

**DEPARTMENT OF MATHEMATICS
UNIVERSITY OF PESHAWAR**



SYLLABUS FOR M.SC (PREVIOUS & FINAL) MATHEMATICS

**For Session 2004-05
(2005 Annual Examination)
And
Onwards**

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M.Sc. Previous Courses.

<i>Paper-I</i>	<i>Real Analysis</i>
<i>Paper-II</i>	<i>Algebra-I</i>
<i>Paper-III</i>	<i>Complex Analysis</i>
<i>Paper-IV</i>	<i>Topology</i>
<i>Paper-V</i>	<i>Computer Algebra System & Programming in MATLAB</i>

Paper-I Real Analysis.

Real number system and extended real number system. Convergence of sequences, sub-sequences, Cauchy sequences and completeness.

Continuous functions and their properties, discontinuity, monotonic functions, Differentiation. Mean value theorems. Definition and existence of the integral, the integral as a limit of sum, integration and differentiation. Uniform convergence and uniform continuity, term by term differentiation and integration. Functions of several variables, linear transformations, differentiation, inverse function theorem, implicit function theorem, Jacobians, maxima and minima. Improper integrals. Test for convergence of infinite series and infinite integrals.

Recommended Books.

1. *Walter Rudin, Introduction to Mathematical Analysis*
2. *Apostol Mathematical Analysis, Addison Wesley 1978.*
3. *E.G.Phillips, A Course of Analysis.*
4. *Kaplan W., Advance Calculus, Addison Wesley 1965.*

Paper-II: Algebra-I

Definition of a group, order of a group and order of an element of a group, Cyclic groups, Subgroups, Product of Subgroups.

Cosets and coset decomposition of groups, Lagrange's Theorem and its consequences, Normal Subgroups, Quotient groups, Concept of Normalizers and Centralizers, Center of group, Commutator and derived group.

Homomorphism of groups, Kernel of Homomorphism, concept of an Isomorphism in groups, Isomorphism between cyclic groups.

Permutation, groups of permutation, Cyclic Permutations, Even and Odd permutations, The Symmetric and Alternating groups, Cayley's theorem.

Vector Spaces

Concept of a Vector Space with Examples, Subspaces, Linear combinations, Internal and external direct sums, Bases and dimension of Vector Spaces, Quotient spaces and their dimensions.

Linear Transformations, Nullity and rank of linear transformation, Singular and Invertible linear transformations, Algebra of linear transformations, Minimal Polynomials of linear transformations. Matrix of a Linear Transformation, Eigenvalues and Eigenvectors of Linear Transformation and Matrices, Diagonalization, Inner product spaces and linear functionals.

Recommended Books:

1. *Herstein I.N. Topics in Algebra, Addison Wesley, 1980.*
2. *Mac Lane & Birkhoff, Algebra, McMillan N.Y., 1967.*
3. *P.M. Cohn, Algebra Vol-I, John Willey & Sons `1974.*
4. *Karamat Hussain, 1st step to Abstract Algebra, Feroz Sons (Pvt) Ltd Lahore 1998.*
5. *Fundamentals of Abstract Algebra, D.S. Malik, John N.Mordeson, M.K. Sen. The MC Graw-Hill Company, New York.*

Paper-III Complex Analysis

Analytic Function.

Function of a Complex variable, Limits, Theorems on Limits. Continuity, Differentiation, Cauchy-Riemann conditions, Sufficient conditions, Analytic functions, Harmonic functions. L.Hospital's Rule. Singular points and their types.

Elementary Functions.

The Exponential function, Trigonometric functions, Logarithmic functions, Branches, Complex exponents. Inverse Trigonometric functions.

Integrals.

Definite Integrals, Contours, Line Integrals, Simply and Multiply connected regions, Cauchy Integral theorem, Cauchy-Goursat theorem for the case of triangle, closed polygon, simple closed curve and Multiply connected region, Indefinite Integrals, Cauchy Integral formula, Derivatives of analytic functions, Morera's theorem, Cauchy inequality, Liouville's theorem, fundamental theorem of Algebra, Maximum and Minimum modulus theorems, Rouché's theorem.

Power Series.

Taylor's Series, Laurent's Series, Properties of Series, Uniform convergence, Integration and Differentiation of Power Series, Uniqueness of representations by Power Series. Multiplication and Division of Series. Zeros of analytic functions.

