MA 7203 STATISTICAL METHODS

(Pre-requisite: Probability and Measure)

Total hours: 56

L	T	P	C
3	1	0	3

Probability distributions:- Random variables- Chebyshev's theorem-Discrete probability distributions- Continuous probability distributions; Sampling distributions and Inference concerning means**-** Population and samples, The sampling distributions, Point estimation and interval estimation, Tests of hypothesis- one mean and two means, paired t- test, Inference concerning variances and proportions- Estimation of variances, Hypothesis concerning variances- Estimation of proportions- Hypothesis concerning proportions, Chi – square test for goodness of fit. Regression Analysis, Analysis of variance. Computer applications

MA 7204 METHODS OF APPLIED MATHEMATICS

(Pre-requisite: with ordinary differential equations **)**

Total hours: 56

L	T	P	C
3	1	0	3

Integral transforms – Applications of Fourier integrals and transforms-Finite Fourier transforms – Finite Fourier sine and cosine transforms - Convolution theorem for finite Fourier transforms - Application for finite Fourier transforms - Integral equations-Types of integral equations-Relation between differential and integral equations - Green' function-Fredholm equation with separable kernels-Resolvent kernel-Hilbert Schmidt theory - Tensor analysis-Contravariant , covariant and mixed tensors-Quotient low-Conjugate tensor- Christofell symbols - Co variant differentiation of tensors-Calculus of variation-The method of variation in problems with fixed boundaries-Euler's equation-The fundamental lemma of calculuas of variation-Functionals involving derivatives higher order - Functionals depending on functions of several independent variables - Rayleigh-Ritz method.

MA 6201: REAL ANALYSIS

(Pre-requisite: nil)

L	T	P	C
3	1	0	3

Total Hours: 56

MODULE I: (14 hours)
A brief review of the real and complex number systems: The real field, The extended real number system, The complex field, Euclidean spaces. Elements of set theory: Finite, Countable and uncountable sets, Metric spaces, compact sets, Connected Sets and Perfect sets.

MODULE II: (14 hours)
Convergent Sequences, Cauchy Sequences, Upper and Lower limits, Series, Tests for convergence, power series, absolute convergence, Limits of functions, Continuity, Connectedness and Compactness, Discontinuities, Monotonic functions, Infinite limits and limit at infinity.

MODULE III: (14 hours)
Differentiation, Mean value theorem, L'Hospital's rule, Derivatives of Higher order, Taylor's theorem, The Riemann – Stieltjes integral. Definition and existence of the integral, properties of the integral, Integration and differentiation.

MODULE IV: (14 hours)
Sequence and series of functions, Uniform convergence-continuity, Differentiation and Integration, Equicontinuous families of functions, Stone-Weistrass theorem, Functions of several variables, Linear Transformations, Inverse function theorem, Implicit function theorem.

References:

1. W. Rudin; "Principles of Mathematical Analysis" , Mc. Graw Hill, 3rd Edn., 1976.
2. T. M. Apostal;"Mathematical Analysis" , Addison – Wesley publishing Co, 2nd Edn., 1974.
3. R. G. Bartle; "Elements of Real Analysis" ,John Wiley ,1976.

4 L. M. Graves; "The Theory of functions of a real variable", Tata Mc Graw Hill ,1978.

MA 6202: LINEAR ALGEBRA

(Pre-requisite: nil)

L	T	P	C
3	1	0	3

Total Hours: 56

MODULE I: (13 hours)

Vector Spaces, Subspaces, Linear independence and dependence, Bases, Dimension, Coordinates, row equivalence, computations concerning subspaces.

MODULE II: (16 hours)

Linear Transformations, The Kernel and Range of a linear transformation, Rank-Nullity theorem, Algebra of linear transformations ,Isomorphism, Representation of transformations by Matrices, linear functionals, dual and double dual of a space, Annihilator of a subset, Transpose of a linear transformation.

MODULE III: (12 hours)

Characteristic values and, Characteristic vectors, The characteristic polynomial, Diagonalization of Matrices and Linear transformation, Annihilating polynomials, Cayley-Hamilton theorem, Invariant subspaces, direct sum decompositions, invariant direct sums, Quotient space, Spectral theorem.

MODULE IV: (15 hours)

Inner products, Inner product spaces, Orthogonality, orthonormal sets, Bessel's inequality, Gram-Schmidt process , Bessel's inequality, Linear functionals and adjoints, Unitary operators , Normal operators, positive form, Bilinear Forms, rank of a bilinear form, symmetric bilinear forms, Positive definite, Quadratic forms.

