LESSON PLAN

PROGRAM NAME: B.Sc.(Major)

COURSE: MATHEMATICS(Major) 1st Semester

PAPER NAME: Algebra **PAPER CODE: MTM-DC-MJ-101**

NAME OF TEACHER(S): RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.), MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Module-1

Polar representation of complex numbers, *n*-th roots of unity, De Moivre's theorem for rational indices and its applications. Inequality: Inequalities involving $AM \geq GM \geq HM$, *m*-th power theorem, Cauchy-Schwartz inequality, Maximum and minimum values of polynomials.

Module-2

General properties of equations, Fundamental theorem of classical algebra (statement only) and its application on exponential, sine, cosine and logarithm of a complex number, Transformation of equations, Descarte's rule of signs for positive and negative rule, Strum's theorem, Relation be- tween the roots and the coefficients of equations, Symmetric functions, Applications of symmetric function of the roots, Solutions of reciprocal and binomial equations, Algebraic solutions of the cubic (Cardon's method) and biquadratic (Ferrari's method).

Module-3

Functions, Composition of functions, Invertible functions, One to one correspondence and cardi- nality of a set. Recurrence relation, definition, example, Formation of recurrence relation, Factorial representation, Fibonacci number, Solution upto second order linear recurrence relation, Generat- ing function. Equivalence relations and partitions.

Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algo- rithm, Congruence relation between integers, Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.

Module-4

Systems of linear equations, row reduction and echelon forms, the matrix equation $Ax = b$, solution sets of linear systems, applications of linear systems, linear independence. Real Quadratic Form involving not more than three variables, Characteristic equation of square matrix of order not more than three, determination of eigenvalues and eigenvectors, Cayley-Hamilton Theorem.

Class	Topic		TEACHER	
Lecture 1	Polar representation of complex numbers,	Module -1	RS	, Jan-2 Classes Feb-3 Classes,
Lecture 2	*n*-th roots of unity,		RS	
Lecture 3			RS	
Lecture 4	De Moivre's theorem for rational indices and its applications.		RS	
Lecture 5	De Moivre's theorem for rational indices and its applications.		RS	
Lecture 6	Inequality: Inequalities involving $AM \geq GM \geq HM$ 1		RS	

Lecture 7	Inequality: Inequalities involving *AM* ≥ *GM* ≥ *HM* 2	Module -1	RS	Sept- 3 Classes , Nov – 32Classes ,
Lecture 8	Cauchy-Schwartz inequality		RS	
Lecture 9	*m*-th power theorem 1		RS	
Lecture 10	*m*-th power theorem 2		RS	
Lecture 11	Maximum and minimum values of polynomials.		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		TKP	
Lecture 12	General properties of equations,	Module -2	SA	Sept- 4 Classes , Nov – 3 Classes ,Dec-3 Classes , Jan-2 Classes Feb-3 Classes,
Lecture 13	Fundamental theorem of classical algebra (statement only) and its application on exponential, sine, cosine and logarithm of a complex number.		SA	
Lecture 14	Transformation of equations.		SA	
Lecture 15	Descarte's rule of signs for positive and negative rule, Strum's theorem		SA	
Lecture 16	Relation be- tween the roots and the coefficients of equations		SA	
Lecture 17	Symmetric functions.		SA	
Lecture 18	Applications of symmetric function of the roots.		SA	
Lecture 19	Solutions of reciprocal equations.		SA	
Lecture 20	Solutions of binomial equations.		SA	
Lecture 21	Algebraic solutions of the cubic (Cardon's method).		SA	
Lecture 22	Algebraic solutions biquadratic (Ferrari's method).		SA	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		TKP	
Lecture 23	Functions, Composition of functions.	Module -3	PK	Sept- 3 Classes , Nov – 3 Classes ,Dec-3 Classes , Jan-4 Classes Feb-3 Classes,
Lecture 24	Invertible functions, One to one correspondence and cardinality of a set.		PK	
Lecture 25	Recurrence relation, definition, example.		PK	
Lecture 26	Formation of recurrence relation.		PK	
Lecture 27	Factorial representation.		PK	
Lecture 27	Fibonacci number, Solution upto second order linear recurrence relation,		PK	
Lecture 28	Generating function. Equivalence relations and partitions.		PK	
Lecture 29	Equivalence relations and partitions.		PK	
Lecture 30	Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm,		PK	
Lecture 31	Divisibility and Euclidean algorithm.		PK	
Lecture 32	Congruence relation between integers.		PK	

Lecture 33	Principles of Mathematical Induction,	Module-3	PK	
Lecture 34	Statement of Fundamental Theorem of Arithmetic.		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		PK	
Lecture 35	Systems of linear equations.	Module -4	TKP	Sept- 2 Classes , Nov – 3 Classes ,Dec-4 Classes , Jan-2 Classes Feb-3 Classes,
Lecture 36	Row reduction and echelon forms.		TKP	
Lecture 37	The matrix equation $Ax = b$, solution sets of linear systems 1		TKP	
Lecture 38	The matrix equation $Ax = b$, solution sets of linear systems, 2.		TKP	
Lecture 39	Applications of linear systems.		TKP	
Lecture 40	Applications of linear systems, linear independence.		TKP	
Lecture 41	Real Quadratic Form involving not more than three variables 1		TKP	
Lecture 42	Real Quadratic Form involving not more than three variables 2		TKP	
Lecture 43	Characteristic equation of square matrix of order not more than three.		TKP	
Lecture 44	Eigenvalues and eigenvectors.		TKP	
Lecture 45	Determination of eigenvalues and eigenvectors.		TKP	
Lecture 46	Cayley-Hamilton Theorem.		TKP	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		TKP	

Text/Reference Books:

1. T. Andreescu and D. Andrica, Complex Numbers from A to . . . Z, Birkhauser Boston, 2008.
2. D.C. Lay, S.R. Lay and J.J. McDonald, Linear Algebra and its Applications, 5rd Ed., Pearson, 2014.
3. K.B. Dutta, Matrix and linear algebra, Prentice Hall, 2004.
4. K. Hoffman and R. Kunze, Linear algebra, Prentice Hall, 1971.
5. W.S. Burnstine and A.W. Panton, Theory of equations, Nabu Press, 2011.
6. S.H. Friedberg, A.J. Insel and L.E. Spence, Linear Algebra, 4th Ed., PHI, 2004.
7. S. Bernard and J.M. Child, Higher Algebra, Macmillan and Co. 1952.

PROGRAM NAME: B.Sc.(Major)

COURSE: MATHEMATICS(Major) 1st Semester

PAPER NAME: Number Theory & Boolean Algebra

PAPER CODE: MTMMJ-SEC-01

NAME OF TEACHER(S):

RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.),

MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Number Theory

Unit-1

Integers: Principle of Mathematical Induction. Division Algorithm. Representation of integer in an arbitrary base. Prime Integers. Fundamental theorem of Arithmetic. Euclid's Theorem. Linear Diophantine equations.

Congruences: Congruence relation on integers, Basic properties of this relation. Linear Congru- ence. Chinese Remainder Theorem, System of Linear Congruences.

Unit-2

Application of Congruences: Divisibility test. Computer file, Storage and Hashing functions. Round-Robin Tournaments. Check-digit in an ISBN, Universal Product code, Major Credit Cards. Error detecting capability.

Congruence Classes: Addition and Multiplication of Congruence Classes. Fermat's little Theorem. Euler's Theorem. Wilson's Theorem. Some simple applications.

Boolean Algebra

Unit-3

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 homo- morphisms.

Unit-4

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal and maximal forms of Boolean polynomials, Quinn-McCluskey method, Kar- naugh diagrams, Logic Gates, switching circuits and applications of switching circuits.

Class	Topic		TEACHER	
Lecture 1	Integers: Principle of Mathematical Induction.	Module -1	RS	,Dec-2 Classes , Jan-2 Classes Feb-1 Classes,
Lecture 2	Division Algorithm. Representation of integer in an arbitrary base. .		RS	
Lecture 3	Prime Integers.		RS	
Lecture 4	Fundamental theorem of Arithmetic. Euclid's Theorem.		RS	
Lecture 5	Linear Diophantine equations. 1		RS	
Lecture 6	Linear Diophantine equations. 2		RS	

	Congruences: Congruence relation on integers.			
Lecture 7	Basic properties of this relation.	Module -1	RS	Sept- 1 Classes , Nov – 2
Lecture 8	Linear Congruence. 1		RS	
Lecture 9	Linear Congruence. 2		RS	
Lecture 10	Chinese Remainder Theorem.		RS	
Lecture 11	System of Linear Congruences.		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		SA	
Lecture 12	Application of Congruences: Divisibility test.	Module -2	SA	Sept- 2 Classes , Nov – 1 Classes ,Dec-2 Classes , Jan-2 Classes Feb-3 Classes,
Lecture 13	Computer file, Storage and Hashing functions.		SA	
Lecture 14	Round-Robin Tournaments.		SA	
Lecture 15	Check-digit in an ISBN.		SA	
Lecture 16	Universal Product code, Major Credit Cards.		SA	
Lecture 17	Error detecting capability.		SA	
Lecture 18	Congruence Classes: Addition and Multiplication of Congruence Classes.		SA	
Lecture 19	Fermat's little Theorem.		SA	
Lecture 20	Wilson's Theorem.		SA	
Lecture 21	Wilson's Theorem. Some simple applications.		SA	
Lecture 22	Exercise		SA	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		SA	
Lecture 23	Definition, examples and basic properties of ordered sets.	Module -3	PK	Sept-2 Classes , Nov–1 Classes Dec-1 Classes , Jan-1 Classes
Lecture 24	Maps between ordered sets.		PK	
Lecture 25	Duality principle.		PK	
Lecture 26	Lattices as ordered sets.		PK	
Lecture 27	Lattices as algebraic structures.		PK	
Lecture 27	Poducts and homomorphisms. 1		PK	
Lecture 28	Poducts and homomorphisms. 2		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		PK	
Lecture 29	Definition, examples and properties of modular lattice.	Module -4	TKP	Sept- 2 Classes ,
Lecture 30	Definition, examples and properties distributive lattices.		TKP	

Lecture 31	Boolean algebras		TKP	
Lecture 32	Boolean polynomials.		TKP	
Lecture 33	Minimal and maximal forms of Boolean polynomials. 1		TKP	
Lecture 34	Minimal and maximal forms of Boolean polynomials. 2		TKP	
Lecture 35	Quinn-McCluskey method.		TKP	
Lecture 36	Karnaugh diagrams.		TKP	
Lecture 37	Logic Gates.		TKP	
Lecture 38	Switching circuits and applications of switching circuits 1		TKP	
Lecture 39	Switching circuits and applications of switching circuits 2		TKP	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		TKP	

Text/Reference Books:

1. B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press, 1990.
2. E.G. Goodaire and M.M. Parmenter, Discrete Mathematics with Graph Theory, (2nd Ed.), Pearson Education (Singapore) P.Ltd., Indian Reprint 2003.
3. R. Lidl and G. Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
4. D.M. Burton, Elementary Number Theory, 6th Ed., Tata McGraw Hill, Indian reprint, 2007.
5. N. Robinns, Beginning Number Theory, 2nd Ed., Narosa Publishing House Pvt. Ltd., Delhi, 2007
6. G.A. Jones and J.M. Jones, Elementary Number Theory, Springer International Edition.
7. N. Koblitz, A course in number theory and cryptography, Springer-Verlag, 2nd edition.
8. K.H. Rosen, Elementary Number Theory & Its Applications, AT&T Bell Laboratories, Addition-Wesley Publishing Company, 3rd Edition.
9. K. Ireland and M. Rosen, A Classical Introduction to Modern Number Theory, 2nd edition, Springer-verlag.
10. R.A. Mollin, Advanced Number Theory with Applications, CRC Press, A Chapman & Hall Book.

