LESSON PLAN

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 1st Semester

PAPER NAME: Calculus & Geometry **PAPER CODE: DC01**

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

Unit-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. Acquaintance with the important properties of continuous functions no closed intervals. Hyperbolic functions, higher order 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 and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit-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. Techniques of sketching conics.

Unit-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.

Unit-4

Acquaintance of plane and straight line in 3D may be assumed. Spheres. Cylindrical surfaces. Central coincides, paraboloids, plane sections of coincides, Generating lines, reduction and classification of quadrics, Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Class	Topic		TEACHER	
Lecture 1	Real-valued functions defined on an interval, limit of a function (Cauchy's definition).	Unit-1	TKP	September-6 Classes
Lecture 2	Algebra of limits. Continuity of a function at a point and in an interval.		TKP	
Lecture 3	Acquaintance with the important properties of continuous functions no closed intervals.		TKP	
Lecture 4	Hyperbolic functions, higher order derivatives		TKP	
Lecture 5	Leibnitz rule of successive differentiation		TKP	
Lecture 6	Applications of Leibnitz rule to problems of type $e^{ax} + b\sin x$, $e^{ax} + b\cos x$, $(ax+b)^n \sin x$, $(ax+b)^n \cos x$,		TKP	

Lecture 7	concavity and inflection points	Unit-1	TKP	November-5 Classes
Lecture 8	Envelopes, Asymptotes		TKP	
Lecture 9	Curve tracing in Cartesian coordinates		TKP	
Lecture 10	Curve tracing in polar coordinates of standard curves		TKP	
Lecture 11	L’Hospital’s rule, applications in business, economics and life sciences.		TKP	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		TKP	
Lecture 12	Reduction formulae	Unit-2	TKP	February-3 Classes, January-5 Classes December-6 Classes
Lecture 13	derivations and illustrations of reduction formulae of the type integration of sinn x, cosn x, tann x,		TKP	
Lecture 14	derivations and illustrations of reduction formulae of the type integration of secn x, (log x)n, sinn x sinm x,		TKP	
Lecture 15	evaluation of definite integrals		TKP	
Lecture 16	, integration as the limit of a sum,		TKP	
Lecture 17	concept of improper integration		TKP	
Lecture 18	use of Beta and Gamma functions		TKP	
Lecture 19	parametric equations, parametrizing a curve		TKP	
Lecture 20	arc length, arc length of parametric curves		TKP	
Lecture 21	area of surface of revolution		TKP	
Lecture 22	Techniques of sketching conics		TKP	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		TKP	
Lecture 23	Reflection properties of conics	Unit-3	RS	November-5 Classes, September-4 Classes
Lecture 24	translation and rotation of axes		RS	
Lecture 25	second degree equations		RS	
Lecture 26	reduction and classification of conics using the discriminant-1		RS	
Lecture 27	reduction and classification of conics using the discriminant-2		RS	
Lecture 27	Angle between two lines		RS	
Lecture 28	Equation of bisectors		RS	
Lecture 29	Equation of two lines joining the origin to the points in which a line meets a conic.		RS	
Lecture 30	Equations of pair of tangents from an external point		RS	
Lecture 31	chord of contact		RS	
Lecture 32	Polar equations of straight lines and conics		RS	

Lecture 33	Equation of chord joining two points	Unit-3	RS	
Lecture 34	Equations of tangent and normal.		RS	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		RS	
Lecture 35	Acquaintance of plane in 3D.	Unit-4	RS	February 2 Classes, January-5 Classes December- 4 Classes
Lecture 36	Acquaintance of straight line in 3D		RS	
Lecture 37	Spheres		RS	
Lecture 38	Cylindrical surfaces		RS	
Lecture 39	Central coincides		RS	
Lecture 40	paraboloids		RS	
Lecture 41	plane sections of coincides		RS	
Lecture 42	Generating lines		RS	
Lecture 43	reduction and classification of quadrics-1		RS	
Lecture 44	reduction and classification of quadrics-2		RS	
Lecture 45	Illustrations of graphing standard quadric surface-cone		RS	
Lecture 46	Illustrations of graphing standard quadric surface-ellipsoid		RS	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		RS	

Graphical Demonstration (Teaching Aid)

1. Plotting of graphs of function $e^{ax+b}, log(ax + b), sin(ax + b), cos(ax + b), |ax + b|$ and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).
4. Obtaining surface of revolution of curves.
5. Tracing of conics in Cartesian coordinates/polar coordinates.
6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates.

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. (Honours)

COURSE: MATHEMATICS(Hons) 1st Semester

PAPER NAME: Algebra **PAPER CODE: DC02**

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

Unit-1

Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. Inequality: The inequality involving AM≥GM≥HM, m^{th} power theorem, Cauchy-Schwartz inequality. Maximum and minimum values of a polynomials.

Unit-2

General properties of equations, Fundamental theorem of classical algebra(statement only) and its application, Transformation of equation, Descarte's rule of signs positive and negative rule, Strum's theorem, Relation between the roots and the coefficients of equations. Symmetric func- tions. Applications of symmetric function of the roots. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic (Cardon's) and biquadratic (Ferrari's). Properties of the derived functions.

Unit-3

Equivalence relations and partitions, 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-4

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 indepen- dence. Real Quadratic Form involving not more than three variables. Characteristic equation of square matrix of order not more than three determination of Eigen Values and Eigen Vectors. Cayley-Hamilton Theorem.