References:

1. K. Hoffman , R. Kunze; " Linear Algebra", Prentice Hall of India, 1971.
2. P. R. Halmos; "Finite dimensional vector spaces", Narosa Publishing House, 1974.
3. M. R. Spiegel; "Linear Algebra", Mc Graw Hill Book Company, 1968.
4. S. Lang; "Linear Algebra", Addison – Wesley Publishing Company, 1972.

MA 6203: NUMERICAL ANALYSIS

(Pre-requisite: nil)

Total hours: 56

L	T	P	C
3	1	0	3

MODULE I(12 hours)

Basics:Algorithms, Convergence, Mathematics on the Computer Floating Point Number Systems, Mathematics on the Computer: Floating Point Arithmetic; Root Finding: The Bisection Method, The method of False Position, Fixed Point Iteration Schemes, Newton's Method, Secant Method, Accelerating Convergence, Roots of Polynomials.

MODULE II (12 hours)

Systems of Equations:Linear Algebra Review, Gaussian Elimination, Pivoting Strategies, Vector and Matrix Norms, Error Estimates and Condition Number, *LU* Decomposition, Direct Factorization, Special Matrices, Iterative Techniques for Linear Systems: Basic Concepts and Methods, Conjugate Gradient Method, Nonlinear Systems of Equations.

MODULE III (12 hours)

Eigen Values and Eigen Vectors: The Power Method, The Inverse Power Method, Deflation, Reduction to Symmetric Tridiagonal Form, Eigen values of Symmetric Tridiagonal Matrices.

MODULE IV (20 hours)

Interpolation: Lagrange Form of the Interpolating Polynomial, Neville's Algorithm, The Newton Form of the Interpolating Polynomial, Optimal Points for Interpolation, Piecewise Linear Interpolation, Cubic Spline Interpolation, Hermite and Hermite Cubic Interpolation, Regression, Numerical Differentiation, Richardson Extrapolation, Numerical Integration- The Basics and Newton-Cotes Quadrature, Composite Newton-Cotes Quadrature, Gaussian Quadrature, Romberg Integration, Adaptive Quadrature, Improper Integrals and other Discontinuities.

Numeric for ordinary differential equations, one step methods, Multi-step methods.

References:

1. B. Bradie ; " A Friendly Introduction to Numercal Analysis" , Pearson Prentice Hall, 2007.
2. C. F. Gerald and P. O. Wheatley; "Applied Numerical Analysis", , Addison Wesley, 5th Edn., 1994.
3. C. E. Froberg; "Introduction to Numerical Analysis", Addison Wesley.
4. G. M. Phillips and P. J. Taylor; "Theory and Applications of Numerical Analysis", Academic Press, 2nd Edn., 1965.
5. M. K. Jain , S. R. K. Iyengar, & R. K. Jain; "Numerical Methods for Scientific and Engg. Computation".,Wiley Eastern, 1985.
6. V. S.Ryaben'kii, S. V.Tsynkov, "A Theoretical Introduction to Numerical Analysis", Chapman & Hall , 2007.
7. W. H. Press, B. P. Flannery, S. A. Teukolsky, W. T. Vetterling; "Numerical Recipes in C: The Art of Scientific Computing", Cambridge University Press, 2nd Edn.,1992.

MA 6204: ORDINARY DIFFERENTIAL EQUATIONS

(Pre-requisite- nil)

L	T	P	C
3	1	0	3

Total hours: 56

Module-I: (13 hrs)

Basic concepts, Modeling with ordinary differential equation(ode), Explicit first order ode, Separable equations, Linear differential equations of higher order, Linear dependence and Wronskian, Method of variation of parameters.

Module-II: (15 hrs)

Solution in power series, Legendre equation and Legendre polynomials, second order with regular and singular points, Frobenius method, Bessel function and its properties, Sturm-Liouville problem.

Module-III: (13 hrs)

System of odes, systems with constant coefficients, Matrix methods for first order linear systems, Eigen values and Eigen vectors, Matrix exponentials, Predator-Prey model.

Module-IV: (15 hrs)

Existence and uniqueness of solutions, Cauchy-Peano and Picard-Lindeloff theorems.

Autonomous differential equation, Phase-space, Phase-portrait, Orbits, Stability, Basic definitions, Conditions for asymptotic stability, Lyapunov stability.