PROGRAM NAME: B.Sc. (Major)

COURSE: MATHEMATICS(Major) 2nd Semester

PAPER NAME: Calculus & Analytical Geometry

PAPER CODE: MTM-DC-MJ-201

NAME OF TEACHER(S):

RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.),

MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Module-1

Real-valued functions defined on an interval, limit of a function (Cauchy's definition), Algebra of limits, Continuity of a function at a point and in an interval, Properties of continuous functions (statement only) and its related problems on closed intervals, Hyperbolic functions. Higher or- der derivatives, Leibnitz rule of successive differentiation and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, concavity, convexity and points of inflection, envelopes, asymptotes, radius of curvature.

Module-2

Reduction formulae, derivations and illustrations of reduction formulae of the type integration of $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sec^n x$, $(\log x)^n$, $\sin^n x \sin^m x$, evaluation of definite integrals, integration as the limit of a sum, concept of improper integration, use of Beta and Gamma functions, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution, volume enclosed by closed surface of revolution.

Module-3

Reflection properties of conics, translation and rotation of axes and second degree equations, reduction and classification of conics using the discriminant, Point of intersection of two intersecting straight lines. Angle between two lines, Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic. Equations of pair of tangents from an external point, chord of contact, Polar equations of straight lines and conics. Equation of chord joining two points. Equations of tangent and normal, Poles and Polars.

Module-4

Spheres, Cylindrical surfaces, Central conicoids, paraboloids, plane sections of conicoids, Generat- ing lines, Classification of quadrics, illustrations of quadric surfaces, like cone, cylinder, paraboloid, ellipsoid, hyperboloid.

Class	Topic		TEACHER	
Lecture 1	Real-valued functions defined on an interval.	Module-1	PK	May-4 Classes ,June-2 Classes,
Lecture 2	limit of a function (Cauchy's definition).		PK	
Lecture 3	Algebra of limits, Continuity of a function at a point and in an interval.		PK	
Lecture 4	Properties of continuous functions (statement only) and its related problems on closed intervals		PK	
Lecture 5	Hyperbolic functions.		PK	
Lecture 6	Higher order derivatives.		PK	
Lecture 7	Leibnitz rule of successive differentiation.		PK	
Lecture 8	Leibnitz rule applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$.		PK	March-2 Classes , April-3 Classes
Lecture 9	Concavity, convexity and points of inflection		PK	
Lecture 10	Asymptotes.		PK	
Lecture 11	Radius of curvature.		PK	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		PK	
Lecture 12	Reduction formulae, derivations and illustrations of reduction formulae of the type integration of $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sec^n x$, $(\log x)^n$, $\sin^n x \sin^m x$ - 1	Module -2	RS	May-4 Classes ,June-3 Classes, March-3 Classes , April-4 Classes
Lecture 13	Reduction formulae, derivations and illustrations of reduction formulae of the type integration of $\sin^n x$, $\cos^n x$, $\tan^n x$, $\sec^n x$, $(\log x)^n$, $\sin^n x \sin^m x$, -2		RS	
Lecture 14	Evaluation of definite integrals,		RS	
Lecture 15	Integration as the limit of a sum, concept of improper integration,		RS	
Lecture 16	Beta and Gamma functions. 1		RS	
Lecture 17	Beta and Gamma functions. 2.		RS	
Lecture 18	Parametric equations.		RS	
Lecture 19	Parametrizing a curve, arc length, arc length of parametric curves.		RS	
Lecture 20	Area of surface of revolution.1		RS	
Lecture 21	Volume enclosed by closed surface of revolution.		RS	
Lecture 22	Exercise solve		RS	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		RS	

Lecture 23	Reflection properties of conics, translation and rotation of axes and second degree equations.	Module -3	TKP	May-3 Classes ,June-4 Classes, March-4 Classes , April-4 Classes
Lecture 24	Reduction and classification of conics using the discriminant. 1		TKP	
Lecture 25	Reduction and classification of conics using the discriminant. 2		TKP	
Lecture 26	Point of intersection of two intersecting straight lines.		TKP	
Lecture 27	Angle between two lines, Equation of bisectors..		TKP	
Lecture 27	Equation of two lines joining the origin to the points in which a line meets a conic.		TKP	
Lecture 28	Equations of pair of tangents from an external point.		TKP	
Lecture 29	Chord of contact, Polar equations of straight lines and conics. 1		TKP	
Lecture 30	Chord of contact, Polar equations of straight lines and conics. 2		TKP	
Lecture 31	Equations of tangent and normal.1		TKP	
Lecture 32	Equations of tangent and normal.2		TKP	
Lecture 33	Poles and Polars.1		TKP	
Lecture 34	Poles and Polars 2		TKP	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		TKP	
Lecture 35	Spheres	Module -4	SA	May-3 Classes ,June-4 Classes, March-4 Classes , April-3 Classes
Lecture 36	Cylindrical surfaces		SA	
Lecture 37	Paraboloids, plane sections of conicoids 1		SA	
Lecture 38	Paraboloids, plane sections of conicoids 2		SA	
Lecture 39	Generating lines 1		SA	
Lecture 40	Generating lines 2		SA	
Lecture 41	Classification of quadrics		SA	
Lecture 42	Illustrations of quadric surfaces, like cone		SA	
Lecture 43	Cylinder		SA	
Lecture 44	Paraboloid, ellipsoid		SA	
Lecture 45	ellipsoid, hyperboloid.		SA	
Lecture 46	Exercise solve		SA	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		SA	

Text/Reference Books:

1. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Co., 1895.
2. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson, 2005.
3. M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus, 3rd Ed., Pearson Education, 2007.
4. H. Anton, I. Bivens and S. Davis, Calculus, 10th Ed., John Wiley and Sons Inc., 2012.
5. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer, 1989.
6. T.M. Apostol, Calculus (Volumes I & II), John Wiley & Sons, 1967.
7. S. Goldberg, Calculus and mathematical analysis.
8. S. Lang, A First Course in Calculus, Springer 1998.
9. K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2nd ed., 2013.
10. R.J.T. Bell, An Elementary Treatise on Coordinate Geometry of Three Dimensions, Macmillan Publishers India Limited, 2000.

PROGRAM NAME: B.Sc.(Major)

COURSE: MATHEMATICS(Major) 2nd Semester

PAPER NAME: Set Theory

PAPER CODE: MTMMJ-SEC-02

NAME OF TEACHER(S):

RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.),

MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Unit-1

Sets, subsets, Set operations, 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-2

Difference and Symmetric difference of two sets. Set identities, Generalized unions and intersec- tions. Cardinality of a set, Concept of Countable and Uncountable set.

Unit-3

Relation: Cartesian Product of sets. Composition of relations, Types of relations, Partitions, Equivalence Relations, Examples of congruence modulo relation and examples in Z. Binary oper- ations on set, Functions.

Unit-4

Partial ordering relations, Poset, *n*-ary relations, Hasse diagram, greatest and least element in a poset. Lattice, distributive lattice.

Class	Topic		TEACHER	
Lecture 1	Sets, subsets, Set operations,	Module -1	RS	Mar-3 Classes, Apr-2 Classes, Mayr-3 Classes,
Lecture 2	The laws of set theory and Venn diagrams..		RS	
Lecture 3	Examples of finite and infinite sets.		RS	
Lecture 4	Finite sets and counting principle.		RS	
Lecture 5	Empty set, properties of empty set		RS	
Lecture 6	Standard set operations		RS	
Lecture 7	Classes of sets.	Module	RS	
Lecture 8	Power set of a set.		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		RS	
Lecture 09	Difference and Symmetric difference of two sets.	Module -2	TKP	Mar-2 Classes, Apr-2 Classes, Mayr-2 Classes, June-2
Lecture 10	Set identities.		TKP	
Lecture 11	Generalized unions and intersections.		TKP	
Lecture 12	Cardinality of a set		TKP	
Lecture 13	Concept of Countable and Uncountable set.		TKP	
Lecture 14	Concept of Countable and Uncountable set.		TKP	
Lecture 15	Exercise		TKP	

Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		TKP	
Lecture 16	Relation: Cartesian Product of sets.	Module -3	PK	Mar-2 Classes, Apr-3 Classes, Mayr-2 Classes, June-2
Lecture 17	Composition of relations.		PK	
Lecture 18	Types of relations		PK	
Lecture 19	Partitions.		PK	
Lecture 20	Equivalence Relations.		PK	
Lecture 21	Examples of congruence modulo relation and examples in Z.		PK	
Lecture 22	Binary operations on set, Functions.		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		PK	
Lecture 29	Partial ordering relations.	Module -4	SA	Mar-2 Classes, Apr-2 Classes, Mayr-2 Classes, June-2
Lecture 30	Partial ordering relations, Poset.		SA	
Lecture 31	*n*-ary relations.		SA	
Lecture 32	Hasse diagram		SA	
Lecture 33	Greatest and least element in a poset.		SA	
Lecture 34	Lattice. 1		SA	
Lecture 35	Lattice. 2		SA	
Lecture 36	Distributive lattice. 1		SA	
Lecture 37	Distributive lattice. 2		SA	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		SA	

Text/Reference Books

1. J. Clark and D.A. Holton, A First Look at Graph Theory, World Scientific, 2005.
2. D.S. Malik, M.K. Sen and S. Ghosh, Introduction to Graph Theory, Cengage Learning Asia, 2014.
3. E.G. Goodaire and M.M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Edition, Pearson Education India, 2015.
4. N Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1979.
5. J.A. Bondy and U.S.R. Murty, Graph Theory with Applications, Macmillan, 1976.

