Math 201 **COMPLEX ANALYSIS**

Unit-I

Functions of Complex Variables, Limit and Continuity Differentiability, Power Series as an Analytic Function, Exponential and Trigonometric Functions, Complex Logarithms, Zeros of Analytic Functions.

Unit-II

Complex Integration, Curves in the Complex Plane , Basic Properties of Complex Integral, Winding Number of a Curve, Cauchy – Goursat Theorem, Cauchy's Integral formula, Morera's Theorem, Laurent's Series.

Unit-III

Maximum Modulus Principle, Schwarz Lemma, Bilinear Transformations, Mobius Transformation, Cross Ratio, Fixed Point, Conformal Mapping Liouville's theorem.

Unit-IV

Isolated and Non-isolated Singularities, Removable Singularty, Poles, Singularty at Infinity , Calculus of Residues, Residue at Finite Point, Residue at the Point at Infinity, Residue Theorem, Number of Zeros and Poles, Rouche's Theorem, Hurwitz's Theorem.

Unit-V

Evaluation of certain Integrals, Integrals of Type $\int_{\alpha}^{2\pi+\alpha} R(\cos\theta, \sin\theta)d\theta$, Integrals of Type $\int_{-\infty}^{\infty} f(x)dx$, Integrals of Type $\int_{-\infty}^{\infty} g(x)\cos mx\,dx$, Singularities on Real Axis

Text Book:

1. Foundation of Complex Analysis by S. Ponnusamy, Narosa Publishing House, 1997.

Reference Books:

1. . Introduction to Complex Analysis by H.A. Priestly, Clarendon Press, Oxford, 1990.
2. Function of one Complex Variable by J.B. Conway, Springer-Verlag. International student-Edition, Narosa Publishing House, 1980.
3. Complex Analysis by L.V. Ahlfors, McGraw-Hill, 1979.
1. Real and Complex Analysis by Walter Rudin, McGraw-Hill Book Co., 1966

Math 202 **DIFFERENTIAL EQUATIONS**

Unit-1.

Preliminaries-Initial value problem and the equivalent integral equation, System of first order ordinary differential equations, concepts of local existence, Existence and uniqueness of solutions of scalar differential Equations, Peano's existence theorem and corollary for scalar case, system of differential Equations, Ascoli-Arzela theorem (Statement only) , Picard-Lindelof theorem, Peano's existence theorem and corollary for vector case.

Unit- 2

Differential Inequalities and integral inequalities –Gronwall's inequality, Maximal and Minimal solutions, differential inequalities, Lower and upper function.

Unit- 3

Linear systems of differential equation, characteristic polynomials eigen values, eigen vectors, linear homogenous systems and their properties, wronskian, fundamental matrix, Abel-Liouville formula, periodic linear system and Floquet's theorem, Inhomogeous linear systems and variation of constants formula.

Unit- 4

Poincare- Bendixson Theory –Autonomous systems, Poincare-Bendixson theorem (statement only), Stability of periodic solutions, foci, nodes and saddle points. Automomous system of ordinary differential equations, Phase Plane, critical points, Stability, Critical Points and Stability of linear systems. Stability by Liapunov's direct method, Lyapunov functions.

Unit-5

Bifurcation of Fixed Points of Ordinary differential Equation, A Zero Eigenvalue; Examples, What is a "Bifurcation of a Fixed Point",The saddle –Node Bifurcation, The Transcritical Bifurcation, The Pitchfork Bifurcation,A Pure Imaginary Pair of eigenvalues.The Poincare- Andronov –Hopf Bifurcation.

Text Books:

1. Ordinary Differential Equations by M.Rama Mohan Rao, East-West Press.
2. Introduction to Applied Nonlinear Dynamical Systems and chaos by Stephen Wiggins, Springer, New York.

Reference Books:

1. Ordinary Differential Equations by P. Hartman, John wiley.
2. Theory of Ordinary Differential Equations by E.A.Coddington and DSN, Levinson, McGraw Hill, NY.
3. Differential Equations with Applications and Historical note by G.F.Simmons, Tata McGraw Hill.
4. Ordinary Differentions by W.T. Reid, John Wiley & Sons, NY.
5. Differential Equations and Dynamical Systems, by Lawrence Perko, Springer, Newyork.

FOR COLLEGE ONLY

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Math 302 **TOPOLOGY**

Unit-I

Topological Spaces: Definition and examples, Open Sets, Closed Sets, Closure neighborhoods, Interior, exterior and boundary, Limit points and derived sets, Basis and Sub basis, Alternate method of defining a topology in terms of Kuratowski Closure operator and Neighbourhood systems.

Unit-II

Continuous functions and homeomorphism, Countability, First and Second countable Spaces, Lindelof theorem, Separable Spaces, Second countability and Separability, The product and box topology.

Unit-III

Connected Spaces, Connected Sets in the real line, Components, Path components, local connectedness, Path connectedness, Local Path connectedness.

Unit-IV

Compact Spaces, Lebesgue number lemma, Uniform continuity theorem, Limit point compactness, Local compactness and sequential compactness, One point compactification.

Unit-V

Separation axioms, Hausdroff, Regular and Normal Spaces, The Urysohn lemma, Tietze extension theorem, The Uryshon metrization theorem, Completely regular spaces.

Text Books:

1. Topology A first course by James R Munkres, Prentice Hall of India, Pvt. Ltd. New Delhi 2000.
2. Introduction to Topology and Modern Analysis by G.F. Simonons McGraw Hill Book Co.

Reference Book :

1. General Topology by J.L. Kelley, Van Nostrand, Reinhold Co. New York.

Math 204 **NUMERICAL METHODS**

Unit-I

Solution of Algebraic Transcendental & Polynomial equations: Bisection method, Iteration method based on first-degree equation: Secant method, Regula-Falsi method, Newton-Raphson method, rate of convergence of Newton-Raphson method & Secant method.

Unit-II

System of linear algebraic equations: Gauss Elimination method, Gauss-Jordan Elimination method, Cholesky method. Iteration methods: Jacobi Iteration method, Gauss-Seidel method.

Unit-III

Interpolation & approximation finite difference operators, Newton's forward and backward interpolation, Central difference interpolation, Lagrange's interpolation, Newton Divided Difference interpolation, Hermite interpolation, Spline interpolation.

Unit-IV

Differentiation and integration: Numerical differentiation, Numerical integration, Newton-cotes formula, Trapezoidal rule, Simpson's one-third rule, Gauss-Legendre integration method, Lobatto integration method, Radau integration method.

Unit-V

Ordinary differential equations- Euler method, Backward Euler method, Midpoint method, Taylor Series method, Runge-Kutta methods, Predictor-Corrector methods.

Text Books:

1. Numerical method for Scientific & Engineering Computation by M.K. Jain & R. K. Iyengar & R.K. Jain-Wiley Eastern Ltd.
2. Numerical Method by S S Sastry.

Reference Book:

1. Numerical Methods by V.RajaRaman, PHI.