References:

1. E. A. Coddington and N. Levinson, "Theory of Ordinary Differential Equations", Mc-Graw Hill, New York, 1972.

2. W. Walter, "Ordinary Differential Equations", Springer, 6th Edn., New York, 1996.

3. F. Verhulst, "Nonlinear Differential Equations and Dynamical Systems", Springer, 2nd Edn., 1996.

MA 6205: TOPOLOGY

(Pre-requisite: nil)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (14 hours)
Topological spaces, Basis for a topology , The order topology , Product topology on X x Y , The subspace topology.

Module II: (14 hours)
Continuous functions and sets with imposed topologies. Closed sets, Limit points, Continuous functions, The Product topology, The metric topology, Properties , The quotient topology.

Module III: (14 hours)
Connected sets, Connected sets in the real line, Components and path components Local connectedness , Compact spaces , Compact sets in the real line , Limit point compactness , Local compactness.

Module IV: (14 hours)
Countability axioms, Separation axioms, Urysohn Lemma , Urysohn Metrization Theorem, Tychonoff Theorem.

References:

1. J. R. Munkres: "Topology – A First Course", Pearson Education, 2000.
2. G. F. Simmons; "Introduction to Topology and Modern Analysis", McGraw Hill, 1963.
3. K. D. Joshi; "Introduction to General Topology", New Age Publications, 1999.

MA 6206 COMPUTER PROGRAMMING I

(Pre-requisite: nil)

L	T	P	C
2	3	0	4

Total hours: 70

Module 1 : (16 hours)

Basics in C; Integer and real operations, Control statements, Do statements, while statements, for statements, nested loops, if-else statements, switch statements, break statements, continue statements, Functions, loops and control statements

Module 2 : (18 hours)

Multidimensional arrays, functions, recursions pointers, structures, Unions, arrays using pointers, structures using pointers, functions using pointers, pointers to the pointers, dynamic memory allocation.

Module 3: (18hours)

Basics in C++; Output Using cout. Directives. Input With cin. type bool.tThe setw manipulator, type conversions, classes and objects, encapsulation, polymorphism.

Module 4: (18 hrs)

constructors and destructors, function and operator overloading, friend functions, inheritance, virtual functions.

References:

1. Rajaraman, V., "Computer Programming in C", Prentice Hall India, 1994.
2. Kernighan, B. and Ritchie, D., "The C P rogramming Language". Prentice Hall India, 1995.
3. Anderson, A. E. Jr., and Heinze, W. J., "C++ Programming and Fundamental Concepts", Prentice Hall P T R, Englewood Cliffs, NJ, 1992.
4. Balagurusami, "Object Oriented Programming with C++" , Tata McGrow Hill Publishing Company, New Delhi.

MA 6221: OPERATIONS RESEARCH

(Pre-requisite: Linear Algebra)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (14 hours)

System of linear equations and inequations-Convex functions-formulation of linear programming problem-Theory of simplex method-Simplex Algorithm-Charne's M-Method-Two phase method Computational complexity of simplex Algorithm - Karmarker's Algorithm.

Module II (14 hours)

Duality in linear programming–Dual simplex method- Sensitivity analysis-Bounded variable problem-Transportation problem-Integrity property-MODI Method-Degeneracy -Unbalanced problem Assignment problem-Development of Hungarian method-Routing problems

Module III(14 hours)

Nature of Dynamic programming problem-Bellmann's optimality principle-Cargo loading problem-Replacement problem-Multistage production planning and allocation problem-Rectangular Games -Two ,persons zero sum games - Pure and mixed strategies-$2\times n$ and $m\times 2$ games - Relation between theory of games and linear programming.

Module IV(14 hours)

Critical path analysis-Probability consideration in PERT. Distinction between PERT and CPM. Resources Analysis in networking scheduling -Time cost optimization algorithm-Linear programming formulation-Introduction to optimization softwares.

References:

1. Bazaara, M. S.,.Jarvis, J J and Sherali, H.D "Linear programming and Network flows" , John Wiley, 2nd Edn., 1990.

2. Bazaara, M S, Sherali H. D. and Shetty, C. M., "Nonlinear programming Theory and Algorithms",John Wiley, 2nd Edn., 1993.