6. R. Diestel, Graph Theory, Springer-Verlag, 2000.

7. F. Harary, Graph Theory, Narosa, 2001.

8. D.B. West, Introduction to Graph Theory, Prentice Hall, 1996.

9. R.J. Wilson, Introduction to Graph Theory, 3rd Ed., Longman, 1985.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 3rd Semester

PAPER NAME: Differential Equation **PAPER CODE: MC05**

NAME OF TEACHER(S):

RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.),

MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Unit-1

Exact, linear and Bernoulli's equations, trajectories. Equations not of first degree, Clairaut's equa- tions, singular solution. Existence & Uniqueness theorem for 1st order IVP Picard's Theorem (Statement only). General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian and its properties. Linear homogeneous and non- homogeneous equations of higher order with constant coefficients, Cauchy-Euler equation, method of undetermined coefficients, method of variation of parameters, Eigenvalue problem.

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. Equilibrium points, Interpretation of the phase plane.

Unit-3

Power series solution of a differential equation about an ordinary point, solution about a regular singular point. Legendre polynomials, Bessel functions of the first kind and their properties.

Unit-4

Partial differential equations, basic concepts and definitions. First-order equations: classifica- tion, construction and geometrical interpretation. Method of characteristics for obtaining general solution of quasi linear equations. Canonical forms of first-order linear equations. Solution by Lagrange's and Charpit's method.

Class	Topic		TEACHER	
Lecture 1	Exact equations	Unit-1	SA	Jul-1classes,Aug – 3classes, Sept- 3 classes, Nov-3classes, Dec- 2classess
Lecture 2	Linear and Bernoulli's equations.		SA	
Lecture 3	Equations solving not of first degree		SA	
Lecture 4	Clairaut's equations		SA	
Lecture 5	Singular solution		SA	
Lecture 6	Lipschitz condition		PK	
Lecture 7	Picard's Theorem		PK	
Lecture 8	General solution of homogeneous equation of second order	Unit-1	PK	
Lecture 9	Principle of super position for homogeneous equation		TKP	
Lecture 10	Wronskian and its properties.		TKP	
Lecture 11	Linear homogeneous equations of higher order with constant coefficients		TKP	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		PK	
Lecture 12	Linear non-homogeneous equations of higher order with constant coefficients	Unit-2	TKP	Jul-2 classes, Aug – 3 classes, Sept- 2 classes, Nov-3 claseses, Dec- 2classess
Lecture 13	Euler's equation		TKP	
Lecture 14	Method of undetermined coefficients		TKP	
Lecture 15	Method of variation of parameters		TKP	
Lecture 16	Eigenvalue problem		TKP	
Lecture 17	Systems of linear differential equations, types of linear systems		TKP	
Lecture 18	Differential operators, an operator method for linear systems with constant coefficients		TKP	
Lecture 19	Basic Theory of linear systems in normal form		TKP	
Lecture 20	Homogeneous linear systems with constant coefficients		TKP	
Lecture 21	Two Equations in two unknown functions		TKP	
Lecture 22	Equilibrium points,		TKP	
Lecture 23	Interpretation of the phase plane		TKP	
Lecture 24	Discussion		TKP	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 24 and Assignment-2		PK,TKP,SA	

Lecture 25	Power series solution of a differential equation	Unit-3	SA	Jul-2 classes, Aug – 3 classes, Sept- 2 classes, Nov-3 classes, Dec- 2classes
Lecture 26	Problem solve		SA	
Lecture 27	Power series solution of a differential equation about an ordinary point		SA	
Lecture 27	Problem solve		SA	
Lecture 28	Power series solution of a differential equation about a regular singular point		SA	
Lecture 29	Problem solve		SA	
Lecture 30	Legendre polynomials		SA	
Lecture 31	Problem solve		SA	
Lecture 32	Bessel functions of the first kind	Unit-3	SA	
Lecture 33	properties of Bessel functions of the first kind		SA	
Lecture 34	Problem solve		SA	
Lecture 35	Discussion		SA	
Examination	Class Test-3(Tutorial Exam) on Lecturer 25 to Lecturer 35 and Assignment-3		SA	
Lecture 36	Partial differential equations	Unit-4	PK	Jul-2 classes, Aug – 4 classes, Sept- 2 classes, Nov-3 classes, Dec- 2classes
Lecture 37	Basic concepts about partial differential equations		PK	
Lecture 38	Problem solve		PK	
Lecture 39	First- Order partial differential equations		PK	
Lecture 40	First- Order Equations: classification		PK	
Lecture 41	First- Order Equations: construction.		PK	
Lecture 42	First- Order Equations: geometrical interpretation.		PK	
Lecture 43	Method of characteristics for obtaining general solution of quasi linear equations		PK	
Lecture 44	Canonical forms of first-order linear equations		PK	
Lecture 45	Solution by Lagrange's method.		PK	
Lecture 46	Solution by Charpit's method.		PK	
Lecture 47	Discussion		PK	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 47 and Assignment-4		PK	

Reference Books

1. G.F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill, 2017.
2. S.L. Ross, Differential Equations, 3rd Ed., Wiley, 2007.
3. C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value Problems Computing and Modeling, Pearson, 2005.
4. M.L. Abel and J.P. Braselton, Differential Equations with MATHEMATICA, 3rd Ed., Elsevier, 2004.
5. D. Murray, Introductory Course in Differential Equations, Orient Longman, 2003.
6. W.E. Boyce and R.C. Diprima, Elementary Differential Equations and Boundary Value Problems, Wiley, 2009.
7. E.A. Coddington, An Introduction to Ordinary Differential Equations, Dover Publications Inc., 1989.

PROGRAM NAME: B.Sc.(Major)

COURSE: MATHEMATICS(Major) 3rd Semester

PAPER NAME: Graph Theory

PAPER CODE: MTMMJ-SEC-03

NAME OF TEACHER(S):

RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.),

MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

Unit-1

Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs, isomorphism of graphs. Paths and cycles.

Unit-2

Eulerian circuits, Eulerian graph, Hamiltonian cycles and related theorems, Representation of a graph by matrix, the adjacency matrix, incidence matrix.

Unit-3

Weighted graph, Travelling salesman's problem, Chinese postman problem, shortest path, Dijk- stra's algorithm, Floyd-Warshall algorithm, Bellman-Ford Algorithm.

Unit-4

Tree forest and their properties, spanning tree, Minimum spanning tree algorithms, Kruskal's al- gorithm, Connectivity, matching in bipartite graphs, matching in general graphs.

Class	Topic		TEACHER	
Lecture 1	Definition, examples and basic properties of graphs1	Module -1	RS	Aug-2 classes,Sept- 2, Nov – 1 ,Dec-2, Jan-2
Lecture 2	Definition, examples and basic properties of graphs 2		RS	
Lecture 3	Pseudo graphs,		RS	
Lecture 4	Complete graphs.		RS	
Lecture 5	Bipartite graphs		RS	
Lecture 6	Isomorphism of graphs.		RS	
Lecture 7	Paths and cycles.		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		RS	
Lecture 09	Eulerian circuits	Module -2	TKP	Aug-1 classes,Sept- 1, Nov – 2 ,Dec-2, Jan-3
Lecture 10	Eulerian circuits, Eulerian graph,		TKP	
Lecture 11	Hamiltonian cycles and related theorems.		TKP	
Lecture 12	Representation of a graph by matrix.		TKP	
Lecture 13	the adjacency matrix,		TKP	
Lecture 14	the adjacency matrix, incidence matrix.		TKP	
Lecture 15	Exercise		TKP	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		TKP	
Lecture 16	Weighted graph.	Modul	PK	Aug-2 classes
Lecture 17	Travelling salesman's problem.		PK	

Lecture 18	Chinese postman problem,		PK	
Lecture 19	Shortest path, Dijkstra's algorithm,		PK	
Lecture 20	Floyd-Warshall algorithm.		PK	
Lecture 21	Floyd-Warshall algorithm.		PK	
Lecture 22	Floyd-Warshall algorithm, Bellman-Ford Algorithm. Exercise		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		PK	
Lecture 29	Tree forest and their properties.	Module -4	SA	Aug-2 classes,Sept- 3, Nov – 2 ,Dec-2, Jan-2
Lecture 30	spanning tree		SA	
Lecture 31	Minimum spanning tree algorithms,		SA	
Lecture 32	Kruskal's algorithm,		SA	
Lecture 33	Connectivity.		SA	
Lecture 34	Matching in bipartite graphs.		SA	
Lecture 35	matching in general graphs.		SA	
Lecture 36	matching in general graphs.		SA	
Lecture 37	Exercise		SA	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		SA	

Reference Books

10. J. Clark and D.A. Holton, A First Look at Graph Theory, World Scientific, 2005.
11. D.S. Malik, M.K. Sen and S. Ghosh, Introduction to Graph Theory, Cengage Learning Asia, 2014.
12. E.G. Goodaire and M.M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Edition, Pearson Education India, 2015.
13. N Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1979.
14. J.A. Bondy and U.S.R. Murty, Graph Theory with Applications, Macmillan, 1976.
15. R. Diestel, Graph Theory, Springer-Verlag, 2000.
16. F. Harary, Graph Theory, Narosa, 2001.
17. D.B. West, Introduction to Graph Theory, Prentice Hall, 1996.
18. R.J. Wilson, Introduction to Graph Theory, 3rd Ed., Longman, 1985

PROGRAM NAME: B.Sc. (Major)

COURSE: MATHEMATICS(Major) 4th Semester

PAPER NAME: Mechanics **PAPER CODE: MC06**

NAME OF TEACHER(S): MD SAHID ALAM (S.A.), POLY KARMAKAR(P.K.)

Mechanics

Unit-1

Coplanar forces in general: Resultant force and resultant couple, Special cases, Varignon's the- orem, Necessary and sufficient conditions of equilibrium. Equilibrium equations of the first, second and third kind.