Residues and Poles.

Residues, Residue theorem, poles, quotients of analytic functions, Cauchy principal value of integrals, Evaluation of improper real integrals, Improper integrals involving Trigonometric functions, Definite integral of Trigonometric functions, Integration around a branch point.

Mapping by Elementary Functions.

Linear functions, The function z^n , The function $1/z$, the point at infinity. The linear fractional Transformation, special Linear fractional Transformations, The function $z^{1/2}$, The transformation $w=e^z$, The Transformation $w=\sin z$.

Recommended Books.

1. Ruel V-Churchill, *Complex Variable and Applications McGraw-Hil*, 1960, 7th Ed., 2009
2. Erwin Kreszig, *Advance Engineering Mathematics (John Wiley and Sons)*. 10thEd. 2010.
3. Whitaker, E.T. & Watson, C.N., *A Course of Modern Analysis. Cambridge University Press.*
4. L.L. Pennisi, *Elements of Complex Variables, Holt Rinehart & Winstone N.Y. 1st Ed .1963.*

Paper-IV: General Topology

Topological spaces: Review of Basic Concepts, Bases and Sub-bases, local bases, Continuous Maps, Open and Closed Maps, Homeomorphism, Induced Topology, Topological Product, Hausdorff Spaces, Regular Spaces, Completely Regular Spaces, Normal Spaces, Metric spaces, Continuity in metric space, Properties of Metric Spaces,

Metrizability, Compact spaces, Open Cover, Finite Intersection Property, Locally Compact Spaces, Compactness in Metric Spaces.

Connected Spaces, Topological Product of Connected Spaces, Locally Connected Spaces, Pathwise and Arcwise Connected Spaces.

Complete Metric Spaces, Concept of Category and Bair's Category theorem.

Recommended Books:

1. J.R. Munkres, *Topology (A first course) Prentice Hall Inc. 2000.*
2. K. D. Joshi, *Introduction to General Topology (Revised), Wiley Eastern,Ltd.*
3. S.Willards, *General Topology, Addison Wesley N.Y. 1970.*
4. A. Majeed, *Elements of Topology and Functional Analysis, Ilmi Kitab Khana Lahore, 1990.*
5. O. Ya Viro. O.A. Ivanov et. Al *Elementary Topology Problem textbook*
6. S. A. Morris *Topology without tears, version 2007.*

Paper-V: Computer Algebra System (CAS) & Programming

Computer Applications: Introduction to computer and operating system Windows/linux, basic architecture of computer system, software and its types, healthy computing concepts on virus, basics of Word processing (Latex), Excel, Power Point and Excess. Introduction to Computer programming C++.

Computer Algebra System (Maple/Mathematica): Numerical Calculations, Exact and approximate results, Complex Numbers, Algebraic calculations, Limits, Differentiation, Integration, Sums and Products, Solving equations, Solving ordinary and partial differential equations, Power series, Integral Transforms, Numerical Solutions (sums, products,

differentiation, integration, solving equations, solving differential equations), Defining functions, Vectors and Matrices, Two and Three dimensional Graphics, Parametric and Density Plots, Polar plots.

Programming in MATLAB: Introduction to MATLAB windows, built in functions, arrays, matrices, script files, plots, functions and function files, loops, selection statements, polynomials, curve fitting and interpolation.

Recommended Books

1. *Martha L. Abell, James P. Braselton, Mathematica by Examples, Third Edition, Elsevier Academic Press, 2004.*
2. *Stephen Wolfram, Mathematica, 5th Edition, Wolfram Media, 2003.*
3. *John S. Devitt, Calculus with Maple V, Brooks/Cole, 1993.*
4. *Rudra Partap, Getting started with MATLAB 7, Oxford University Press, 2006.*
5. *Etter, D.M., Kuncicky, D. and Hull, D., Introduction to MATLAB 6, Prentice Hall, Englewood Cliffs, NJ, USA, 2001.*
6. *Timothy J. O’Leary, Linda I. O’Leary, Computing Essentials, 15th Edition, McGraw-Hill’s Primis Custom Publishing, 2004.*
7. *Robert Lafore, Turbo C++, 2nd Edition, SAMS Publishing, 1997.*

Theory Marks : 60
Practical Marks: 40

M.Sc. (FINAL) MATHEMATICS:

Any five of the following:

<i>Paper-VI</i>	<i>Algebra-II</i>
<i>Paper-VII</i>	<i>Electromagnetic Theory</i>
<i>Paper-VIII</i>	<i>Functional Analysis</i>
<i>Paper-IX</i>	<i>Mathematical Statistics</i>
<i>Paper-X</i>	<i>Differential Geometry</i>
<i>Paper-XI</i>	<i>Numerical Analysis</i>
<i>Paper-XII</i>	<i>Number Theory</i>
<i>Paper-XIII</i>	<i>Measure Theory and Integrations</i>
<i>Paper-XIV</i>	<i>Dynamics</i>
<i>Paper-XV</i>	<i>Fluid Mechanics</i>
<i>Paper-XVI</i>	<i>Optimization Theory</i>
<i>Paper-XVII</i>	<i>Differential Equations</i>

Paper-VI: Algebra-II

Isomorphism theorems, Conjugacy classes, Centralizers and Normalizers, Generating systems for finite symmetric and Alternating groups.

Endomorphism and Automorphism of a group, Characteristic and Fully Invariant subgroups, direct Product of groups, Sylow theory and its Applications, Simple groups, Simplicity of A_n for $n \geq 5$, Zassenhaus lemma, Normal

series, Composition series, Jordan Holder theorem, Solvable groups, The derived series of a group, The lower and upper Central series of a group and Nilpotent groups.

Recommended Books:

1. *John. B Fraleigh, A first Course in Abstract Algebra, Addison-Wesley Pub Co. London (1980).*
2. *M. Hall, Theory of groups, The MacMillan Company N.Y. (1959).*
3. *Lan D McDonald, The theory of groups, Oxford University Press (1975).*
4. *Rose. T, A Course of group theory, Cambridge University Press (1978).*
5. *A. Majeed, Theory of groups, Ilmi Kitab Khana, Lahore (1994).*

Paper-VII Electromagnetic Theory.

The Electromagnetic Law of force, potential and fields for several charges. Equipotential and lines of force, conductors, capacity, Gauss's flux theorem. Mechanical force on a charged surface and on a conductor, electrostatics potential energy of a system of charges, energy of a system of conductors, dielectrics, simple examples of fields in two or three dimensions.

The magneto static law of force, magnetic doublets, magnetic shells, forces on magnetic doublets, magnetic induction, electric currents, linear conductors, conductivity, resistances, Kirchoff's laws, maximum energy theorem, effects produced by resistance of voltmeters, ammeters heat production, current density vector, magnetic field of straight and circular currents, magnetic field and energy law of electromagnetic induction, current of A.C.

Maxwell's equations in free space and in material media and their solution in simple cases. Electromagnetic waves, reflection, refraction and polarization.

Recommended Books:

1. *Ferrero, Electromagnetic Theory, ELBS London, 1950.*
2. *A.S. Ramsey, Electricity and Magnetism, Cambridge University Press, 1952.*
3. *Lorrain & Corson, Electromagnetic Fields and Waves, Tappn company Ltd, 1970.*
4. *C.A. Coulson, Electricity, Linear and Boyd Edinburgh, 1951.*
5. *J. R. Reitz, F.L. Milford and Christy, Foundation of Electromagnetic Theory.*

Paper-VIII: Functional Analysis

* Normed Linear Spaces, Bounded Linear Operators, Finite Dimensional Normed Linear Spaces, The Holder and Minkowski Inequalities.

* Banach Spaces, Quotient Spaces, Conjugate Spaces, The Hahn-Banach Theorem for Normed Linear Spaces, The Principle of Uniform Boundedness, The Open Mapping Theorem and The Closed Graph Theorem and Their Applications.

** Hilbert Spaces and related results, Orthogonal and Orthonormal Sets, Orthogonal Complements in Hilbert Spaces and properties, The Conjugate Spaces, The Adjoint of an Operator, Self-adjoint Operators, Invariant Subspaces, Normal and Unitary Operators, Projections.

** The Definition of Spectrum of an Operator and Some Examples, Spectral Properties of Self-adjoint Operators, The Spectral Mapping Theorem for Finite Dimensional Hilbert Spaces.