3. Hadley, G., "Linear programming", Narosa Publishing House, 1990.

4. Taha, H. A., "Operation Research-Introduction" , Prentice Hall India, 7th Edn., 2006.

MA 6222: COMPLEX ANALYSIS

(Pre-requisite: nil)

Total hours: 56

L	T	P	C
3	1	0	3

Module I: (13 hours)

Analytic functions, Power series, Arcs and closed curves, Analytic functions in regions, Conformal maps, Bilinear transformations.

Module II: (14 hours)

Line Integral , Rectifiable Arcs, Cauchy's Theorem for a Rectangle , Cauchy's Theorem in a Disk, Cauchy's Integral Formula: The index of a point with respect to a closed curve, the Integral Formula, higher derivatives, Liouville's theorem, Morera's theorem.

Module III: (15 hours)

Local properties of Analytical Functions : Singularities, Taylor's Theorem , Zeros and Poles , Laurent's series, The Maximum Principle, The General Form of Cauchy's Theorem, Chains and cycles, Simple connectivity , Homology , Proof of Cauchy's Theorem , Locally Exact Differentials , Multiply connected Regions.

Module IV: (14 hours)

The Calculus of Residues: The Residue Theorem , The Argument Principle , Evaluation of Definite Integrals, Harmonic Functions:- Definition and Basic Properties, The mean-value Property , Poisson's Formula , Schwarz's Theorem.

References:

1. L. V. Ahlfors; "Complex Analysis", McGraw Hill, 3rd Edn., 1979.

2. Cartan H., "Elementary Theory of Analytic Functions of one or several Complex variables", Dover Publications, 1st Edn., 1995.

3. Conway J. B., "Functions of one complex variable", , Narosa Publishers, 2nd Edn., 1991.

4. Nehari Z.; "Introduction to Complex Analysis", Allyn and Bacon, Inc., 1961.

5. Nehari Z.; "Conformal Mapping", McGraw Hill Book Company, 1952.

6. Silvermann R. K., "Complex Analysis with Application", Prentice Hall.

MA 6223: MEASURE AND PROBABILITY

(Pre-requisite: Real Analysis)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (15 hours)

Measure space and Probability space: σ-algebra, events, measures, probability measures, examples, Borel σ-algebras, Outer measure, Lebesgue measure, limit inferior and limit superior of a sequence of events, measurability and measurable functions, random variables, distribution function.

Module II: (16 hours)

Lebesgue integral: Inductive definition via simple functions, existence of the integral, properties of the integral, expectation as Lebesgue integral, Dominated Convergence theorem, Monotone convergence, Fatou's lemma, L^p spaces, integrable real valued random variables, moments, absolute moments, variance. Densities: Dominated measures, Radon-Nikodym theorem, uniqueness of densities, Lebesgue densities, examples.

Module III: (10 hours)

Products of measurable spaces: Fubini's theorem, Product of a finite family of σ algebras, marginal distributions, independence of finite families of events, of random variables, independence and expectation.

Module IV: (15 hours)

Laws of large numbers: Convergence in measure, Almost sure convergence, Convergence in mean**,** uniqueness of limits, relation between modes of convergence, Weak law of large numbers (iid sequences), Strong law of large numbers(finite moments), Characteristic function, central limit theorem for iid sequence of random variables.

References:

1. Royden, H. L., "Real Analysis", Macmillan, 3rd Edn.,1988.
2. Stein E. M. and Shakarchi, R., "Real analysis: Measure Theory, Integration, and Hilbert Spaces", Princeton University Press, 2005.
3. Folland, G. B., "Real analysis: Modern Techniques and Their Applications", Wiley-Interscience, 2nd Edn., 1999.
4. Athreya S., and Sunder, V. S., "Measure and Probability", Universities Press, 2008.
5. Basu, A.K., "Measure Theory and Probability", Prentice – Hall of India, 2003.
6. Bhat, B.R., "Modern Probability Theory", Wiley Eastern, 2nd Edn., 1985.

MA 6224: GRAPH THEORY AND COMBINATORICS

(Pre-requisite: nil)

L	T	P	C
3	1	0	3

Total hours: 56

Module : I (14 hours)

Graphs: subgraphs, paths and cycles, isomorphism, cut vertex, bridge, block, bipartite graph, complement of a graph, line graph, Degree sequence, Trees, metric in graph, eccentricity , centre, median, centroid, Matrix representation of graph.