An arbitrary force system in space: Moment of a force about an axis, Varignon's theorem. Resultant force and resultant couple, necessary and sufficient conditions of equilibrium. Equi- librium equations, Reduction to a wrench, Poinsot's central axis, intensity and pitch of a wrench, Invariants of a system of forces. Statically determinate and indeterminate problems.

Equilibrium in the presence of sliding Friction force: Contact force between bodies, Coulomb's laws of static Friction and dynamic friction. The angle and cone of friction, the equilibrium region.

Unit-2

Virtual work: Workless constraints- examples, virtual displacements and virtual work. The principle of virtual work, Deductions of the necessary and sufficient conditions of equilibrium of an arbitrary force system in plane and space, acting on a rigid body.

Stability of equilibrium: Conservative force field, energy test of stability, condition of stability of a perfectly rough heavy body lying on a fixed body. Rocking stones.

Unit-3

Kinematics of a particle: Velocity, acceleration, angular velocity, linear and angular momen- tum. Relative velocity and acceleration. Expressions for velocity and acceleration in case of rectilinear motion and planar motion in Cartesian and polar coordinates, tangential and normal components. Uniform circular motion.

Newton laws of motion and law of gravitation: Space, time, mass, force, inertial reference frame, principle of equivalence and g. Vector equation of motion. Work, power, kinetic energy, conservative forces-potential energy. Existence of potential energy function.

Energy conservation in a conservative field. Stable equilibrium and small oscillations: Ap- proximate equation of motion for small oscillation. Impulsive forces

Unit-4

Problems in particle dynamics: Rectilinear motion in a given force field - vertical motion under uniform gravity, inverse square field, constrained rectilinear motion, vertical motion under grav- ity in a resisting medium, simple harmonic motion, Damped and forced oscillations, resonance of an oscillating system, motion of elastic strings and springs.

Planar motion of a particle: Motion of a projectile in a resisting medium under gravity, or- bits in a central force field, Stability of nearly circular orbits. Motion under the attractive inverse square law, Kepler's laws on planetary motion. Slightly disturbed orbits, motion of artificial satellites. Constrained motion of a particle on smooth and rough curves. Equations of motion referred to a set of rotating axes.

Class	Topic		TEACHER	
Lecture 1	Coplanar forces in general: Resultant force and resultant couple,Special cases .	Unit-1	PK	, July- 4 Classes, , Aug-5 Classes,
Lecture 2	Coplanar forces,Varignon's theorem.		PK	
Lecture 3	Necessary and sufficient conditions of equilibrium.		PK	
Lecture 4	Equilibrium equations of the first, second and third kind.		PK	
Lecture 5	An arbitrary force system in space: Moment of a force about an axis,.		PK	
Lecture 6	Varignon's theorem.		PK	
Lecture 7	Resultant force and resultant couple, necessary and sufficient conditions of equilibrium.		PK	
Lecture 8	Equilibrium equations.		PK	
Lecture 9	Reduction to a wrench, Poinsot's central axis, intensity and pitch of a wrench.		PK	
Lecture 10	Invariants of a system of forces.		PK	
Lecture 11	Statically determinate and indeterminate problems.		PK	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		PK	
Lecture 12	Equilibrium in the presence of sliding Friction force.	Unit-2	PK	Sept-4 Classes, Nov-2 classes, Dec- 4 classes
Lecture 13	Friction force: Contact force between bodies.		PK	
Lecture 14	Coulomb's laws of static Friction and dynamic friction.		PK	
Lecture 15	The angle and cone of friction, the equilibrium region.		PK	
Lecture 16	Virtual work: Workless constraints examples, virtual displacements and virtual work.		PK	
Lecture 17	The principle of virtual work.		PK	
Lecture 18	Deductions of the necessary and sufficient conditions of equilibrium of an arbitrary force system in plane and space, acting on a rigid body.		PK	
Lecture 19	Virtual work problems.		PK	
Lecture 20	Virtual work problems.		PK	
Lecture 21	Stability of equilibrium: Conservative force field.		PK	
Lecture 22	Energy test of stability.		PK	
Lecture 23	Condition of stability of a perfectly rough heavy body lying on a fixed body		PK	
Lecture 24	Rocking stones.		PK	

Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 24 and Assignment-2		PK	
Lecture 25	Kinematics of a particle: Velocity, acceleration, angular velocity, linear and angular momentum.	Unit-3	SA	July-4 Classes, , Aug-5 Classes,
Lecture 26	Relative velocity and acceleration.		SA	
Lecture 27	Expressions for velocity and acceleration in case of rectilinear motion and planar motion in Cartesian and polar coordinates,.		SA	
Lecture 27	Expressions for velocity and acceleration in case of rectilinear motion and planar motion in tangential and normal components.		SA	
Lecture 28	Uniform circular motion.		SA	
Lecture 29	Newton laws of motion and law of gravitation: Space, time, mass, force, inertial reference frame, principle of equivalence and g.		SA	
Lecture 30	Vector equation of motion. Work, power		SA	
Lecture 31	Kinetic energy.		SA	
Lecture 32	Conservative forces-potential energy.		SA	
Lecture 33	Existence of potential energy function.		SA	
Lecture 34	Energy conservation in a conservative field.		SA	
Lecture 35	Energy conservation in a conservative field.		SA	
Examination	Class Test-3(Tutorial Exam) on Lecturer 25 to 35 and Assignment-3		SA	
Lecture 36	Stable equilibrium and small oscillations: Approximate equation of motion for small oscillation.	Unit-4	SA	Sept-3 Classes, Nov-3classes, Dec- 4 classes
Lecture 37	Impulsive forces		SA	
Lecture 38	Problems in particle dynamics: Rectilinear motion in a given force field - vertical motion under uniform gravity.		SA	
Lecture 39	Inverse square field, constrained rectilinear motion.		SA	
Lecture 40	vertical motion under gravity in a resisting medium,		SA	
Lecture 41	simple harmonic motion.		SA	
Lecture 42	Damped and forced oscillations		SA	
Lecture 43	Resonance of an oscillating system, motion of elastic strings and springs.		SA	
Lecture 44	Planar motion of a particle: Motion of a projectile in a resisting medium under gravity,		SA	
Lecture 45	orbits in a central force field	Unit-4	SA	December-6 Classes
Lecture 46	Stability of nearly circular orbits.		SA	
Lecture 47	Motion under the attractive inverse square law, Kepler's laws on planetary motion..		SA	

Lecture 48	Slightly disturbed orbits, motion of artificial satellites.		SA	
Lecture 49	Constrained motion of a particle on smooth and rough curves.		SA	
Lecture 50	Equations of motion referred to a set of rotating axes		SA	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 50 and Assignment-4		SA	

Reference Books

1. R.D. Gregory, Classical mechanics, Cambridge University Press, 2006.
2. K.R. Symon, Mechanics, Addison Wesley, 1971.
3. M. Lunn, A First Course in Mechanics, Oxford University Press, 1991.
4. J.L. Synge and B.A. Griffith, Principles of Mechanics, Mcgraw Hill, 1949.
5. T.W.B. Kibble, F.H. Berkshire, Classical Mechanics, Imperial College Press, 2004.
6. D.T. Greenwood, Principle of Dynamics, Prentice Hall, 1987.
7. F. Chorlton, Textbook of Dynamics, E. Horwood, 1983.
8. D. Kleppner and R. Kolenkow, Introduction to Mechanics, Mcgraw Hill, 2017.
9. A.P. French, Newtonian Mechanics, Viva Books, 2011.
10. S.P. Timoshenko and D.H. Young, Engineering Mechanics, Schaum Outline Series, 4th Ed., 1964.
11. D. Chernilevski, E. Lavrova and V. Romanov, Mechanics for Engineers, MIR Publishers
12. I.H. Shames and G.K.M. Rao, Engineering Mechanics: Statics and Dynamics, 4th Ed., Pearson, 2009.
13. R.C. Hibbeler and A. Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Pearson, Delhi.
14. S.L. Loney, An Elementary Treatise on the Dynamics of Particle and of Rigid Bodies, Loney Press, 2007.
15. S.L. Loney, An Elementary Treatise on Statics, Cambridge University Press, 2016.
16. R.S. Verma, A Textbook on Statics, Pothishala, 1962.
17. A.S. Ramsey, Dynamics (Part I & II), Cambridge University Press, 1952.

PAPER CODE: MC07

NAME OF TEACHER(S): Dr. TILAK KUMAR , RAKESH SARKAR(R.S.)

Unit-1

Errors: Relative, Absolute, Round off, Truncation, Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Convergence of these methods.

Unit-2

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. LU Decomposition. Finite difference operators. Interpolation: Newton's and Lagrange methods. Error bounds. Central difference interpolation. Numerical differentiation.

Unit-3

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, Gauss quadrature formula. The algebraic eigenvalue problem: Power method. Approximation: Least square polynomial approximation.

Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.

Unit-4

Overview of the C-Programming Languages, Data Type, Constants and Variables, Input and Output, Operators and Expressions, if-else Statement, switch Statement, for Loop, while Loop, do-while Loop, break and continue, functions, array and simple problems.