Class	Topic		TEACHER	
Lecture 1	Polar representation of complex numbers.	Unit-1	SA	November-5 Classes, September-6 Classes
Lecture 2	De Moivre's theorem for rational indices and its applications.		SA	
Lecture 3	Inequality: The inequality involving AM≥GM≥HM		SA	
Lecture 4	mth power theorem,		SA	
Lecture 5	Cauchy-Schwartz inequality.		SA	
Lecture 6	Maximum and minimum values of a polynomials.		SA	
Lecture 7	General properties of equations		SA	
Lecture 8	Fundamental theorem of classical algebra(statement only) and its application.		SA	
Lecture 9	Transformation of equation		SA	
Lecture 10	Descarte's rule of signs positive and negative rule		SA	
Lecture 11	Strum's theorem,		SA	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		SA	
Lecture 12	Relation between the roots and the coefficients of equations.	Unit-2	SA	January-3 Classes December-3 Classes
Lecture 13	Symmetric functions. Applications of symmetric function of the roots.		SA	
Lecture 14	Solutions of reciprocal and binomial equations.		SA	
Lecture 15	Algebraic solutions of the cubic (Cardon's)		SA	
Lecture 16	Biquadratic (Ferrari's).		SA	
Lecture 17	Properties of the derived functions		SA	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 17 and Assignment-2		SA	
Lecture 18	Equivalence relations and partitions.	Unit-3	PK	November-5 Classes, September-4 Classes
Lecture 19	Functions, Composition of functions		PK	
Lecture 20	Invertible functions, One to one correspondence and cardinality of a set.		PK	
Lecture 21	Well-ordering property of positive integers,		PK	
Lecture 22	Division algorithm,		PK	
Lecture 23	Divisibility and Euclidean algorithm		PK	

Lecture 24	Congruence relation between integePK.		PK	
Lecture 25	Principles of Mathematical Induction,		PK	
Lecture 26	statement of Fundamental Theorem of Arithmetic		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 18 to Lecturer 26 and Assignment-3		PK	
Lecture 27	Systems of linear equations,	Unit-4	PK	February 2 Classes, January-5 Classes December- 4 Classes
Lecture 27	Row reduction and echelon forms, vector equations,		PK	
Lecture 28	The matrix equation Ax = b, solution sets of linear systems.		PK	
Lecture 29	Applications of linear systems, linear independence.		PK	
Lecture 30	Real Quadratic Form involving not more than three variables		PK	
Lecture 31	Characteristic equation of square matrix of order not more than three determinations of Eigen Values and Eigen Vectors.		PK	
Lecture 32	Eigen Values and Eigen Vectors.		PK	
Lecture 33	Cayley-Hamilton Theorem.		PK	
Lecture 34	Cayley-Hamilton Theorem.		PK	
Examination	Class Test-4(Tutorial Exam) on Lecturer 27 to Lecturer 34 and Assignment-4		PK	

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. (Honours)

COURSE: MATHEMATICS(Hons) 2nd Semester

PAPER NAME: Real Analysis I **PAPER CODE: DC03**

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

Unit-1

Development of real numbers. The algebraic properties of R, rational and irrational numbers, the order properties of R. Absolute value and the real line, bounded and unbounded sets in R, supremum and infimum, neighbourhood of a point. The completeness property of R, the Archimedean property, density of rational numbers in R, nested intervals property, binary representation of real numbers, uncountability of R. Closed set, open set, closure & interior of a subset of the real line.

Unit-2

Sequences, the limit of a sequence and the notion of convergence, bounded sequences, limit theorems, squeeze theorem, monotone sequences, monotone convergence theorem. Subsequences, monotone subsequence theorem and the Bolzano-Weierstrass theorem, the divergence criterion, limit superior and limit inferior of a sequence, Cauchy sequences, Cauchy's convergence criterion. Infinite series, convergence and divergence of infinite series. Tests for Convergence: Comparison test, root test, ratio test, integral test. Alternating series, absolute and conditional convergence.

Unit-3

Sequential criterion for limits, divergence criteria. Limit theorems, infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorems.

Unit-4

Differentiability of a function at a point and in an interval, Caratheodory's theorem, chain rule, derivative of inverse functions, algebra of differentiable functions. Mean value theorems, Rolle's Theorem, Lagrange's mean value theorem. Applications of mean value theorem to inequalities, relative extremum and approximation of polynomials. The intermediate value property of derivatives, Darboux's theorem. L'Hospital's rule. Taylor's theorem and its application. Expansion of functions.

Class	Topic		TEACHER	
Lecture 1	Development of real numbers. The algebraic properties of R, rational and irrational numbers, the order properties of R.	Unit-1	PK	March-5 Classes
Lecture 2	Absolute value and the real line, bounded and unbounded sets in R, supremum and infimum, neighbourhood of a point.		PK	
Lecture 3	The completeness property of R, the Archimedean property, density of rational numbers in R.		PK	

Lecture 4	Nested intervals property, binary rep- resentation of real numbers.		PK	
Lecture 5	Exercise solve		PK	
Lecture 6	Discussion		PK	
Lecture 7	Uncountability of R		PK	
Lecture 8	Closed set, open set.		PK	April-6 Classes
Lecture 9	Closure & interior of a subset of the real line.		PK	
Lecture 10	Exercise solve		PK	
Lecture 11	Discussion		PK	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		PK	
Lecture 12	Sequences, the limit of a sequence and the notion of convergence.	Unit-2	SA	June-5 Classes, May-6 Classes
Lecture 13	Bounded sequences, limit theorems, squeeze theorem, monotone sequences, monotone convergence theorem		SA	
Lecture 14	Subsequences, monotone subsequence theorem		SA	
Lecture 15	Tthe Bolzano-Weierstrass theorem, the divergence criterion		SA	
Lecture 16	Limit superior and limit inferior of a sequence		SA	
Lecture 17	Cauchy sequences, Cauchy's convergence criterion		SA	
Lecture 18	Infinite series, convergence and divergence of infinite series.		SA	
Lecture 19	Tests for Convergence: Comparison test		SA	
Lecture 20	Root test, ratio test, integral test.		SA	
Lecture 21	Alternating series, absolute and conditional convergence		SA	
Lecture 22	Exercise solve		SA	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		SA	
Lecture 23	Sequential criterion for limits	Unit-3	SA	April-6 Classes, March-5 Classes
Lecture 24	Divergence criteria		SA	
Lecture 25	Limit theorems, infinite limits and limits at infinity		SA	
Lecture 26	Continuous functions,		SA	
Lecture 27	Sequential criterion for continuity and discontinuity.		SA	
Lecture 27	Algebra of continuous functions.		SA	
Lecture 28	Continuous functions on an interval		SA	
Lecture 29	Intermediate value theorem, location of roots theorem,		SA	

