 AE-II	AE-II	English	2
MATP 21 DSC-1	DSC-1 Paper 2	Theory of Real Functions and Introduction to Metric Spaces	$5+1$
MATP 21 DSC-2	DSC-2 Paper 2	D.E & Vector Calculus	$5+1$
MATP 21 DSC-3	DSC-3 Paper 2	Group Theory	$5+1$

MATP21DSC-1, Paper-2:

THEORY OF REAL FUNCTIONS ANDINTRODUCTION TO METRIC SPACE

6 Credits

Unit 1

Limits of functions (ε-δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity.

Unit 2

Differentiability of a function at a point and in an interval, algebra of differentiable functions . Relative extrema, interior extremum theorem. Rolle's theorem. Mean value theorem, intermediate value property of derivatives, darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials.

Unit 3

Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of reminder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, log(1+x), $1/(ax+b)$ and $(x+1)^n$.

Unit 4

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.

Reference Books

- R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003.
- K. A. Ross, Elementary Analysis : The Theory of Calculus, Springer, 2004.
- A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.

- S. R. Ghorpade and B. V. Limaye, a Course in Calculus and Real Analysis, Springer, 2006.
- T. Apostol, Mathematical Analysis, Narosa Publishing House.
- Courant and John, Introduction to Calculus and Analysis,Voll II, Springer.
- W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill
- Terence Tao, Analysis II, Hindustan Book Agency, 2006
- SatishShirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
- S. Kumareasan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
- G. F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.

MATP21DSC-2, Paper-2:

DIFFERENTIAL EQUATIONS AND 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.

MATP21DSC-3, Paper-2: GROUP THEORY

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

External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Unit 5

Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms. First, Second and Third isomorphism theorems (Statement only).

Reference Books

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
- Joseph J. Rotman, An Itroduction to the Theory of Groups, 4th Ed., Springer Verlag, 1995.
- I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
- D. S. Malik, John M. Mordeson and M. K. Sen, Fundamentals of abstract algebra.

SEMESTER-3

Subject Course No.	Syllabus Code	Course	Credit
MATP 31 DSC-1	DSC-1 Paper 3	Numerical Methods	5 + 1
MATP 31 DSC-2	DSC-2 Paper 3	Ring Theory and Linear Algebra	5 + 1
MATP 31 DSC-3	DSC-3 Paper 3	Riemann Integration & Series of functions	5 + 1
MATP 33 SE-I	SE-I Paper 1		2

MATP 31 DSC-1 Paper–3: NUMERICAL METHODS

6 Credits

Unit 1

Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation.

Unit 2

Transcendental and polynomial equations: Bisection method, Newton's method, secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods.

Unit 3

System of linear algebraic equations: Gaussian elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit 4

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation. Numerical differentiation: Methods based on interpolations, methods based on finite differences.

Unit 5

Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's Rule. midpoint rule, Composite trapezoidal rule, composite Simpson's 1/3rd rule.

Unit 6

Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two.

Reference Books

- Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
- M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
- C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
- Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
- John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
- Scarborough, James B., Numerical Mathematical Analysis, Oxford and IBH publishing co.
- Atkinson, K. E., An Introduction to Numerical Analysis, John Wiley and Sons, 1978.
- Yashavant Kanetkar, Let Us C , BPB Publications.

MATP31 DSC-2 Paper-3 : RING THEORY AND LINEAR ALGEBRA

6 Credits

Unit 1

Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristics of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Unit 2

Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III(only statements).

Unit 3

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

Unit 4

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.
- 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.

MATP31 DSC-3 Paper-3 : RIEMANN INTEGRATION AND SERIES OF FUNCTIONS

6 Credits

Unit 1

Riemann integration: inequalities of upper and lower sums, Darbaux integration, Darbaux theorem, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two definitions. Riemann integrability of monotone and continuous functions, properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorem of Integral Calculus.

Unit 2

Improper integrals. Convergence of Beta and Gamma functions.

Unit 3

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions.

Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Unit 4

Fourier series: Definitions of Fourier coefficients and series, Riemann Lebesgue lemma, Bessel's inequality.

Unit 5

Power series, radius of convergence, Cauchy Hadamard theorem. Differentiation and integration of power series ; Abel's theorem .

Reference Books

- K. A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
- R. G. Bartle D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
- Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.
- S. Goldberg, Calculus and mathematical analysis.
- Santi Narayan, Integral calculus.
- T. Apostol, Calculus I, II.

SEMESTER-4

Subject Course No.	Syllabus Code	Course	Credit
MATP 41 DSC-1	DSC-1 Paper 4	Mechanics	5 + 1
MATP 41 DSC-2	DSC-2 Paper 4	Partial Differential Equations and Applications	5 + 1
MATP 41 DSC-3	DSC-3 Paper 4	Metric Spaces and Complex Analysis	5 + 1
MATP 43 SE-I	SE-I Paper 2		2

MATP41 DSC-1 Paper-4 : 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, (4th 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).

MATP41 DSC-2 Paper-4 :
PARTIAL DIFFERENTIAL EQUATIONS & APPLICATIONS

6 Credits

Unit 1

Partial differential equations – Basic concepts and definitions. Mathematical problems. First-order equations: classification, construction and geometrical interpretation. Method of characteristics for obtaining general solution of quasi linear equations. Canonical forms of first-order linear equations. Method of separation of variables for solving first order partial differential equations.

Unit 2

Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order linear equations to canonical forms.

Unit 3

Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.

Reference Books

- Tyn Myint-U and Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th edition, Springer, Indian reprint, 2006.
- 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.
- Sneddon, I. N., Elements of Partial Differential Equations, McGraw Hill.
- Miller, F. H., Partial Differential Equations, John Wiley and Sons.
- Loney, S. L., An Elementary Treatise on the Dynamics of particle and of Rigid Bodies, Loney Press.

MATP41 DSC-3 Paper-4 : Metric Spaces and Complex Analysis

6 Credits

Unit 1

Continuous mapping, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness, connected subsets of $\mathbb{R}$.

Compactness: Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property and continuous functions on compact sets.

Homeomorphism. Contraction mappings. Banach fixed point theorem and its application to ordinary differential equation.

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.

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