Class	Topic	TEACHER
Lecture 1	Errors Calculation, Relative, Absolute,	TKP
Lecture 2	Round off, Truncation	TKP
Lecture 3	Transcendental and Polynomial equations	TKP
Lecture 4	Bisection method	TKP
Lecture 5	Solution of Transcendental and Polynomial equations using Bisection method	TKP
Lecture 6	Newton's method and Solution of Transcendental and Polynomial equations	TKP
Lecture 7	Secant method, Regula-falsi method	TKP
Lecture 8	fixed point iteration, Newton-Raphson method	TKP
Lecture 9	Convergence of these methods	TKP
Lecture 10	Solution of Transcendental and Polynomial equations using Secant method, Regula-falsi method	TKP
Lecture 11	Solution of Transcendental and Polynomial equations using fixed point iteration, Newton-Raphson method	TKP
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	TKP

Lecture 12	System of linear algebraic equations	TKP
Lecture 13	Gaussian Elimination	TKP
Lecture 14	Gauss Jordan methods	TKP
Lecture 15	Solution of System of linear algebraic equations by Gaussian Elimination and Gauss Jordan methods	TKP
Lecture 16	Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 17	Convergence Analysis of Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 18	Solution of System of linear algebraic equations by Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 19	LU Decomposition	TKP
Lecture 20	Finite difference operators	TKP
Lecture 21	. Interpolation: Newton's and Lagrange methods and Error bounds	TKP
Lecture 22	Central difference interpolation. Numerical differentiation	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2	TKP
Lecture 23	Numerical Integration: Newton Cotes formula	RS
Lecture 24	Numerical Integration: Trapezoidal rule, Composite Trapezoidal rule	RS
Lecture 25	Numerical Integration: Simpson's 1/3rd rule, Composite Simpson's 1/3rd rule and Simpsons 3/8th rule	RS
Lecture 26	Weddle's rule	RS
Lecture 27	Boole's Rule	RS
Lecture 27	Midpoint rule	RS
Lecture 28	Gauss quadrature formula	RS
Lecture 29	The algebraic eigenvalue problem: Power method	RS
Lecture 30	Approximation: Least square polynomial approximation	RS
Lecture 31	Ordinary Differential Equations: The method of successive approximations	RS
Lecture 32	Euler's method, the modified Euler method	RS
Lecture 33	Runge-Kutta methods of orders two and four	RS
Lecture 34	Numerical solutions of some special types of Ordinary Differential Equations	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3	RS
Lecture 35	Overview of the C-Programming Languages	RS
Lecture 36	Data Type	RS
Lecture 37	Constants and Variables	RS

Lecture 38	Input and Output	RS
Lecture 39	Operators and Expressions	RS
Lecture 40	if-else Statement, nested if-else Statement	RS
Lecture 41	Some applications of if-else Statement and nested if-else Statement	RS
Lecture 42	switch Statement	RS
Lecture 43	for Loop	RS
Lecture 44	while Loop, do-while Loop	RS
Lecture 45	break and continue	RS
Lecture 46	functions	RS
Lecture 47	array and simple problems	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4	RS

Reference Books

1. K.E. Atkinson, An Introduction to Numerical Analysis, John Wiley and Sons, 1978.
2. B.W. Kernighan and D. Ritchie, The C Programming Language, Prentice Hall, 1988.
3. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
4. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineer- ing Computation, 6th Ed., New age International Publisher, 2007.
5. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
6. U.M. Ascher and C. Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
7. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
8. J.B. Scarborough, Numerical Mathematical Analysis, Oxford and IBH, 2005.
9. H. Schildt, The Complete Reference: C, McGraw Hill, 2017.
10. G. David, Head First C, Shroff, 2012.
11. S. Prata, C Primer Plus, Sams, 2004.
12. C. Xavier, C Language and Numerical Methods, New Age International, 2007.
13. B. Gottfried, Programming with C, McGraw Hill, 2017.

14. E. Balaguruswamy, Programming in ANSI C, McGraw Hill, 2017.
15. F.J. Scheid, Computers and Programming, McGraw-Hill, 1982.
16. T. Jeyapoovan, A First Course in Programming With C, Vikas Publication House, 2004.
17. Y. Kanetkar, Let Us C, BPB Publications, 2016.

PROGRAM NAME: B.Sc. (Honours)
COURSE: MATHEMATICS(Hons) 5th Semester
PAPER NAME: Advanced Analysis on R & C **PAPER CODE: DC11**
NAME OF TEACHER(S): POLY KARMAKAR(P.K.)

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, closure, subspaces, dense sets, separable spaces.

Unit-2

Sequences and their convergence in matric spaces, Cauchy sequences. Complete Matric Spaces, Cantor's theorem. Continuous mappings, sequential criterion and other characterizations of continuity, uniform continuity. Connectedness and compactness of a metric space.

Unit-3

Limits and continuity of the complex functions. Complex differentiation and the Cauchy-Riemann equations, analytic functions, examples of analytic functions, elementary properties of analytic functions, harmonic function, evaluation of the harmonic conjugate. Complex power series and radius of convergence, complex exponential function, trigonometric functions, hyperbolic functions, complex logarithm and analytic branch of logarithm. Introduction to conformal mapping.

Unit-4

Complex valued function defined on real intervals, curves and paths in the complex plane, parameterization of curves, contour and its elementary properties. Complex line integrals, Cauchy- Goursat theorem, Cauchy's theorem and its simple application, Cauchy's integral formula. Power series representation of complex functions, Taylor series representation, Laurent series representation.

Class	Topic	TEACHER
Lecture 1	Metric spaces: Definition and examples	PK
Lecture 2	Open balls	PK
Lecture 3	closed balls	PK
Lecture 4	Neighbourhood, open set	PK
Lecture 5	interior of a set	PK
Lecture 6	Limit point of a set	PK
Lecture 7	Closed set	PK
Lecture 8	closure	PK
Lecture 9	subspaces	PK
Lecture 10	dense sets	PK
Lecture 11	separable spaces	PK
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	PK
Lecture 12	Sequences and their convergence in matric spaces	PK
Lecture 13	Cauchy sequences	PK
Lecture 14	Complete Matric Spaces	PK
Lecture 15	Cantor's theorem	PK

Lecture 16	Continuous mappings	PK
Lecture 17	sequential criterion of continuity	PK
Lecture 18	other characterizations of continuity	PK
Lecture 19	uniform continuity	PK
Lecture 20	Connectedness of a metric space	PK
Lecture 21	compactness of a metric space.	PK
Lecture 22	Discussion	PK
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2	PK
Lecture 23	Limits and continuity of the complex functions	PK
Lecture 24	Complex differentiation	PK
Lecture 25	the Cauchy- Riemann equations	PK
Lecture 26	analytic functions, examples of analytic functions	PK
Lecture 27	, elementary properties of analytic functions	PK
Lecture 27	harmonic function	PK
Lecture 28	evaluation of the harmonic conjugate	PK
Lecture 29	Complex power series and radius of convergence	PK
Lecture 30	complex exponential function	PK
Lecture 31	Complex trigonometric functions	PK
Lecture 32	, hyper- bolic functions	PK
Lecture 33	complex logarithm	PK
Lecture 34	analytic branch of logarithm	PK
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3	PK
Lecture 35	Introduction to conformal mapping	PK
Lecture 36	Complex valued function defined on real intervals in the complex plane	PK
Lecture 37	Complex valued function defined on curves in the complex plane	PK
Lecture 38	Complex valued function defined on paths in the complex plane	PK
Lecture 39	Parameterization of curves and its elementary properties.	PK

Lecture 40	Parameterization of contour and its elementary properties.	PK
Lecture 41	Complex line integrals	PK
Lecture 42	Cauchy- Goursat theorem	PK
Lecture 43	Cauchy's theorem and its simple application	PK
Lecture 44	Cauchy's integral formula	PK
Lecture 45	Power series representation of complex functions	PK
Lecture 46	Taylor series representation	PK
Lecture 47	Laurent series representation.	PK
Lecture 48	Discussion	PK
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 48 and Assignment-4	PK

Reference Books

1. S. Shirali and H.L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.
2. S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
3. M.O Searcoid, Metric Spaces, Springer, 2007.
4. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, 2004.
5. J.E. Marsden and M.J. Hoffman, Basic Complex Analysis, W.H. Freeman, 1998.
6. J.W. Brown and R.V. Churchill, Complex Variables and Applications, 8th Ed., McGraw Hill, 2009.
7. J. Bak and D.J. Newman, Complex Analysis (Undergraduate Texts in Mathematics), 2nd Ed., Springer, 1997.
8. S. Ponnusamy, Foundations of Complex Analysis, Narosa, 2011.
9. E.M. Stein and R. Shakrachi, Complex Analysis, Princeton University Press, 2003.
10. J.B. Conway, Functions of one Complex variable, Narosa, 1996.
11. D. Sarason, Complex Function Theory, Hindustan Book Agency, 2008.
12. V. Karunakaran, Complex Analysis, Alpha Science, 2005.
13. T.W. Gamelin, Complex Analysis, Springer, 2001.
14. A. Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.
15. K.A. Ross, Elementary Analysis: The Theory of Calculus (Undergraduate Texts in Mathematics), Springer, 2013.
16. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., Wiley, 2002.
17. C.G. Denlinger, Elements of Real Analysis, Jones & Bartlett, 2011.

18. S. Goldberg, Calculus and Mathematical Analysis.

19. T.M. Apostol, Calculus (Vol. I & II), Wiley, 2007

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 5th Semester

PAPER NAME:Numerical Methods & C Programming Language PAPER CODE: DC12

NAME OF TEACHER(S): Dr. TILAK KUMAR , RAKESH SARKAR(R.S.)

Unit-1

Errors: Relative, Absolute, Round off, Truncation, Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regula-falsi method, fixed point iteration, Newton-Raphson method. Convergence of these methods.

Unit-2

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis. LU Decomposition. Finite difference operators. Interpolation: Newton's and Lagrange methods. Error bounds. Central difference interpolation. Numerical differentiation.

Unit-3

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, Gauss quadrature formula. The algebraic eigenvalue problem: Power method. Approximation: Least square polynomial approximation.

Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.

Unit-4

Overview of the C-Programming Languages, Data Type, Constants and Variables, Input and Output, Operators and Expressions, if-else Statement, switch Statement, for Loop, while Loop, do-while Loop, break and continue, functions, array and simple problems.