Module II (14 hours)

Connectivity : Vertex and Edge connectivity, Whiteney's theorem, n - connected graphs Mengers' theorem.
Traversability : Hamiltonian graphs : Ore's theorem, Posa's theorem, Other sufficient conditions for hamiltonicity, Euler graphs, Planar graphs, Euler formula, platonic bodies. Non planar graphs.

Module III (14 hours)

Graph Coloring , chromatic polynomials, The four color problem, The five color theorem.
Digraphs: Connectedness - Acyclic Digraph,Strong digraphs, Tournaments, Directed trees, binary trees, weighted trees and prefix codes, BFS, DFS, Kruskal's, Prim's, Dijkstra's & Floyd's algorithms.

Module IV (14 hours)
Generating functions, partitions of integers, the exponential generating function, the summation operator, recurrence relations, first order and second order nonhomogeneous recurrence relations, method of generating functions.

References:

1. Chartrand, G.and Zhang, P. " Introduction to Graph Theory", McGraw Hill International Edition, 2005.
2. Vasudev, C., "Graph Theory with Applications", New Age international publishers, 2006.
3. Grimaldi, R. P., "Discrete and Combinatorial Mathematics: An Applied Introduction". Addison Wesley, 1994.
4. Foulds, C. R., "Graph Theory Applications", Narosa Publishing House, 1994.
5. Harary. F, "Graph Theory", Addison Wesley, 1972.
6. Bollobas, B., "Modern Graph Theory", Springer Verlag, 2005.

MA 6225: ABSTRACT ALGEBRA

(Pre-requisite: nil)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (13 hours)

Groups- Binary operation, and its properties. Definition of a group, Examples and basic properties. Subgroups, Cosets and Lagrange's theorem. Cyclic groups and generators, Order of a group. Normal subgroups, Quotient group. Homomorphisms, Kernel and Image of a homomorphism, Isomorphisms and Automorphisms.

Module II: (14 hours)

Group Actions and Applications- Permutation groups, Cayley's theorem. Direct product of groups. Group action on a set, Semi-direct product. Sylow's theorems. Structure of finite abelian groups. Applications, Some nontrivial examples.

Module III: (14 hours)

Rings- Definition and Basic concepts in rings, Examples and basic properties. Zero divisors, Integral domains, Fields, Characteristic of a ring, Quotient field of an integral domain. Subrings, Ideals, Maximal ideal, Prime ideal, definition and examples. Quotient rings, Isomorphism theorems.

Module IV: (15 hours)

Fields- Ring of polynomials. Prime, Irreducible elements and their properties. Eisensteins irreducibility criterion and Gauss's lemma. UFD, PID and Euclidean domains. Ring of polynomials over a field. Field extensions. Algebraic and transcendental elements, Algebraic extensions. Splitting field of a polynomial. Algebraic closure of a field.

References:

1. Fraleigh J. B., "A First Course in Abstract Algebra", 7th Edn, Pearson Education, 1994.
2. Herstein. I. N., "Topics in Algebra", 2nd Edn, Wiley-Eastern, 1975.
3. Jacobson, N.; "Basic Algebra", Vol. 1&2, Hindustan Publishing company (India), 1984.
4. Gallian, J. A., Contemporary Abstract Algebra, D. C. Heath and Company (Lexington)1990.

MA 6226 COMPUTER PROGRAMMING II

(Pre-requisite: nil)

L	T	P	C
2	0	3	4

Total hours: 70

Module 1: (16 hours)

Binary search, linked list; single linked list, doubly linked list, circular linked list, linked list applications; polynomial addition, sparse matrices.

Module 2: (18 hours)

Stacks, queues, priority queues, binary tree, sorting; insertion sort, Shell sort, tree sort, quick sort and merge sort.

Module 3: (18 hours)

Introduction to scientific computing using Matlab; solving linear systems, solving nonlinear system, interpolations, curve fitting.

Module 4: (18 hours)

Numerical integration and differentiation, solving of ODEs; Euler's method, Runge-Kutta's methods, solving stiff and non-stiff ODEs.

References:

1. Aho,A. V., Ullman, J. D and Hopcroft, J. E.," Data Structures and Algorithms". Addison Wesley, 1983.
2. Cormen, T. H., Leiserson,C. E., Rivest, R. L.and Stein, C., "Introduction to Algorithms", McGraw-Hill, 2001.
3. Knuth, D. E., "The Art of Computer Programming", Volumes 1-3, Addison-Wesley Professional, 1998.
4. Chapman, S.J., "MATLAB Programming for Engineers", Brooks/Cole Publishers, Third Edition, 2004.
5. Palm, W.J.,III, "Introduction to MATLAB 7 for Engineers", McGraw Hill, 2005.
6. Rao, S.S., " Applied Numerical Methods for Engineers and Scientists", Prentice Hall, 2002.