Lecture 30	Preservation of intervals theorem.		SA	
Lecture 31	Uniform continuity		SA	
Lecture 32	Non-uniform continuity criteria		SA	
Lecture 33	Uniform continuity theorems.		SA	
Lecture 34	Exercise solve		SA	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		SA	
Lecture 35	Differentiability of a function at a point and in an interval,	Unit-4	PK	June-6 Classes, May-6 Classes
Lecture 36	,Caratheodory’s theorem, chain rule		PK	
Lecture 37	Derivative of inverse functions, algebra of differentiable functions.		PK	
Lecture 38	Mean value theorems		PK	
Lecture 39	Rolle’s Theorem, Lagrange’s mean value theorem.		PK	
Lecture 40	Applications of mean value theorem to inequalities		PK	
Lecture 41	Relative extremum and approximation of polynomials.		PK	
Lecture 42	The intermediate value property of derivatives		PK	
Lecture 43	Darboux’s theorem. L’Hospital’s rule.		PK	
Lecture 44	Taylor’s theorem and its application.		PK	
Lecture 45	Expansion of functions.		PK	
Lecture 46	Exercise solve		PK	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 46 and Assignment-4		PK	

Graphical Demonstration (Teaching Aid)

1. Plotting of recursive sequences.
2. Study the convergence of sequences through plotting.
3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.
4. Study the convergence/divergence of infinite series by plotting their sequences of partial sum.
5. Cauchy’s root test by plotting n-th roots, Ratio test by plotting the ratio of n-th and $(n+1)$-th term.

Text/Reference Books:

1. R.G. Bartle and D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., Wiley, 2000.
2. G.G. Bilodeau , P.R. Thie and G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2009.
3. B.S. Thomson, A.M. Bruckner and J.B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.
4. S.K. Berberian, A First Course in Real Analysis, Springer, 1998.
5. T.M. Apostol, Mathematical Analysis, Narosa, 2002.
6. R. Courant and F. John, Introduction to Calculus and Analysis, Vol I, Springer, 1999.
7. W. Rudin, Principles of Mathematical Analysis, McGraw Hill, 2017.
8. C.C. Pugh, Real Mathematical Analysis, Springer, 2002.
9. T. Tao, Analysis I, Hindustan Book Agency, 2006
10. S. Goldberg, Calculus and mathematical analysis.
11. H.R. Beyer, Calculus and Analysis, Wiley, 2010.
12. S. Lang, Undergraduate Analysis, Springer, 2nd Ed., 1997.
13. A. Kumar and S. Kumaresan, A Basic Course in Real Analysis, CRC Press, 2014.

PROGRAM NAME: B.Sc. (Honours)
COURSE: MATHEMATICS(Hons) 2nd Semester
PAPER NAME: Abstract Algebra **PAPER CODE: DC04**
NAME OF TEACHER(S): RAKESH SARKAR (R.S.), Dr. TILAK KUMAR PAL (T.K.P.)

Unit-1

Definition and examples of groups, elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group. Properties of cyclic groups, classification of subgroups of cyclic groups. Permutation group, cycle notation for permutations, properties of permutations, even and odd permutations, alternating group. Cosets, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. Normal subgroup and quotient group.

Unit-2

Group homomorphisms, properties of homomorphisms, properties of isomorphisms. First, Second, and Third isomorphism theorems. External direct product of a finite number of groups, Cauchy's theorem for finite abelian groups. Cayley's theorem.

Unit-3

Definition and examples of rings, elementary properties of rings, subrings, integral domains and fields, characteristic of a ring. Ring homomorphisms, properties of ring homomorphisms.

First Isomorphism theorem. Isomorphism theorems II and III (statement only), field of quotients. Elementary properties of field, Introduction to polynomial ring.

Unit-4

Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Class	Topic		TEACHER	
Lecture 1	Definition and examples of groups.	Unit-1	TKP	April-6 Classes, March-5 Classes
Lecture 2	Elementary properties of groups.		TKP	
Lecture 3	Subgroups and examples of subgroups.		TKP	
Lecture 4	centralizer, normalizer, center of a group.		TKP	
Lecture 5	Properties of cyclic groups,		TKP	
Lecture 6	classification of subgroups of cyclic groups		TKP	
Lecture 7	Permutation group, cycle notation for permutations,		TKP	
Lecture 8	properties of permutations, even and odd permutations,		TKP	
Lecture 9	alternating group , examples		TKP	
Lecture 10	Cosets, properties of cosets,		TKP	
Lecture 11	Lagrange's theorem and consequences including Fermat's Little theorem.		TKP	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		TKP	
Lecture 12	Normal subgroup and quotient group.	Unit-2	TKP	June-5 Classes, May-6 Classes
Lecture 13	Group homomorphisms, properties of homomorphisms,		TKP	
Lecture 14	properties of isomorphisms.		TKP	
Lecture 15	First isomorphism theorems.		TKP	
Lecture 16	Second isomorphism theorems.		TKP	
Lecture 17	Third isomorphism theorems.		TKP	
Lecture 18	External direct product of a finite number of groups,		TKP	
Lecture 19	Cauchy's theorem for finite abelian groups.		TKP	
Lecture 20	Cayley's theorem and its application		TKP	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 20 and Assignment-2		TKP	
Lecture 21	Definition and examples of rings,	Unit-3	RS	March-5 Classes
Lecture 22	elementary properties of rings,		RS	
Lecture 23	Subrings, some properties and		RS	