Class	Topic	TEACHER
Lecture 1	Errors Calculation, Relative, Absolute,	TKP
Lecture 2	Round off, Truncation	TKP
Lecture 3	Transcendental and Polynomial equations	TKP
Lecture 4	Bisection method	TKP
Lecture 5	Solution of Transcendental and Polynomial equations using Bisection method	TKP
Lecture 6	Newton's method and Solution of Transcendental and Polynomial equations	TKP
Lecture 7	Secant method, Regula-falsi method	TKP
Lecture 8	fixed point iteration, Newton-Raphson method	TKP
Lecture 9	Convergence of these methods	TKP
Lecture 10	Solution of Transcendental and Polynomial equations using Secant method, Regula-falsi method	TKP

Lecture 11	Solution of Transcendental and Polynomial equations using fixed point iteration, Newton-Raphson method	TKP
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	TKP
Lecture 12	System of linear algebraic equations	TKP
Lecture 13	Gaussian Elimination	TKP
Lecture 14	Gauss Jordan methods	TKP
Lecture 15	Solution of System of linear algebraic equations by Gaussian Elimination and Gauss Jordan methods	TKP
Lecture 16	Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 17	Convergence Analysis of Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 18	Solution of System of linear algebraic equations by Gauss Jacobi method, Gauss Seidel method	TKP
Lecture 19	LU Decomposition	TKP
Lecture 20	Finite difference operators	TKP
Lecture 21	. Interpolation: Newton's and Lagrange methods and Error bounds	TKP
Lecture 22	Central difference interpolation. Numerical differentiation	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2	TKP
Lecture 23	Numerical Integration: Newton Cotes formula	RS
Lecture 24	Numerical Integration: Trapezoidal rule, Composite Trapezoidal rule	RS
Lecture 25	Numerical Integration: Simpson's 1/3rd rule, Composite Simpson's 1/3rd rule and Simpsons 3/8th rule	RS
Lecture 26	Weddle's rule	RS
Lecture 27	Boole's Rule	RS
Lecture 27	Midpoint rule	RS
Lecture 28	Gauss quadrature formula	RS
Lecture 29	The algebraic eigenvalue problem: Power method	RS
Lecture 30	Approximation: Least square polynomial approximation	RS
Lecture 31	Ordinary Differential Equations: The method of successive approximations	RS
Lecture 32	Euler's method, the modified Euler method	RS
Lecture 33	Runge-Kutta methods of orders two and four	RS
Lecture 34	Numerical solutions of some special types of Ordinary Differential Equations	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3	RS
Lecture 35	Overview of the C-Programming Languages	RS
Lecture 36	Data Type	RS

Lecture 37	Constants and Variables	RS
Lecture 38	Input and Output	RS
Lecture 39	Operators and Expressions	RS
Lecture 40	if-else Statement, nested if-else Statement	RS
Lecture 41	Some applications of if-else Statement and nested if-else Statement	RS
Lecture 42	switch Statement	RS
Lecture 43	for Loop	RS
Lecture 44	while Loop, do-while Loop	RS
Lecture 45	break and continue	RS
Lecture 46	functions	RS
Lecture 47	array and simple problems	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4	RS

Reference Books

1. K.E. Atkinson, An Introduction to Numerical Analysis, John Wiley and Sons, 1978.
2. B.W. Kernighan and D. Ritchie, The C Programming Language, Prentice Hall, 1988.
3. B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
4. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineer- ing Computation, 6th Ed., New age International Publisher, 2007.
5. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
6. U.M. Ascher and C. Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
7. John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
8. J.B. Scarborough, Numerical Mathematical Analysis, Oxford and IBH, 2005.
9. H. Schildt, The Complete Reference: C, McGraw Hill, 2017.
10. G. David, Head First C, Shroff, 2012.
11. S. Prata, C Primer Plus, Sams, 2004.
12. C. Xavier, C Language and Numerical Methods, New Age International, 2007.
13. B. Gottfried, Programming with C, McGraw Hill, 2017.
14. E. Balaguruswamy, Programming in ANSI C, McGraw Hill, 2017.
15. F.J. Scheid, Computers and Programming, McGraw-Hill, 1982.
16. T. Jeyapoovan, A First Course in Programming With C, Vikas Publication House, 2004.

17. Y. Kanetkar, Let Us C, BPB Publications, 2016.

PAPER NAME: Advanced Algebra **PAPER CODE: MATH-H-DSE1(1)**

NAME OF TEACHER(S): MD SAHID ALAM(S.A)

Advanced Algebra

Unit-1

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic sub-groups, Commutator subgroup and its properties.

Unit-2

Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups.

Group actions, stabilizers and kernels, permutation representation associated with a given group action. Applications of group actions. Generalized Cayleys theorem. Index theorem.

Unit-3

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n, p-groups, Sylow's theorems and consequences, Cauchys theorem. Simplicity of A_n for $n \geq 5$, non-simplicity tests.

Unit-4

Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, and unique factorization in $\mathbb{Z}[x]$. Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domains.

Class	Topic	TEACHER
Lecture 1	Automorphism	RS
Lecture 2	Automorphism, inner automorphism	RS
Lecture 3	automorphism groups	RS
Lecture 4	automorphism groups of finite	SA
Lecture 5	automorphism groups of infinite	SA
Lecture 6	applications of factor groups to automorphism groups	SA
Lecture 7	Characteristic sub- groups.	SA
Lecture 8	Commutator subgroup and its properties.	SA
Lecture 9	Commutator subgroup and its properties. REVISION	SA
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 09 and Assignment-1	SA
Lecture 10	External direct products	SA
Lecture 11	Properties of external direct products.	SA

Lecture 12	The group of units modulo n as an external direct product.	SA
Lecture 13	Internal direct products.	SA
Lecture 14	Fundamental Theorem of finite abelian groups.	SA
Lecture 15	Group actions.	SA
Lecture 16	Stabilizers and kernels.	SA
Lecture 17	Permutation representation associated with a given group action.	SA
Lecture 18	Applications of group actions.	SA
Lecture 19	Generalized Cayleys theorem.	SA
Lecture 20	Index theorem.	SA
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 20 and Assignment-2	SA
Lecture 21	Groups acting on themselves by conjugation.	SA
Lecture 22	Class equation and consequences.	SA
Lecture 23	Conjugacy in Sn.	SA
Lecture 24	P-groups.	SA
Lecture 25	Sylow's theorems and consequences.	SA
Lecture 26	Cauchys theorem.	SA
Lecture 27	Simplicity of An for $n \geq 5$.	SA
Lecture 27	Simplicity of An for $n \geq 5$, non-simplicity tests.	SA
Lecture 28	Polynomial rings over commutative rings.	SA
Lecture 29	Division algorithm and consequences.	SA
Lecture 30	Principal ideal domains.	SA
Lecture 31	Factorization of polynomials.	SA
Lecture 32	Principal ideal domains, factorization of polynomials .	SA
Lecture 33	Reducibility tests, irreducibility tests.	SA
Lecture 34	Eisenstein criterion.	SA
Lecture 35	Unique factorization in Z[x].	SA
Examination	Class Test-3(Tutorial Exam) on Lecturer 21 to Lecturer 35 and Assignment-3	SA
Lecture 36	Divisibility in integral domains.	SA
Lecture 37	Irreducible.	SA

Lecture 38	Primes.	
Lecture 39	Unique factorization domains.	SA
Lecture 40	Euclidean domains.	SA
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 40 and Assignment-4	SA

Reference Books

1. J.B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. J.A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
5. G. Strang, Linear Algebra and its Applications, Thomson, 2007.
6. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall of India, 1999.
7. K. Hoffman and R.A. Kunze, Linear Algebra, 2nd Ed., Prentice Hall of India, 1971.
8. S.H. Friedberg, A.L. Insel and L.E. Spence, Linear Algebra, Prentice Hall of India, 2004
9. D.S. Dummit and R.M. Foote, Abstract Algebra, 3rd Ed., Wiley & Sons, 2004.
10. J.R. Durbin, Modern Algebra, Wiley & Sons, 2000.
11. D. A. R. Wallace, Groups, Rings and Fields, Springer, 1998
12. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, McGraw Hill, 1996.
13. I.N. Herstein, Topics in Algebra, Wiley, India, 1975.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 5th Semester

PAPER NAME: Fluid Mechanics **PAPER CODE: DSE-02**

NAME OF TEACHER(S): DR. TILAK KUMAR PAL(TKP)

Unit-1

Perfect fluid. Pressure at a point. Pressure of heavy fluid. Pressure at any point of a fluid at rest is the same in every directions. Conditions of equilibrium for homogeneous, heterogeneous, and elastic fluid. Lines of force. Surfaces of equal pressure and density. Pressure gradient, pressure function and equation of equilibrium. Homogeneous fluid at rest under gravity.

Unit-2

Definition of center of pressure. Formula for the depth of the center of pressure of a plane area. Position of center of pressure. Thrusts on plane and curved surfaces. Rotating fluid. Pressure at any point and surfaces of equipressure when a mass of homogeneous fluid contained in a vessel revolves uniformly about a vertical axis. Floating bodies. Stability of equilibrium of floating bodies.

Unit-3

Kinematics of Fluid: Scalar and Vector Field, flow field, Description of Fluid Motion. La-

grangian method, Eulerian method, Relation between Eulerian and Lagrangian method, Variation of flow parameters in time and space. Steady and unsteady flow, uniform and non-uniform flow. Material derivative and acceleration: temporal derivative, convective derivative.

Unit-4

Conservation Equation: Control mass system, control volume system, Isolated system. Conservation of Mass-The Continuity equation: Differential form and vector form, integral form. Conservation of Momentum: Momentum theorem, Reynolds transport theorem. Conservation of energy.

Class	Topic	TEACHER
Lecture 1	Perfect fluid.	TKP
Lecture 2	Pressure at a point.	TKP
Lecture 3	Pressure of heavy fluid.	TKP
Lecture 4	Pressure at any point of a fluid at rest is the same in every directions.	TKP
Lecture 5	Conditions of equilibrium for homogeneous, heterogeneous, and elastic fluid.	TKP
Lecture 6	Lines of force. Surfaces of equal pressure and density.	TKP
Lecture 7	Pressure gradient, pressure function and equation of equilibrium	TKP
Lecture 8	Homogeneous fluid at rest under gravity.	TKP
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	TKP
Lecture 9	Definition of center of pressure.	TKP
Lecture 10	Formula for the depth of the center of pressure of a plane area.	TKP
Lecture 11	Position of center of pressure.	TKP
Lecture 12	Thrusts on plane and curved surfaces.	TKP
Lecture 13	Rotating fluid.	TKP
Lecture 14	Pressure at any point and surfaces of equipressure when a mass of homogeneous fluid contained in a vessel revolves uniformly about a vertical axis.	TKP
Lecture 15	Floating bodies.	TKP
Lecture 16	Stability of equilibrium of floating bodies.	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 9 to Lecturer 16 and Assignment-2	TKP
Lecture 17	Kinematics of Fluid	TKP

Lecture 18	Scalar and Vector Field, flow field,	TKP
Lecture 19	Description of Fluid Motion.	TKP
Lecture 20	Lagrangian method,	TKP
Lecture 21	Eulerian method,	TKP
Lecture 22	Relation between Eulerian and Lagrangian method,	TKP
Lecture 23	Steady and unsteady flow,	TKP
Lecture 24	uniform and non-uniform flow.	TKP
Lecture 25	Material derivative and acceleration:	TKP
Lecture 26	temporal derivative,	TKP
Lecture 27	convective derivative.	TKP
Examination	Class Test-3(Tutorial Exam) on Lecturer 17 to Lecturer 27 and Assignment-3	TKP
Lecture 28	Conservation Equation:	TKP
Lecture 29	Control mass system,	TKP
Lecture 30	control volume system,	TKP
Lecture 31	Isolated system	TKP
Lecture 32	Conservation of Mass-The Continuity equation:	TKP
Lecture 33	Differential form and vector form, integral form.	TKP
Lecture 34	Conservation of Momentum:	TKP
Lecture 35	Momentum theorem,	TKP
Lecture 36	Reynolds transport theorem.	TKP
Lecture 37	Conservation of energy.	TKP
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 37 and Assignment-4	TKP

Reference Books

1. G.K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 1967.
2. F. Chorlton, Textbook of Fluid Dynamics, Van Nostrand Co., 1967.
3. F.M. White, Fluid Mechanics, McGraw Hill, 2003.
4. P.K. Kundu and I.M. Cohen, Fluid Mechanics, 4th Rev. Ed., Academic Press, 2008.
5. G. Falkovich, Fluid Mechanics: A short course for physicists, Cambridge University Press,
6. I.G. Currie, Fundamental Mechanics of Fluids, McGraw Hill, 1974.
7. B. Massey and J.W. Smith, Mechanics of Fluids, 8th Ed., Taylor & Francis, 2005.