Recommended Books:

- 1*. *A.E. Taylor and D.C. Lay, Introduction to Functional Analysis, John Wiley & Sons, 1980.*
- 2**. *G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book company, 1963.*
3. *E.Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, 1978.*
4. *W. Rudin, Functional Analysis, Tata McGraw Hill Publishing Company, 1970.*
5. *Abdul Majeed, Elements of Topology and Functional Analysis, Ilmi Kitab Khana, 1997.*

Paper-IX Mathematical Statistics.

Probability: Random Experiment. Sample Space. Events. σ -Fields of Events. Classical, Relative frequency definitions of Probability and Kolmogorov axiomatic definition of Probability and its consequences. Conditional Probability and independence of events. Bayes theorem of Probability.

Random Variables: Cumulative Distribution Function, Probability density function. Expectations and Moments. Moment Generating functions. Factorial Moment Generating Functions. Cumulants and cumulant Generating functions. Skewness and Kurtosis.

Discrete Distributions: Discrete Uniform Distribution. Bernoulli and Binomial Distributions. Hypergeometric Distribution. Poisson Distribution. Geometric and Negative Binomial Distributions.

Continuous Distributions: Uniform or Rectangular Distribution. Normal Distribution. Exponential Gamma and Chi-square Distributions. Beta Distribution. Cauchy Distribution.

Joint Distribution Functions: Cumulative Distribution function. Joint density functions for Discrete and continuous Random Variables. Independent Random Variables. Covariance and correlation coefficient. Sample Correlation coefficient. Rank correlation. Bivariate Normal Distribution. Marginal and conditional Densities. Fitting of curves up to second degree parabolas.

Simple, Multiple linear Regression and Correlation: Least Squares Estimates in Simple and Multiple linear Regression. Standard error of estimate. Coefficient of Determination and Multiple Determination. Multiple correlation. Subscript Notation. Properties of Residuals. Partial Correlation. Relation between multiple and Partial Correlation coefficient.

Recommended Books.

1. Freund and Walpole *Mathematical Statistics (3rd Ed.)* Prentice-Hall, Inc. N.J. (1980)
2. Rohatgi, V.K. *An Introduction to Probability Theory and Mathematical Statistics.* MacMillan Publishing Co, Inc. N.Y. (1976).
3. Mood, Graybill and Boes. *Introduction to the Theory of Statistics (3rd Ed.)* McGraw-Hill Publishing Company (1974)
4. Roussas, G.G. *A First Course in Mathematical Statistics.* Addison Wesley Publishing Company (1973).
5. Hogg, R.V. and Craig, A.T. *Introduction to Mathematical Statistics (4th Ed.)* Mac-Millan Publishing Co. Inc. New York (1978).

Paper-X Differential Geometry

Space Curve. The Moving trihedral Curvature. Torsion and skew curvature. Serret-Frenet Formulae. Osculating circle and sphere. Curves of constant slope or cylindrical helices. The spherical indicatrices and their curvature and torsion. Concepts of surface. Tangent plane. Envelopes and characteristics relating to one parameter family of surfaces. Edge of regression. Developable surfaces and developables associated with a space curve. Parametric curves. Two fundamental forms. Meusnier's theorem. Principal directions and principal curvature. Lines of curvatures, Euler's theorem. Geodesics and Geodesic Equations.

Recommended Books:

1. Weatherburn. C.E., *Differential Geometry of three Dimensions*, Cambridge University press, 1961
2. Struik. D.J., *Lecture on Classical Differential Geometry*, Addison Wesley Publishing Co. Landon, 1962
3. Wilmore. T.J., *An Introduction to Differential Geometry*, Clarendon Press, Oxford.
4. Millen & Parker; *Elements of Differential Geometry*, Prentice Hall, 1977.
5. B.O' Neill, *Elementary Differential Geometry*, Academic Press

Paper-XI **Numerical Analysis**

Error Analysis: Errors and their sources. Approximate numbers and significant digits. Absolute, Relative and percentage Errors. Effect of Rounding Errors in Arithmetic Operations. Errors of Powers and Roots. Errors in Function Evaluation.

Finite Differences: Difference operators (Forward, Backward, Central, Average and Shift) and their relationship. Factorial functions and polynomials. Difference tables.

Interpolation: Lagrange interpolation. Newton's Forward formula. Newton's Backward formula. Central-Difference formulae. Divided differences. Newton's divided difference formula. Aitken's formula. Inverse interpolation. Hermit interpolation. Cubic spline interpolation.