Lecture 24	Integral domains and properties.		RS	
Lecture 25	characteristic of a ring		RS	
Lecture 26	Fields and their properties		RS	
Lecture 27	Ring homomorphisms, properties of ring homomorphisms.		RS	
Lecture 27	First Isomorphism theorem.	Unit-3	RS	April-6 Classes,
Lecture 29	Isomorphism theorems II and III (statement only),		RS	
Lecture 30	field of quotients. Elementary properties of field,		RS	
Lecture 31	Introduction to polynomial ring.		RS	
Examination	Class Test-3(Tutorial Exam) on Lecturer 21 to Lecturer 31 and Assignment-3		RS	
Lecture 32	Definition of Ideal, example	Unit-4	RS	June-5 Classes, May-6 Classes
Lecture 33	ideal generated by a subset of a ring,		RS	
Lecture 34	factor rings, and its example		RS	
Lecture 35	operations on ideals,		RS	
Lecture 36	Prime and its properties		RS	
Lecture 37	Definition of maximal ideals and some theorem		RS	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 37 and Assignment-4		RS	

Text/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, 8th Ed., Houghton Mi_in, 2012.
4. J.J. Rotman, An Introduction to the Theory of Groups, 4th Ed., Springer, 1995.
5. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, 1975.
6. D.S. Malik, J.M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, McGraw,Hill, 1996.

7. D.S. Dummit and R.M. Foote, Fundamentals of Abstract Algebra, 3rd Ed., Wiley, 2003.

8. M.K. Sen, S. Ghosh, P. Mukhopadhyay and S.K. Maiti, Topics in Abstract Algebra, 3rd ed. University press, 2019.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 3rd Semester

PAPER NAME: Real Analysis II **PAPER CODE: DC05**

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

Unit-1

Properties of monotone functions. Functions of bounded variation, total variation, continuous functions of bounded variation. Curves and paths, rectifiable paths and arc length.

Unit-2

Riemann integration: upper and lower sums, upper and lower integral, definition and conditions of integrability. Riemann integrability of monotone and continuous functions, elementary properties of the Riemann integral. Intermediate Value theorems for Integrals. Fundamental theorem of Integral Calculus, change of variables.

Unit-3

Periodic function, Fourier coefficient & Fourier series, convergence, Bessel's inequality, Parseval's inequality, Dirichlet's condition, example of Fourier series. Improper integrals: Range of integration, finite or infinite. Necessary and sufficient condition for convergence of improper integral. Tests of convergence: Comparison and M-test. Absolute and non-absolute convergence and inter-relations. Statement of Abel's and Dirichlet's test for convergence on the integral of a product. Convergence and working knowledge of Beta and Gamma function and their inter-relation.

Unit-4

Pointwise and uniform convergence of sequence of functions. Theorems on continuity, differentiability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and differentiability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Class	Topic		TEACHER	
Lecture 1	Properties of monotone functions.	Unit-1	SA	July-6 Classes
Lecture 2	Functions of bounded variation with examples		SA	
Lecture 3	Total variation, Calculate total variation		SA	

Lecture 4	Continuous functions of bounded variation		SA	
Lecture 5	Curves and paths,		SA	
Lecture 6	rectifiable paths and arc length		SA	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 6 and Assignment-1		SA	
Lecture 7	Riemann integration	Unit-2	PK	August-9 Classes
Lecture 8	Upper and lower sums,		PK	
Lecture 9	Upper and lower integral,		PK	
Lecture 10	Definition and conditions of integrability.		PK	
Lecture 11	Riemann integrability of monotone and continuous functions,		PK	
Lecture 12	Elementary properties of the Riemann integral.		PK	
Lecture 13	Intermediate Value theorems for Integrals.		PK	
Lecture 14	Fundamental theorem of Integral Calculus,		PK	
Lecture 15	Change of variables.		PK	
Examination	Class Test-2(Tutorial Exam) on Lecturer 7 to Lecturer 15 and Assignment-2		PK	
Lecture 16	Periodic function examples	Unit-3	SA	November-5 Classes, September -6 Classes
Lecture 17	Fourier coefficient & Fourier series		SA	
Lecture 18	convergence, Bessel's inequality		SA	
Lecture 19	Parseval's inequality, Dirichlet's condition,		SA	
Lecture 20	example of Fourier series.		SA	
Lecture 21	Necessary and sufficient condition for convergence of improper integral.		SA	
Lecture 22	Tests of convergence: Comparison and M-test.		SA	
Lecture 23	Absolute and non-absolute convergence and inter-relations.		SA	
Lecture 24	Statement of Abel's and Dirichlet's test for convergence on the integral of a product.		SA	
Lecture 25	Convergence and working knowledge of Beta		SA	
Lecture 26	Convergence and working knowledge Gamma function and their inter-relation.		SA	

Examination	Class Test-3(Tutorial Exam) on Lecturer 16 to Lecturer 26 and Assignment-3		SA	
Lecture 27	Pointwise and uniform convergence of sequence of functions.	Unit-4	PK	November -3 Classes
Lecture 28	Theorems on continuity,		PK	
Lecture 29	differentiability and the limit function of a sequence of functions		PK	
Lecture 30	Integrability of the limit function of a sequence of functions		PK	December-6 Classes
Lecture 31	Series of functions;		PK	
Lecture 32	Theorem of Continuity of the sum function of a series of functions;		PK	
Lecture 33	differentiability of the sum function of a series of functions;		PK	
Lecture 34	Cauchy criterion for uniform convergence		PK	
Lecture 35	Weierstrass M-Test.		PK	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 35 and Assignment-4		PK	