MA 7201 PARTIAL DIFFERENTIAL EQUATIONS

(Pre-requisite: Differential Equations)

Total hours: 56

L	T	P	C
3	1	0	3

MODULE 1: (14 hours)

Partial differential equations of first order, Cauchy problem, Linear first order P.D.E., Method of characteristics, Lagrange, Charpit's and Jacobi's methods

MODULE II: (15hours)

P.D.E. of second order, Classification of second order equations, Hyperboloic, parabolic and Elliptic equations, Linear second order equations with constant coefficients.

MODULE III: (13 hours)

Parabolic differential equations, One dimensional diffusion equation, Method of separation of variables, Solutions in cylindrical and spherical equation, Maximum modulus principle.

MODULE IV(14 hours):

Hyperbolic differential equations, One dimensional wave equation, Parabolic solution of one dimensional wave equation, Forced vibrations, Solution of non-homogeneous equations, Boundary and initial value problem of two dimensional wave equation

References:

1. Sneddon, I., "Elements of Partial Differential Equations", McGraw Hill International, 1972.
2. Greenspan D., "Introduction to Partial differential Equations", TMH Edition, 1961.
3. Kreyszig, E.,"Advanced Engineering Mathematics", John Wiley and Sons, 1995.
4. Rao. K. S., "Intorduction to partial differential equations", Prentice Hall of India. Pvt. Ltd.
5. Tychonov and Samarski; "Partial differential equations of Mathematical physics", Hoyden- Day Inc.

MA 7202 FUNCTIONAL ANALYSIS

(Pre-requisite: Linear Algebra and Real Analysis)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (17hours)

Linear spaces and linear maps, Metric spaces and continuous functions, l^p spaces, convergence and completeness, L^p spaces; Holder's inequality, Minkowski's inequality, Fundamentals of Normed linear spaces, Riesz-Fischer theorem, continuity of linear maps, bounded linear maps, Hahn-Banach theorems, Banach spaces, Embedding of a normed linear space in its second conjugate space, Uniform boundedness principle, Closed graph and Open mapping theorems, Spectrum of a bounded operator.

Module II: (15 hours)

Linear functionals, Duals and transposes, Duals of $L^p\lfloor a,b \rfloor$ and $C[a,b]$, Weak and Weak* convergence, Reflexivity and examples. Banach algebra and its properties, spectrum.

Module III: (14 hours)

Inner product spaces, Orthonormal sets, Bessel's inequality, Approximation and optimization, Projection and Riesz representation theorem.

Module IV: (10 hours)

Bounded operators and adjoints, Normal, Unitary and self-adjoint operators, Spectrum and Numerical range.

<u>**References**</u>**:**

1. Limaye, B.V., "Functional Analysis" 2nd Edn, New Age Publishers, 2006.
2. Kreyszig, E., "Introductory Functional Analysis with applications", Wiley Eastern, 1989.
3. Rudin, W., "Functional Analysis", 2nd Edn, Tata McGraw - Hill edn.,2006.
4. Conway. J. B., "A course in Functional Analysis", 2nd Edn, Springer, 1990.
5. Douglas, R. G., "Banach Algebra Techniques in Operator Theory", Academic Press, 1972.

MA 7203 STATISTICAL METHODS

(Pre-requisite: Measure and Probability)

L	T	P	C
3	1	0	3

Total hours: 56

Module I: (14 hours)

Probability distributions:- Random variables, Mean and variance of a probability distribution, Chebyshev's theorem, Discrete probability distributions-Binomial distribution, Hyper- geometric distribution, Poisson distribution, Geometric distribution. Continuous probability distributions- Normal Distribution, Uniform distribution, Gamma distribution, Beta distribution, Chi-Square distributions, Weibull distribution.

Module II: (14 hours)

Sampling distributions and Inference concerning means:- Population and samples, The sampling distribution of the mean (□ known and □ unknown), Sampling distribution of the variance, Point estimation and interval estimation, Tests of hypothesis, Hypothesis concerning one mean, Inference concerning two means, paired t- test, Computer applications.