PAPER NAME: Discrete Mathematics **PAPER CODE: SEC-1**

NAME OF TEACHER(S): RAKESH SARKAR(R.S.)

Unit-1

Definition of undirected graphs, Using of graphs to solve different puzzles and problems. Multi- graphs. Walks, Trails, Paths, Circuits and cycles, Eulerian circuits and paths. Eulerian graphs, example of Eulerian graphs. Hamiltonian cycles and Hamiltonian graphs. Weighted graphs and Travelling salespersons Problem. Dijkstra's algorithm to find shortest path. Definition of Trees and their elementary properties. Definition of Planar graphs, Kuratowski's graphs. Partial Order relations and lattices, Chains and antichains. Pigeon hole Principle.

Unit-2

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-3

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. Difference and Symmetric differ- ence 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.

Unit-4

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

Class	Topic	TEACHER
Lecture 1	Definition of undirected graphs, Multi- graphs	RS
Lecture 2	Using of graphs to solve different puzzles and problems	RS
Lecture 3	Walks, Trails, Paths, Circuits and cycles	RS
Lecture 4	Eulerian circuits and paths	RS
Lecture 5	Eulerian graphs, example of Eulerian graphs	RS
Lecture 6	Hamiltonian cycles and Hamiltonian graphs	RS
Lecture 7	Weighted graphs and Travelling salespersons Problem	RS
Lecture 8	Dijkstra's algorithm to find shortest path	RS
Lecture 9	Definition of Trees and their elementary properties	RS
Lecture 10	Definition of Planar graphs, Kuratowski's graphs	RS

Lecture 11	Partial Order relations and lattices	RS
Lecture 12	Chains and antichains. Pigeon hole Principle	RS
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 12 and Assignment-1	RS
Lecture 13	Introduction, propositions, truth table, negation	RS
Lecture 14	Introduction, propositions, truth table, negation	RS
Lecture 15	conjunction and disjunction	RS
Lecture 16	Implications, biconditional propositions	RS
Lecture 17	converse, contra positive and inverse propositions of logical operators	RS
Lecture 18	precedence of logical operators	RS
Lecture 19	Propositional equivalence	RS
Lecture 20	Logical equivalences	RS
Lecture 21	Predicates and quantifiers	RS
Lecture 22	Introduction, Quantifiers, Binding variables and Negations	RS
Examination	Class Test-2(Tutorial Exam) on Lecturer 13 to Lecturer 22 and Assignment-2	RS
Lecture 23	Sets, subsets, Set operations and the laws of set theory and Venn diagrams	RS
Lecture 24	Examples of finite and infinite sets	RS
Lecture 25	Finite sets and counting principle	RS
Lecture 26	Empty set, properties of empty set	RS
Lecture 27	Standard set operations, Classes of sets	RS
Lecture 27	Power set of a set. Difference and Symmetric difference of two sets	RS
Lecture 28	Set identities, Generalized union and intersections	RS
Lecture 29	Relation: Product set	RS
Lecture 30	Composition of relations, Types of relations, Partitions	RS
Lecture 31	Equivalence Relations with example of congruence modulo relation	RS
Lecture 32	Partial ordering relations	RS
Lecture 33	Partial ordering relations and n-ary relations	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 33 and Assignment-3	RS
Lecture 34	Definition, examples lattices	
Lecture 35	Definition, examples and properties of modular lattices	RS

Lecture 36	Definition, examples and properties of modular and distributive lattices	RS
Lecture 37	Boolean algebras	RS
Lecture 38	Examples of Boolean algebras	RS
Lecture 39	Boolean polynomials	RS
Lecture 40	Minimal and Maximal forms of Boolean polynomials	RS
Lecture 41	Quinn-McCluskey method	RS
Lecture 42	Karnaugh diagrams	RS
Lecture 43	Logic Gates	RS
Lecture 44	Diagrams on Logic Gates	RS
Lecture 45	Switching Circuits	RS
Lecture 46	Applications of Switching Circuits	RS
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4	RS

Reference Books

1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Educa- tion, 1998.
2. P.R. Halmos, Naive Set Theory, Springer, 1974.
3. E. Kamke, Theory of Sets, Dover Publishers, 1950.
4. K.A. Ross and C.R. Wright, Discrete Mathematics, Prentice Hall, 2002.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 6th Semester

PAPER NAME: Linear Programming Problems & Game Theory **PAPER CODE: DC-13**

NAME OF TEACHER(S): RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.)

Unit-1

Linear programming modeling, Optimal solutions and graphical interpretation of optimality. Notion of convex set, convex function, their properties and applications in context of LPP. Pre-liminary definitions (like convex combination, extreme point etc.). Optimal hyper-plane and existence of optimal solution of LPP. Basic feasible solutions: algebraic interpretation of extreme point. Relationship between extreme points and corresponding BFS. Adjacent extreme points and corresponding BFS along with examples. Fundamental theorem of LPP and its illustration through examples.

Unit-2

LPP in canonical form to get the initial BFS and method of improving current BFS. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to arti_cial variables, two-phase method. Big-M method and their comparison.

Unit-3

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-4

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.

Class	Topic	TEACHER
Lecture 1	Linear programming modelling with example	TKP
Lecture 2	Optimal solutions and graphical interpretation of optimality.	TKP
Lecture 3	Notion of convex set, convex function, their properties	TKP
Lecture 4	and applications in context of LPP. Pre-liminary definitions (like convex combination, extreme point etc.).	TKP
Lecture 5	Optimal hyper-plane and existence of optimal solution of LPP.	TKP
Lecture 6	Basic feasible solutions: algebraic interpretation of extreme point	TKP
Lecture 7	Relationship between extreme points and corresponding BFS	TKP
Lecture 8	Adjacent extreme points and corresponding BFS along with examples.	TKP
Lecture 9	Fundamental theorem of LPP and its illustration through examples.	TKP
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 9 and Assignment-1	TKP
Lecture 10	LPP in canonical form to get the initial BFS	TKP
Lecture 11	Method of improving current BFS.	TKP
Lecture 12	Theory of simplex method,	TKP
Lecture 14	Graphical solution,	TKP
Lecture 15	Convex sets, optimality and unboundedness,	TKP

Lecture 16	The simplex algorithm,	TKP
Lecture 17	Simplex method in tableau format,	TKP
Lecture 18	Introduction to artificial variables,	TKP
Lecture 19	Two-phase method.	TKP
Lecture 20	Big-M method and their comparison.	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 10 to Lecturer 20 and Assignment-2	TKP
Lecture 21	Duality, formulation of the dual problem,	RS
Lecture 22	primal-dual relationships,	RS
Lecture 23	economic interpretation of the dual.	RS
Lecture 24	northwest-corner method,	RS
Lecture 25	least cost method	RS
Lecture 26	Vogel approximation method for determination of starting basic solution,	RS
Lecture 27	algorithm for solving transportation problem,	RS
Lecture 28	assignment problem and its mathematical formulation,	RS
Lecture 29	Hungarian method for solving assignment problem.	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 21 to Lecturer 29 and Assignment-3	RS
Lecture 30	Game theory: formulation of two person zero sum games,	
Lecture 31	solving two person zero sum games,	RS
Lecture 32	games with mixed strategies,	RS
Lecture 33	graphical solution procedure,	RS
Lecture 34	linear programming solution of games.	RS
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 34 and Assignment-4	RS

Reference Books

1. M.S. Bazaraa, J.J. Jarvis and H.D. Sherali, Linear Programming and Network Flows, 2nd Ed., Wiley, 2004.
2. P.K. Dutta, Strategies and Games: Theory and Practice, MIT Press, 1999.
3. L.F. Fernandez and H.S. Bierman, Game Theory with Economic Applications, Addison Wesley, 1998.
4. R.D. Gibbons, Game Theory for Applied Economists, Princeton University Press, 1992.
5. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., McGraw

Hill, 2009.
6. H.A. Taha, Operations Research: An Introduction, 8th Ed., Prentice Hall India, 2006.
7. G. Hadley, Linear Programming, Narosa, 2002.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 6th Semester

PAPER NAME: Computer aided Laboratory(Practical Paper)

PAPER CODE: DC14

NAME OF TEACHER(S): RAKESH SARKAR (R.S.), DR. TILAK KR. PAUL(T.K.P.), MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)

List of practical (By using C in LINUX)

1. Solution of transcendental and algebraic equations by
   - Bisection method
   - Newton Raphson method.
   - Fixed point method.
   - Regula Falsi method.
2. Solution of system of linear equations
   - LU decomposition method
   - Gaussian elimination method
   - Gauss-Jacobi method
   - Gauss-Seidel method
3. Interpolation
   - Lagrange Interpolation
   - Newton Interpolation
4. Numerical Integration
   - Trapezoidal Rule
   - Simpson's one third rule
   - Weddle's Rule
   - Gauss Quadrature
5. Method of finding Eigenvalue by Power method
6. Fitting a Polynomial Function
7. Solution of ordinary differential equations
   - Euler method
   - Modified Euler method
   - Runge Kutta method
8. Programming in probability and statistics
   - Probability by using Empirical Definition
   - Mean
   - Median