Reference Books

1. R. Bartle and D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons, 2003.
2. K.A. Ross, Elementary Analysis: The Theory of Calculus, Springer, 2004.
3. A. Mattuck, Introduction to Analysis, Prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, A Course in Calculus and Real Analysis, Springer, 2006.
5. T.M. Apostol, Mathematical Analysis, Narosa Publishing House
6. R. Courant and F. John, Introduction to Calculus and Analysis, Vol II, Springer
7. W. Rudin, Principles of Mathematical Analysis, McGraw Hill, 2017.
8. T. Tao, Analysis II, Hindustan Book Agency, 2006
9. S. Shirali and H.L. Vasudeva, Metric Spaces, Springer, 2006.
10. G.G. Bilodeau , P.R. Thie and G.E. Keough, An Introduction to Analysis, 2nd Ed., Jones & Bartlett, 2010.
11. B.S. Thomson, A.M. Bruckner and J.B. Bruckner, Elementary Real Analysis,Prentice Hall, 2001.
12. C.C. Pugh, Real Mathematical Analysis, Springer, 2002.

13. H.R. Beyer, Calculus and Analysis, Wiley, 2010.
14. S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.
15. S. Goldberg, Calculus and Mathematical Analysis.
16. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
17. 17. S. Lang, Undergraduate Analysis, 2nd Ed., Springer, 1997.

PROGRAM NAME: B.Sc. (Honours)
COURSE: MATHEMATICS(Hons) 3rd Semester
PAPER NAME: Linear Algebra **PAPER CODE: DC06**
NAME OF TEACHER(S): POLY KAMAKAR(P.K.)

Unit-1

Definition and examples of vector spaces, subspaces, linear combination of vectors, linear span, linear dependence and independence, bases and dimension.

Unit-2

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Unit-3

Linear operator and its eigen value and eigen vectors, characteristic equation, eigenspace, algebraic and geometric multiplicity of eigenvalues. Diagonalization, conditions for diagonalizability. Invariant subspace and Cayley-Hamilton theorem, simple application of Caley-Hamilton Theorem.

Unit-4

Inner products and norms, special emphasis on Euclidean spaces. Orthogonal and orthonormal vectors, Gram-Schmidt orthogonalisation process, orthogonal complements. The adjoint of a linear operator, unitary, orthogonal and normal operators.

Class	Topic		TEACHER	
Lecture 1	Definition and examples of vector spaces	Unit-1	PK	July-7 Classe
Lecture 2	Subspaces		PK	

Lecture 3	Linear combination of vectors		PK	
Lecture 4	Llinear span,		PK	
Lecture 5	Linear dependence and independence		PK	
Lecture 6	Bases		PK	
Lecture 7	Dimension		PK	
Lecture 8	Linear transformations	Unit-1	PK	August-5 Classes
Lecture 9	Null space, range		PK	
Lecture 10	Rank of a linear transformation		PK	
Lecture 11	Nullity of a linear transformation		PK	
Lecture 12	Discussion		PK	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 12 and Assignment-21		PK	
Lecture 13	Matrix representation of a linear transformation	Unit-2	PK	September -6 Classes, August-5 Classes
Lecture 14	Application of matrix representation of a linear transformation		PK	
Lecture 15	Algebra of linear transformations		PK	
Lecture 16	Isomorphisms		PK	
Lecture 17	Isomorphism theorems,		PK	
Lecture 18	Invertibility		PK	
Lecture 19	Isomorphisms		PK	
Lecture 20	Change of coordinate matrix		PK	
Lecture 21	Application of change of coordinate matrix		PK	
Lecture 22	Discussion		PK	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		PK	
Lecture 23	Linear operator	Unit-3	PK	November-9 Classes, October -3 Classes
Lecture 24	Linear operator's eigen value		PK	
Lecture 25	Linear operator's eigen vectors		PK	
Lecture 26	Characteristic equation		PK	
Lecture 27	Eigenspace		PK	
Lecture 27	Algebraic multiplicity of eigenvalues		PK	

Lecture 28	Geometric multiplicity of eigenvalues		PK	
Lecture 29	Diagonalization		PK	
Lecture 30	Conditions for diagonalizability		PK	
Lecture 31	Application of diagonalizability		PK	
Lecture 32	Cayley-Hamilton theorem		PK	
Lecture 33	Application of Caley-Hamilton Theorem.		PK	
Lecture 34	Discussion		PK	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		PK	
Lecture 35	Inner products	Unit-4	PK	January -2 Classes, December -9 Classes
Lecture 36	Norms		PK	
Lecture 37	Special emphasis on Euclidean spaces		PK	
Lecture 38	Orthogonal vectors		PK	
Lecture 39	Orthonormal vectors		PK	
Lecture 40	Gram-Schmidt orthogonalisation process		PK	
Lecture 41	Orthogonal complements		PK	
Lecture 42	The adjoint of a linear operator		PK	
Lecture 43	Unitary , Orthogonal operators		PK	
Lecture 44	Normal operators.		PK	
Lecture 45	Discussion		PK	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 45 and Assignment-4		PK	

Reference Books

1. S.H. Friedberg, A.J. Insel and L.E. Spence, Linear Algebra, 4th Ed., PHI, 2004.
2. J.B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
3. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
4. A.R. Rao and P. Bhimasankaram, Linear Algebra, Hindustan Book Agency, 2000.
5. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
6. G. Strang, Linear Algebra and its Applications, Thomson, 2007.
7. S. Kumaresan, Linear Algebra- A Geometric Approach, PHI, 1999.
8. K. Hoffman and R.A. Kunze, Linear Algebra, 2nd Ed., PHI, 1971.