Difference Equations: Formation of difference equations. Order of a difference equation. Linear homogeneous difference equations. Linear inhomogeneous difference equations. Numerical solution of linear (Homogeneous and inhomogeneous) difference equations with constant co-efficients.

Numerical Integration: The Trapezoidal rule with error Term. Simpson's 1/3 rule with error Term. Composite Trapezoidal rule. Composite Simpson's rule. Romberg integration. Method of undetermined co-efficients.

Solution of Non-Linear Equations in one Variable: The Bisection Method. Fixed-point iteration. The Newton-Raphson Method. The secant Method. The Method of False position. Rate of convergence of iterative Methods.

Solution of Linear System of Equations: Jacobi Iteration method. Gauss-Seidel Iteration Method. Successive over Relaxation (SOR) Method.

Recommended Books

1. *Richard L. Burden and J. Douglas Faires, Numerical Analysis, Brooks/Cole Publishing Company, 2000.*
2. *C.E. Froberg, Introduction to Numerical Analysis, Addison-Wesley Co., 1974.*
3. *M.K.Jain, Numerical Methods for Scientific and Engg. Computation, Wiley Eastern Limited, 1993.*
4. *Dr. Faiz Ahmed and M. Afzal Rana, Elements of Numerical Analysis, National Book Foundation, 1995.*

Paper-XII **Number Theory**

Analytic Number Theory: Division and Division algorithm, different bases G.C.D. and L.C.M. of integers, the equation $ax + by = h$, primes. Fundamental theorem of arithmetic and its applications.

Congruences. Elementary properties. Residue classes and Euler's Φ function. Linear congruences and congruences of higher degree, congruences with prime moduli, The theorems of Fermat, Euler and Wilson.

Primitive roots and indices. Integers belonging to a given exponent. Composite moduli. Indices.

Quadratic Residues. Composite moduli, Legendre Symbol. Law of Quadratic reciprocity. The Jacobi Symbol.

Number Theoretic Functions. Mobius Function. The function $[x]$, Symbols O and \sim and their basic properties.

Diophantine Equations and Fermat's conjecture for $N=2$, $N=4$.

Algebraic Number Theory: Algebraic Number and integers. Units and primes $R(v)$ Ideals.

Arithmetic of Ideals, Congruences. The norm of a prime Ideal. Unit of Algebraic number field.

Applications to Rational Number Theory. Equivalence and class number Cyclotomic field K . Fermat's equations. Kummer's theorem. The equation $x^2 + 2 = y^3$. Pure cubic fields. Distribution of primes and Riemann zeta function. The prime Number Theorem.

Recommended Books:

1. LeVeque. W.J., *Topics in Number Theory, Vol: I & II, Addison-Wesley Publishing Company.*
2. Grosswald, E., *Topics from the theory of Numbers, The McMillan Company, New York.*
3. Hardy & Wright, *Number Theory, Clarendon Press, Oxford.*
4. *The Theory of Algebraic Numbers, John Wiley.*

Paper-XIII Measure Theory & Integration.

Foundation of Analysis. A development of Integral, rational, real and complex number system from the Peano axioms. Denumerable and non-denumerable sets, cardinal and ordinal numbers, partially ordered sets and totally ordered sets, well-ordered sets, Transfinite induction, axiom of choice and well-ordering theorem.

Theory of set of points, covering theorems, theory of measure. Measurable functions, the Lebesgue Integral Convergence theorems, the fundamental theorem of the integral calculus, derivative, non-differentiable functions, functions of bounded variation and absolutely continuous functions, the Lebesgue set, the Lebesgue classes \mathcal{O}^p . Strong convergence, Simple treatment of Riemann-Stieltjes and Lebesgue-Stieltjes integrals.

Recommended Books.

1. H.I. Royden, *Real Analysis, The McMillan Co, 1968.*
2. Natanson, *Theory of Functions of Real Variables.*
3. Burkill, *Lebesgue Integral.*
4. Titchmarsh, *Theory of Functions.*
5. Edmond Landau, *Foundation of the Analysis.*
6. Seymour Lipschutz, *Set Theory and Related Topics.*

Paper-XIV Dynamics.