- Mode
- Standard deviation
- Coefficient of correlation

9. Matrices

- Determinants
- Transpose
- Product
- Addition/Subtraction
- Rank
- Inverse

Class	Topic	TEACHER
Lecture 1	Bisection method	SA
Lecture 2	Newton Raphson method.	SA
Lecture 3	Fixed point method.	SA
Lecture 4	Regula Falsi method	SA
Lecture 5	LU decomposition method	PK
Lecture 6	Gaussian elimination method.	PK
Lecture 7	Gauss-Jacobi method	PK
Lecture 8	Gauss-Seidel method	PK
Lecture 9	Lagrange Interpolation	SA
Lecture 10	Newton Interpolation	SA
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 10 and Assignment-1	
Lecture 11	Trapezoidal Rule	TKP
Lecture 12	Simpson's one third rule	TKP
Lecture 13	Weddle's Rule	TKP
Lecture 14	Gauss Quadrature	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 11 to Lecturer 14 and Assignment-2	
Lecture 15	Method of finding Eigenvalue by Power method	SA
Lecture 16	Fitting a Polynomial Function	SA
Lecture 17	Euler method	PK
Lecture 18	Modified Euler method	PK
Lecture 19	Runge Kutta method	PK
Lecture 20	Probability by using Empirical Definition	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 15 to Lecturer 20 and Assignment-3	
Lecture 21	Mean	RS

Lecture 22	Median	RS
Lecture 23	Mode	RS
Lecture 24	Standard deviation	RS
Lecture 25	Coefficient of correlation	RS
Lecture 26	Determinants	RS
Lecture 27	Transpose of matrices	RS
Lecture 27	Product of matrices	RS
Lecture 28	Addition/Subtraction of matrices	RS
Lecture 29	Rank of matrices	PK
Lecture 30	Inverse of matrices	PK
Examination	Class Test-4(Tutorial Exam) on Lecturer 21 to Lecturer 30 and Assignment-4	

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 6th Semester

PAPER NAME: **Point Set Topology**

PAPER CODE: **MATH-H-DSE-3(1)**

NAME OF TEACHER(S): **MD SAHID ALAM(S.A.), POLY KARMAKAR(P.K.)**

Unit-1

Countable and Uncountable Sets, Schroeder-Bernstein Theorem, Cantors Theorem. Cardinal Numbers and Cardinal Arithmetic. Continuum Hypothesis, Zorns Lemma, Axiom of Choice. Well-Ordered Sets, Hausdorffs Maximal Principle. Ordinal Numbers.

Unit-2

Topological spaces, Basis and Subbasis for a topology, subspace Topology, Interior Points, Limit Points, Derived Set, Boundary of a set, Closed Sets, Closure and Interior of a set.

Unit-3

Continuous Functions, Open maps, Closed maps and Homeomorphisms. Product Topology, Quotient Topology, Metric Topology, Baire Category Theorem.

Unit-4

Connected and Path Connected Spaces, Connected Sets in R, Components and Path Components, Local Connectedness. Compact Spaces, Compact Sets in R. Compactness in Metric Spaces. Totally Bounded Spaces, Ascoli-Arzela Theorem, The Lebesgue Number Lemma. Local Compactness.

Class	Topic	TEACHER
Lecture 1	Countable and Uncountable Sets,	SA
Lecture 2	Schroeder-Bernstein Theorem,	SA
Lecture 3	Cantors Theorem.	SA

Lecture 4	Cardinal Numbers and Cardinal Arithmetic	SA
Lecture 5	Continuum Hypothesis,	SA
Lecture 6	Zorns Lemma.	
Lecture 7	Axiom of Choice.	
Lecture 8	Well-Ordered Sets,	SA
Lecture 9	Hausdorffs Maximal Principle.	SA
Lecture 10	Ordinal Numbers.	SA
Lecture 11	Topological spaces,	SA
Lecture 12	Basis and for a topology,	SA
Lecture 13	Subbasis for a topology	SA
Lecture 14	Subspace Topology,	
	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	SA
Lecture 15	Interior Points, Limit Points,	SA
Lecture 16	Derived Set, Boundary of a set, Closed Sets,	SA
Lecture 17	Closure and Interior of a set.	SA
Lecture 18	Continuous Functions	SA
Lecture 19	Open maps, Closed maps.	SA
Lecture 20	Homeomorphisms.	SA
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 17 and Assignment-2	SA
Lecture 21	Product Topology	PK
Lecture 22	Quotient Topology	PK
Lecture 23	Metric Topology	PK
Lecture 24	Baire Category Theorem	PK
Lecture 25	Connected Spaces	PK
Lecture 26	Path Connected Spaces.	PK
Lecture 27	Connected Sets in R,	PK
Lecture 27	Components	PK
Lecture 28	Path Components.	PK
Examination	Class Test-3(Tutorial Exam) on Lecturer 18 to Lecturer 26 and Assignment-3	PK
Lecture 29	Local Connectedness	PK
Lecture 30	Compact Spaces,	PK
Lecture 31	Compact Sets in R.	PK

Lecture 32	Compactness in Metric Spaces.	PK
Lecture 33	Totally Bounded Spaces,	PK
Lecture 34	Ascoli-Arzela Theorem,	PK
Lecture 35	The Lebesgue Number Lemma.	PK
Lecture 36	Local Compactness	PK
Examination	Class Test-4(Tutorial Exam) on Lecturer 27 to Lecturer 36 and Assignment-4	PK

Text/Reference Books:

1. J.R. Munkres, Topology: A First Course, Prentice Hall of India, 2000.
2. J. Dugundji, Topology, Allyn and Bacon, 1966.
3. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, 1963.
4. K.D. Joshi, Introduction to General Topology,New Age International Private Limited, 2017.
5. J.L. Kelley, General Topology, Springer, 1975.
6. J. Hocking and G. Young, Topology, Dover Publications, 1988.
7. L.A. Steen and J.A. Seebach, Counter Examples in Topology, Dover Publications, 1995.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 6th Semester

PAPER NAME: Problem Solving Techniques in Probability & Statistics

PAPER CODE: SEC-2

NAME OF TEACHER(S): RAKESH SARKAR(R.S.), Dr. TILAK KUMAR PAUL(T.K.P.)

Unit-1	
1.	Application problems based on Classical Definition of Probability.
2.	Application problems based on Bayes' Theorem.

3. Fitting of binomial distributions for n and $p = q = \frac{1}{2}$.

4. Fitting of binomial distributions for given n and p.

5. Fitting of binomial distributions after computing mean and variance.

6. Fitting of Poisson distributions for given value of lambda.

7. Fitting of Poisson distributions after computing mean.

Unit-2

1. Fitting of negative binomial distribution.

2. Fitting of suitable distribution.

3. Application problems based on binomial distribution.

4. Application problems based on Poisson distribution.

5. Application problems based on negative binomial distribution.

Unit-3

1. Graphical representation of data

2. Problems based on measures of central tendency

3. Problems based on measures of dispersion

4. Problems based on combined mean and variance and coefficient of variation

5. Problems based on moments, skewness and kurtosis

Unit-4

1. Fitting of polynomials, exponential curves

2. Karl Pearson correlation coefficient

3. Partial and multiple correlations

4. Spearman rank correlation with and without ties.

5. Correlation coefficient for a bivariate frequency distribution

6. Lines of regression, angle between lines and estimated values of variables.

7. Checking consistency of data and finding association among attributes

Class	Topic	TEACHER
Lecture 1	Application problems based on Classical Definition of Probability	TKP
Lecture 2	Application problems based on Bayes' Theorem	TKP
Lecture 3	binomial distributions	TKP
Lecture 4	Fitting of binomial distributions for n and p = q = 1/2	TKP

Lecture 5	Fitting of binomial distributions for given n and p.	TKP
Lecture 6	Fitting of binomial distributions after computing mean and variance-1	TKP
Lecture 7	Fitting of binomial distributions after computing mean and variance-2	TKP
Lecture 8	Poisson distributions	TKP
Lecture 9	Fitting of Poisson distributions for given value of lambda	TKP
Lecture 10	Fitting of Poisson distributions after computing mean-1	TKP
Lecture 11	Fitting of Poisson distributions after computing mean-2	TKP
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1	TKP
Lecture 12	Fitting of negative binomial distribution-1	TKP
Lecture 13	Fitting of negative binomial distribution-2	TKP
Lecture 14	Fitting of suitable distribution-1	TKP
Lecture 15	Fitting of suitable distribution-2	TKP
Lecture 16	Fitting of suitable distribution-3	TKP
Lecture 17	Application problems based on binomial distribution-1	TKP
Lecture 18	Application problems based on binomial distribution-2	TKP
Lecture 19	Application problems based on Poisson distribution-1	TKP
Lecture 20	Application problems based on Poisson distribution-2	TKP
Lecture 21	Application problems based on negative binomial distribution-1	TKP
Lecture 22	Application problems based on negative binomial distribution-2	TKP
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2	TKP
Lecture 23	Graphical representation of data-1	RS
Lecture 24	Graphical representation of data-2	RS
Lecture 25	Problems based on measures of central tendency-1	RS
Lecture 26	Problems based on measures of central tendency-1	RS
Lecture 27	Problems based on measures of dispersion-1	RS
Lecture 27	Problems based on measures of dispersion-2	RS
Lecture 28	Problems based on measures of dispersion-3	RS
Lecture 29	Problems based on combined mean and variance and coefficient of variation-1	RS
Lecture 30	Problems based on combined mean and variance and coefficient of variation-2	RS
Lecture 31	Problems based on combined mean and variance and coefficient of variation-3	RS
Lecture 32	Problems based on moments, skewness and kurtosis-1	RS

Lecture 33	Problems based on moments, skewness and kurtosis-2	RS
Lecture 34	Problems based on moments, skewness and kurtosis-3	RS
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3	RS
Lecture 35	Fitting of polynomials, exponential curves-1	RS
Lecture 36	Fitting of polynomials, exponential curves-2	RS
Lecture 37	Karl Pearson correlation coefficient-1	RS
Lecture 38	Karl Pearson correlation coefficient-2	RS
Lecture 39	Partial and multiple correlations-1	RS
Lecture 40	Partial and multiple correlations-2	RS
Lecture 41	Spearman rank correlation with and without ties-1	RS
Lecture 42	Spearman rank correlation with and without ties-2	RS
Lecture 43	Correlation coefficient for a bivariate frequency distribution-1	RS
Lecture 44	Correlation coefficient for a bivariate frequency distribution-2	RS
Lecture 45	Lines of regression, angle between lines and estimated values of variables-1	RS
Lecture 46	Lines of regression, angle between lines and estimated values of variables-2	RS
Lecture 47	Checking consistency of data and finding association among attributes-1	RS
Lecture 48	Checking consistency of data and finding association among attributes-2	RS
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 48 and Assignment-4	RS