9. S. Axler, Linear Algebra Done Right, Springer, 2014.
10. S.J. Leon, Linear Algebra with Applications, Pearson, 2015.
11. J.S. Golan, Foundations of Linear Algebra, Springer, 1995.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 3rd Semester

PAPER NAME: **Multivariate Calculus & Vector Calculus** **PAPER CODE:** DC07

NAME OF TEACHER(S): **RAKESH SARKAR(R.S.), POLY KAMAKAR(P.K.)**

Unit-1

Functions of several variables, limit and continuity of functions of two or more variables, directional derivative and partial differentiation, Schwartz's & Young's theorem and Euler's theorem for homogenous function, total differentiability and Jacobian, sufficient condition for differentiability, Mean value theorem, Taylor's theorem, Implicit function theorem (statement only), the gradient, tangent planes. Chain rule for one and two independent parameters. Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems.

Unit-2

Double integration over rectangular region, double integration over non-rectangular region, changing the order of integration. Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals.

Unit-3

Triple product, introduction to vector fields, operations with vector-valued functions, limits and continuity of vector functions, differentiation of vector valued function, gradient, divergence and curl. Curves and their parameterization, line integration of vector functions, circulation. Surface and volume integration.

Unit-4

Gauss's theorem, Green's theorem, Stoke's theorem and their simple applications.

Class	Topic		TEACHER	
Lecture 1	Functions of several variables	Unit-1	RS	August-6 Classes, July-6 Classes
Lecture 2	limit of functions of two or more variables		RS	
Lecture 3	continuity of functions of two or more variables		RS	
Lecture 4	directional derivative and partial differentiation,		RS	
Lecture 5	Schwartz's theorem for homogenous function of two variables		RS	

Lecture 6	Young's theorem and Euler's theorem for homogenous function of two variables		RS	
Lecture 7	Application of Schwartz's & Young's theorem and Euler's theorem for function of several variables		RS	
Lecture 8	total differentiability and Jacobian		RS	
Lecture 9	sufficient condition for differentiability, Mean value theorem		RS	
Lecture 10	Taylor's theorem, Implicit function theorem(statement only),), the gradient, tangent planes		RS	
Lecture 11	Chain rule for one and two independent parameters.		RS	
Lecture 12	Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 12 and Assignment-1		RS	
Lecture 13	Double integration over rectangular region	Unit-2	PK	September -6 Classes, August-5 Classes
Lecture 14	double integration over non-rectangular region		PK	
Lecture 15	changing the order of integration.		PK	
Lecture 16	Triple integrals		PK	
Lecture 17	Triple integral over a parallelepiped and solid regions-1		PK	
Lecture 18	Triple integral over a parallelepiped and solid regions-2		PK	
Lecture 19	Volume by triple integrals-1		PK	
Lecture 20	Volume by triple integrals-2		PK	
Lecture 21	cylindrical and spherical co-ordinates		PK	
Lecture 22	Change of variables in double integrals and triple integrals		PK	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 22 and Assignment-2		PK	
Lecture 23	Scalar and Vector triple product	Unit-3	RS	November-10 Classes, October -2 Classes
Lecture 24	introduction to vector fields		RS	
Lecture 25	operations with vector-valued functions		RS	
Lecture 26	limits and continuity of vector functions		RS	
Lecture 27	differentiation of vector valued function		RS	
Lecture 27	Gradient of scalar function, divergence of a vector field		RS	
Lecture 28	Curl of a vector field		RS	
Lecture 29	Curves and their parameterization		RS	
Lecture 30	line integration of vector functions		RS	

Lecture 31	circulation on a vector field		RS	
Lecture 32	Surface integration		RS	
Lecture 33	volume integration		RS	
Lecture 34	Miscellaneous examples on line, surface and volume integration		RS	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 34 and Assignment-3		RS	
Lecture 35	Gauss's theorem	Unit-4	RS	
Lecture 36	Application of Gauss's theorem		RS	
Lecture 37	Application of Gauss's theorem		RS	January -3 Classes, December -8 Classes
Lecture 38	Green's theorem		RS	
Lecture 39	Application of Green's theorem	Unit-4	RS	
Lecture 40	Application of Green's theorem		RS	
Lecture 41	Stoke's theorem		RS	
Lecture 42	Application of Stoke's theorem		RS	
Lecture 43	Application of Stoke's theorem		RS	
Lecture 44	Miscellaneous examples on Gauss's theorem, Green's theorem, Stoke's theorem-1		RS	
Lecture 45	Miscellaneous examples on Gauss's theorem, Green's theorem, Stoke's theorem-2		RS	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 45 and Assignment-4		RS	

Reference Books

18. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson, 2005.
19. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Pearson, 2007.
20. E. Marsden, A.J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer, 2005.
21. J. Stewart, Multivariable Calculus, Concepts and Contexts, 4nd Ed., Cengage Learning, 2009.
22. T.M. Apostol, Mathematical Analysis, Narosa, 2002.
23. S.R. Ghorpade and B.V. Limaye, A Course in Multivariable Calculus and Analysis, Springer, 2010.
24. R. Courant and F. John, Introduction to Calculus and Analysis (Vol. II), Springer, 1999.
25. W. Rudin, Principles of Mathematical Analysis, McGraw Hill, 2017.
26. J.E. Marsden, and A. Tromba, Vector Calculus, W.H. Freeman, 1996.