Module III: (14 hours)

Inference concerning variances proportions:- Estimation of variances , Hypothesis concerning one variance, Hypothesis concerning two variances , Estimation of proportions, Hypothesis concerning one proportion , Hypothesis concerning two proportions, Hypothesis concerning several proportions, Analysis of r x c tables, Chi – square test for goodness of fit. Computer applications

Module IV: (14 hours)

Regression Analysis:- Curve fitting, Method of least squares, Simple linear regression, Curvilinear regression, Correlation. Multiple regression, multiple correlation coefficient, partial correlation coefficient. Computer Applications

Analysis of variance:- General principles, Completely randomized designs, Randomized block diagram, Latin square designs, Analysis of covariance. Computer applications

References:

1. Johnson R. A., "Miller & Freund's Probability and Statistics for Engineers", 6^{th} Edn, PHI , (2004) New Delhi.
2. Hines W. H, Montgomery, et. al., "Probability and Statistics for Engineering", John Wiley & Sons, Inc., 2003.
3. Milton J. S. and Arnold J. C., "Introduction to Probability and Statistics", 4^{th} Edn, Tata Mcgraw-Hill, 2003.
4. S.M. Ross, "Introduction to Probability and statistics for Engineers", 3^{rd} Edn, Academic Press(Elsevier), Delhi, 2005.

MA 7204 METHODS OF APPLIED MATHEMATICS

(Pre-requisite: Ordinary Differential Equations with computational Methods)

Total hours: 56

L	T	P	C
3	1	0	3

Module I: (14 hours)

Integral Transforms- The Fourier Integral as the Limit of a Fourier Series – Fourier Integral Approximations and the Gibbs Phenomenon – Properties of Fourier Transforms – Applications of Fourier Integrals and Transforms – From the Fourier Integral to the Laplace Transformation – Finite Fourier Transforms – Finite Fourier sine and cosine transforms – Convolution theorem for finite Fourier transforms – Multiple finite Fourier transforms – Applications of finite Fourier transforms.

Module II: (14 hours)
Integral equations**-** Introduction –Types of Integral Equations-Solution of Integral Equations- Relation between differential and integral equations – Green's functions – Fredholm equations with separable Kernels – Iterative Methods for the solution of Integral Equations of the second kind – Resolvent Kernel - Hilbert Schmidt theory.

Module III: (14 hours)
Tensor Analysis**-** Space on n-dimensional – coordinate transformations – contravariant, covariant and metric tensors – Fundamental operation with Tensors – quotient law – The line element and metric tensors – Conjugate Tensor – Christofell symbols – Covariant differentiation of tensors.

Module IV : (14 hours)
Calculus of variation- Introduction – The method of variations in problems with fixed boundaries – Variation of a functional – Euler's equation – The fundamental lemma of the calculus of variation – functionals involving derivatives of higher order – functionals depending on functions of several independent variables, variational problems of constrained extrema – Rayleigh-Ritz method.

References:

1. Wylie C. R., & Barrett , L. C., "Advanced Engineering Mathematics", 6th Edn, McGraw-Hill, Inc., 1995.
2. Sneddon, I. N., "The Use of Integral Transforms", McGraw Hill, 1972.
3. Hilderbrand F. B., "Methods of Applied Mathematics", Prentice Hall of India, 1961.
4. Pogorzelski W., "Integral Equations and their Applications", PWN-Polish Scientific Publishers, 1900.
5. Spain B., "Tensor Calculus", Oliver and Boyd, London, 1988.
6. Sokolnikoff L. S., "Tensor Analysis", John – Wiley and Sons, 1951.
7. Andrews L. C., & Philips R. L., "Mathematical Techniques for Engineers and Scientists", Prentice Hall of India, 2005.
8. Riley, K.F., Hofson M.P. & Bence, S.J., "Mathematical methods for Physics and Engineering" , Cambridge University Press , 1998.
9. Elsgolc, L. E., "Calculus of Variations", Pergamon Press Ltd., 1961.
10. Wienstock, R., "Calculus of variations", McGraw Hill Book Company, 1994.

MA 7291SEMINAR

(Pre-requisite: nil)

L	T	P	C
0	0	0	1

The student will be assigned with suitable topics for seminar of one hour duration

MA 7295 PROJECT

(Pre-requisite: nil)

L	T	P	C
0	0	0	10

Student will be assigned with a suitable project work in the institute or in a reputed R&D institution.