Dynamics of a Rigid Body: Moments and product of inertia. D' Alembert's principle. Motion about a fixed axis. Linear Momentum and Kinetic energy of a rigid body. Compound pendulum. Motion in two dimension, Finite forces; impulsive forces. Lagrange's equations in generalized coordinates.

Dynamics of a Particle: Uniplanar motion, acceleration parallel to fixed axes, polar coordinates, moving axes, central forces, stability of orbits, acceleration varying as the inverse square of the distance, Kepler's laws. Planetary motions. Tangential and Normal accelerations. Motion in a resisting medium. Angular momentum and rate of change of angular momentum for a system of particles.

Recommended Books.

1. S.L. Loney, *Dynamics of a particle and Rigid Bodies*
2. F.Charlton, *A Text Book of Dynamics, Ellis Horwood Ltd, 1983.*
3. L.A.Pars, *Introduction to Dynamics, Cambridge University Press, 1953.*
4. A.S.Ramsey, *Dynamics Part-I, Cambridge University Press, 1962.*

Paper-XV Fluid Mechanics.

Introduction, fundamental concepts, fluid statics, basic equations in integral form for a control volume, introduction to differential analysis of fluid motion, incompressible inviscid flow, dimensional analysis and similitude, internal incompressible viscous flow, external incompressible viscous flow, flow in open channels, introduction to compressible flows, steady one-dimensional compressible flow, introduction to turbulent flows.

Recommended Book:

1. Fox, R.W. and McDonald, A.T., *Introduction to Fluid Mechanics, 5th Edition*, John Wiley & Son, 2006.
2. White, F.M., *Fluid Mechanics, 5th Ed*, McGraw-Hill, 2003.
3. Nazir Ahmad, *Mechanics of Fluids, 4e*, McGraw-Hill, 2003.

Paper-XVI Optimization Theory.

Linear programming, simplex method, duality theory, dual and primal-dual simplex methods, unconstrained optimization, optimality conditions, one-dimensional problems, multi-dimensional problems, basic descent methods, conjugate direction methods, Quasi-Newton methods, constrained optimization with equality constraints, optimality conditions, Lagrange multipliers, Hessians and bordered Hessians, inequality constraints and the Kuhn-Tucker theorem, primal methods, penalty and barrier methods, Lagrange methods, the calculus of variations, the Euler-Lagrange equations, functionals depending on several variables, variational problems in parametric form.

Recommended Books:

1. Gotfried, B.S. and Weisman, J., *Introduction to Optimization Theory*, Prentice Hall, Englewood Cliffs, NJ, USA, 1973.
2. Luenberger, D.G., *Introduction to Linear and Non-Linear Programming*, Addison-Wesley, Reading, Ma, USA, 1973.
3. Fletcher, R., *Practical Methods of Optimization*, (2nd edition), John Wiley and Sons, 2000.
4. Elsgolts, L.E., *Differential Equations and the Calculus of Variations*, Mir Publishers, Moscow, 1970.

Paper-XVII Differential Equations.

Ordinary Differential Equations: Introduction, formation, solution and applications of first-order-differential equations, formation and solution of higher-order-linear-differential equations, differential equations with variable coefficients, Sturm-Liouville (S-L) system and boundary-value problems, series solution and its limitations, the Frobenius method, solution of Bessel, hypergeometric, Legendre and Hermite equations, properties of Bessel, Legendre and Hermite functions.

Partial Differential Equations: First-order-partial-differential equations, classification of second-order PDE, canonical form for second-order equations, wave, heat and Laplace equation in Cartesian, cylindrical and spherical-polar coordinates, solution of partial differential equation by the methods of separation of variables, Fourier, Laplace and Hankel transforms, non-homogeneous-partial-differential equations.

Recommended Books:

1. Zill, D.G. and Cullen, M.R., *Differential Equations with Boundary-Value Problems*, (7th edition), Book Cole Publishing Co., 2008.

2. *Myint, U.T., Partial Differential Equations for Scientists and Engineers (3rd edition), Prentice Hall, 1987.*
3. *Giordano, F.R. and Weir, M.D., Differential Equations: A Modeling Approach, Addison- Wesley, Reading, Ma, USA,1991.*
4. *Jerri, A.J., Introduction to Integral Equations with Applications, (2nd edition), Marcel Dekker, New York, 2008.*