27. T. Tao, Analysis II, Hindustan Book Agency, 2006

28. M.R. Speigel, Schaum's outline: Vector Analysis, McGraw Hill, 2017.

29. C.E. Weatherburn, Elementary Vector Analysis: With Application to Geometry and Physics, CBS Ltd., 1926.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 4th Semester

PAPER NAME: **Differential Equations** **PAPER CODE: DC08**

NAME OF TEACHER(S): POLY KARMAKAR(P.K.), Dr. TILAK KUMAR PAUL(T.K.P.)

Unit-1

Exact, linear and Bernoulli's equations. Equations not of first degree, Clairaut's equations, singular solution. Lipschitz condition and 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, Euler's 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: classification, 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	PK	July -7

Lecture 2	Linear and Bernoulli’s equations.	Unit-1	PK	
Lecture 3	Equations solving not of first degree		PK	
Lecture 4	Clairaut’s equations		PK	
Lecture 5	Singular solution		PK	
Lecture 6	Lipschitz condition		PK	
Lecture 7	Picard’s Theorem		PK	
Lecture 8	General solution of homogeneous equation of second order		PK	August-4 Classes
Lecture 9	Principle of super position for homogeneous equation		PK	
Lecture 10	Wronskian and its properties.		PK	
Lecture 11	Linear homogeneous equations of higher order with constant coefficients		PK	
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	PK	September-4 Classes, August-9 Classes
Lecture 13	Euler’s equation		PK	
Lecture 14	Method of undetermined coefficients		PK	
Lecture 15	Method of variation of parameters		PK	
Lecture 16	Eigenvalue problem		PK	
Lecture 17	Systems of linear differential equations, types of linear systems		PK	
Lecture 18	Differential operators, an operator method for linear systems with constant coefficients		PK	
Lecture 19	Basic Theory of linear systems in normal form		RS	
Lecture 20	Homogeneous linear systems with constant coefficients		PK	
Lecture 21	Two Equations in two unknown functions		PK	
Lecture 22	Equilibrium points,		PK	
Lecture 23	Interpretation of the phase plane		PK	
Lecture 24	Discussion		PK	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 24 and Assignment-2		PK	
Lecture 25	Power series solution of a differential equation	Unit-3	TKP	September-8
Lecture 26	Problem solve		TKP	

Lecture 27	Power series solution of a differential equation about an ordinary point		TKP	
Lecture 27	Problem solve		TKP	
Lecture 28	Power series solution of a differential equation about a regular singular point		TKP	
Lecture 29	Problem solve		TKP	
Lecture 30	Legendre polynomials		TKP	
Lecture 31	Problem solve		TKP	
Lecture 32	Bessel functions of the first kind		TKP	November-4 Classes
Lecture 33	properties of Bessel functions of the first kind	Unit-3	TKP	
Lecture 34	Problem solve		TKP	
Lecture 35	Discussion		TKP	
Examination	Class Test-3(Tutorial Exam) on Lecturer 25 to Lecturer 35 and Assignment-3		TKP	
Lecture 36	Partial differential equations		TKP	
Lecture 37	Basic concepts about partial differential equations		TKP	
Lecture 38	Problem solve		TKP	
Lecture 39	First- Order partial differential equations		TKP	
Lecture 40	First- Order Equations: classification		TKP	
Lecture 41	First- Order Equations: construction.		TKP	December-8 Classes, November-3 Classes
Lecture 42	First- Order Equations: geometrical interpretation.	Unit-4	TKP	
Lecture 43	Method of characteristics for obtaining general solution of quasi linear equations		TKP	
Lecture 44	Canonical forms of first-order linear equations		TKP	
Lecture 45	Solution by Lagrange’s method.		TKP	
Lecture 46	Solution by Charpit’s method.		TKP	
Lecture 47	Discussion		TKP	
Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 47 and Assignment-4		TKP	

Graphical Demonstration (Teaching Aid)

1. Plotting of family of curves which are solutions of second order differential equation.

2. Plotting of family of curves which are solutions of third order differential equation.

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. (Honours)

COURSE: MATHEMATICS(Hons) 4th Semester

PAPER NAME: Mechanics **PAPER CODE: DC 09**

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

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	RS	August-3 Classes, July-9 Classes
Lecture 2	Coplanar forces,Varignon's theorem.		SA	
Lecture 3	Necessary and sufficient conditions of equilibrium.		SA	
Lecture 4	Equilibrium equations of the fiSAt, second and third kind.		SA	
Lecture 5	An arbitrary force system in space: Moment of a force about an axis,.		SA	
Lecture 6	Varignon's theorem.		SA	
Lecture 7	Resultant force and resultant couple, necessary and sufficient conditions of equilibrium.		SA	
Lecture 8	Equilibrium equations.		SA	
Lecture 9	Reduction to a wrench, Poinsot's central axis, intensity and pitch of a wrench.		SA	
Lecture 10	Invariants of a system of forces.		SA	

Lecture 11	Statically determinate and indeterminate problems.		SA	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 11 and Assignment-1		SA	
Lecture 12	Equilibrium in the presence of sliding Friction force.	Unit-2	SA	September-3 Classes, August-8 Classes
Lecture 13	Friction force: Contact force between bodies.		SA	
Lecture 14	Coulomb's laws of static Friction and dynamic friction.		SA	
Lecture 15	The angle and cone of friction, the equilibrium region.		SA	
Lecture 16	Virtual work: Workless constraints examples, virtual displacements and virtual work.		SA	
Lecture 17	The principle of virtual work.		SA	
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.		SA	
Lecture 19	Virtual work problems.		SA	
Lecture 20	Virtual work problems.		SA	
Lecture 21	Stability of equilibrium: Conservative force field.		SA	
Lecture 22	Energy test of stability.		SA	
Lecture 23	Condition of stability of a perfectly rough heavy body lying on a fixed body		SA	
Lecture 24	Rocking stones.		SA	
Examination	Class Test-2(Tutorial Exam) on Lecturer 12 to Lecturer 24 and Assignment-2		SA	
Lecture 25	Kinematics of a particle: Velocity, acceleration, angular velocity, linear and angular momentum.	Unit-3	SA	November-4 Classes, September-7 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	November-9 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.

PROGRAM NAME: B.Sc. (Honours)

COURSE: MATHEMATICS(Hons) 4th Semester

PAPER NAME: Probability & Statistics **PAPER CODE: DC10**

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

Unit-1

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

Unit-2

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

Unit-3

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

Unit-4

Random Samples, Sampling Distributions. Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample problems of normal populations, confidence intervals for proportions, problems. Testing of hypothesis: Null and alternative hypotheses, the critical and acceptance regions, two types of error, Neyman-Pearson Fundamental Lemma, tests for one sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications.

Class	Topic		TEACHER	
Lecture 1	Sample space	Unit-1	RS	July-7 Classes
Lecture 2	probability axioms		RS	
Lecture 3	real random variables (discrete and continuous)		RS	
Lecture 4	cumulative distribution function		RS	
Lecture 5	probability mass/density functions		RS	
Lecture 6	mathematical expectation		RS	
Lecture 7	moments		RS	
Lecture 8	moment generating function	Unit-1	RS	August-5 Classes
Lecture 9	characteristic function		RS	
Lecture 10	Discrete distributions & continuous distributions		RS	
Lecture 11	Discrete distributions: uniform distributions		RS	
Lecture 12	Discrete distributions: binomial		RS	
Examination	Class Test-1(Tutorial Exam) on Lecturer 1 to Lecturer 12 and Assignment-1		RS	
Lecture 13	Discrete distributions: Poisson	Unit-2	RS	September-3 Classes, August-8 Classes
Lecture 14	Discrete distributions: geometric		RS	
Lecture 15	Discrete distributions: negative binomial		RS	
Lecture 16	Continuous distributions: uniform		RS	
Lecture 17	Continuous distributions: normal		RS	
Lecture 18	Continuous distributions: exponential		RS	
Lecture 19	Joint cumulative distribution function and its properties		RS	
Lecture 20	Joint probability density functions		RS	
Lecture 21	Marginal distributions		RS	
Lecture 22	Conditional distributions		RS	

Examination	Class Test-2(Tutorial Exam) on Lecturer 13 to Lecturer 22 and Assignment-2		RS	
Lecture 23	Expectation of function of two random variables	Unit-3	RS	November-4 Classes, September-7 Classes
Lecture 24	Conditional expectations		RS	
Lecture 25	Independent random variables		RS	
Lecture 26	Bivariate normal distribution		RS	
Lecture 27	Correlation coefficient		RS	
Lecture 27	Joint moment generating function (jmgf)		RS	
Lecture 28	Calculation of covariance (from jmgf),		RS	
Lecture 29	Linear regression for two variables		RS	
Lecture 30	Chebyshevs inequality statement		RS	
Lecture 31	Chebyshevs inequality interpretation of (weak) law of large numbers and strong law of large numbers.		RS	
Lecture 32	Central Limit theorem for independent identically distributed random variables with finite variance.		RS	
Lecture 33	Central Limit theorem for identically distributed random variables with finite variance.		RS	
Examination	Class Test-3(Tutorial Exam) on Lecturer 23 to Lecturer 33 and Assignment-3		RS	
Lecture 34	Random Samples, Sampling Distributions	Unit-4		December-5 Classes, November-8 Classes
Lecture 35	Estimation: Unbiasedness, consistency		RS	
Lecture 36	The method of moments and the method of maximum likelihood estimation,		RS	
Lecture 37	Confidence intervals for parameters in one sample problems of normal populations,		RS	
Lecture 38	Confidence intervals for proportions, problems.		RS	
Lecture 39	Testing of hypothesis: Null and alternative hypotheses tests for one sample problems for normal populations, tests for proportions,		RS	
Lecture 40	The critical and acceptance regions,		RS	
Lecture 41	Two types of error, Neyman-Pearson Fundamental Lemma,		RS	
Lecture 42	Tests for one sample problems for normal populations		RS	
Lecture 43	Tests for proportions		RS	
Lecture 44	Chi-square goodness of fit test		RS	
Lecture 45	Applications of Chi-square goodness of fit test		RS	

Examination	Class Test-4(Tutorial Exam) on Lecturer 1 to Lecturer 45 and Assignment-4	RS

Reference Books

1. Miller and M. Miller, John E. Freund's Mathematical Statistics with Applications, 7th Ed., Pearson, 2006.
2. S. Ross, Introduction to Probability Models, 9th Ed., Academic Press, 2007.
3. R.B. Ash, Basic Probability Theory, Dover Publications, 2008.
4. R.V. Hogg, J.W. McKean and A.T. Craig, Introduction to Mathematical Statistics, Pear- son, 2007.
5. A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the Theory of Statistics, 3rd Ed., McGraw Hill, 2007.
6. Gupta, Groundwork of Mathematical Probability and Statistics, Academic Publisher, 2015.
7. W. Feller, An Introduction to Probability Theory and its Applications, Wiley, 1968.
8. A.P. Baisnab and M. Jas, Elements of Probability and Statistics, McGraw Hill, 1993.
9. V.K. Rohatgi, A.K.Md.E. Saleh, An Introduction to Probability and Statistics, Wiley, 2008.

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 Math- ematics), 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 crite- rion, 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 ≥ 5.	SA
Lecture 27	Simplicity of An for n ≥ 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. Lagrangian 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) 6^{th} 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, 2^{nd} 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) 6^{th} 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 Com- ponents, 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) 6^{th} 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