Gautam Buddha University
School of Vocational Studies and Applied Sciences
Mathematics Courses

Department of Applied Mathematics
B.Tech.+M.Tech./MBA
(Engineering/ICT/Biotechnology/Food Processing and Technology)

Session 2013-2014

Contents

B.Tech.+M.Tech./MBA (Engineering/ICT/Biotechnology/Food Processing and Technology)

MA 101 (Engineering Mathematics-I)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Limits, Continuity and differentiability of a function of single variable, Leibnitz theorem, Maxima and Minima and Point of Inflection. Taylor's series for a function of single variable.

Unit II
Limits, Continuity and differentiability of functions of several variables, Partial differentiation, Chain rule, Directional Derivatives and Gradient Vectors, Maxima and Minima and Saddle points, Lagrange's multiplier method. Taylor's series for a function of several variables, Jacobians.

Unit III
Cartesian Coordinate system, Curve Tracing in Cartesian Coordinates. Polar Coordinate, Curve Tracing in Polar Coordinates, Area and Length in Polar Coordinates.

Unit IV
Double and triple integrals, Change of order for double integral, Change of variables, Jacobian, Beta and Gamma functions, Applications of double and triple integral to area and volumes.

Unit V
Gradient, divergence and curl of a vector and their physical interpretations, Line, surface and volume integrals and its applications, Green's Theorem, Stoke's Theorem and Gauss divergence theorems(without proof).

Textbook

R. K. Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications.

Reference Books

[1] G. B. Thomas and R. L. Finney, *Calculus and Analytical Geometry*, Pearson Education Asia, 2000.

[2] E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 2005.

[3] P.V. O'Neil, *Advanced Engineering Mathematics*, Thomson (Cengage) Learning, 2007.

[4] J. Stewart, *Calculus*, Cengage Learning, Sixth Edition.

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MA 102 (Engineering Mathematics-II)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Matrices, Algebra of Matrices, Elementary row and column operations and row reduced echelon form Rank of a matrix, Normal Forms, Consistency of linear system of equations and their solutions,

Unit II
Finite dimensional vector spaces over reals, Subspace, Linear Dependence and Independence of vectors, Bais, Dimension. Characteristic equations and Characteristic Polynomial, Eigen values and Eigen vectors, Caley-Hamilton theorem, Diagonalisation.

Unit III
Algebra of Complex numbers, Polar form of complex numbers, Functions of complex variables, Limit, Continuity and Differentiability of Complex functions,

Unit IV
Analytic function, C-R equation, Harmonic functions, Line Integral in complex form, Cauchys integral theorem, Moreras Theorem, Cauchys integral formula: Cauchys Integral formula for derivatives of analytic functions, Liouvilles theorem, Fundamental Theorem of algebra (without proof)

Unit V
Taylors and Laurents Series, Singularities, Zeroes and Poles, Residue, Residue theorem, Evaluation of real integrals, Conformal mapping.

Textbook

R. K. Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications.

Reference Books

[1] E. Kreyszig, *Advanced Engineering Mathematics*. John Wiley and Sons, 2005.

[2] Churchill and Brown, Complex Variables and Applications, Tata MacGraw Hill, 1996

MA 103 (Mathematics for Biotechnology/Food Technology-I)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Sets and their representations, operations on sets, Cartesian product of sets, relations, functions, algebraic and transcendental function, Principle of Mathematical induction, Solution of quadratic equations. Permutation and Combination, Binomial Theorem.

Unit II
Straight Lines, slope of a line and angle between two lines, various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, two point forms, intercepts form and normal form, general equation of a line, distance of a point from a line. Introductory idea of Ellipse, Circle, parabola and Hyperbola.

Unit III
Trigonometric functions, positive and negative angles, Measuring angle in radians & in degree and conversion from one measure to another. Definition of trigonometric with the help of unit circle. Trigonometric identities. Complex numbers, algebraic properties of complex numbers, Argand plane and polar representation of complex numbers, Fundamental theorem of algebra.

Unit IV
Vectors and scalars, magnitude and direction of a vector, direction cosines (and ratios) of vectors, Types of vectors, position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar product of vectors, projection of a vector on a line, vector product of vectors.

Unit V
Matrices and determinants: definition of a matrix, various types of matrices, addition, subtraction, multiplication of matrices, inverse of matrix, determinant of matrices, expansion of determinant, properties of determinants, solution of linear system of equations, Cramer rule.

Textbook

Mathematics Part I and Part II - Textbook for Class XI and XII, NCERT.

Reference Books

[1] H.S. Hall and S.R. Knight, *Higher Algebra*. Arihant, 2010.

[2] B.V. Ramana, *Higher Engineering Mathematics*. Tata McGraw Hill Publishing.

MA 104 (Mathematics for Biotechnology/Food Technology-II)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Limit, continuity and differentiability of functions, Derivatives of elementary functions, rules of differentiation, Derivatives of polynomial and trigonometric functions, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function, logarithmic differentiation. Derivative of functions expressed in parametric forms, successive differentiation

Unit II
Successive differentiation, Leibnitz Theorem, Partial differentiation, Euler Theorem, Taylors series (Single Variable), Maxima and Minima (Single Variables),

Unit III
Integration as inverse process of differentiation, Integration of elementary functions, integration by substitution, by partial fractions and by parts, Fundamental theorem of calculus, Basic properties of definite integrals and evaluation of definite integrals, definite integral as limit of sum, Application to areas and curves

Unit IV
Definition of ordinary differential equations, order and degree, general and particular solutions of a differential equation, Formation of differential equation, solution of differential equations of first order and first degree: solution by method of separation of variables, homogeneous differential equations, linear differential equations, exact differential equations, Solution of second order differential equations with constant coefficients.

Unit V
Introduction to mathematical modeling, modeling of Simple elementary biological system, population growth model, exponential models, logarithmic models

Textbook

Mathematics Part I and Part II - Textbook for Class XI and XII, NCERT.

Reference Books

[1] B.V. Ramana, *Higher Engineering Mathematics*. Tata McGraw Hill Publishing.

[2] G. B. Thomas and R. L. Finney, *Calculus and Analytical Geometry*, Pearson Education.

[3] J. N. Kapoor, *Mathematical Modeling*, New Age International.

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MA 201 (Engineering Mathematics-III)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Definition of differential equation (linear/nonlinear) with examples, order and degree of the differential equation, types of solutions of differential equations, methods of solution, variables separable method, exact differential equations, integrating factors of first order differential equation of the type $M(x,y)dx + N(x,y)dy = 0$, Bernoulli equations, Riccati differential equation, Picard existence and uniqueness theorem for $dy/dx = f(x,y)$ (without proof)

Unit II
Linear differential equations of nth order with constant coefficients, solutions of homogeneous and non-homogeneous linear differential equations, complementary functions and particular integrals, simultaneous linear differential equations, Euler -Cauchy linear differential equations, method of variation of parameters, applications to engineering problems (Motion of a particle in resisting medium, simple harmonic motion, electric circuit problem).

Unit III
Existence theorem for Laplace transform, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function, Dirac delta function, Laplace transform of periodic functions, Convolution theorem, Application to solve linear and simultaneous differential equations.

Unit IV
Periodic functions, Trigonometric series, Fourier series of period 2π, Euler's formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine Fourier series,

Unit V
PDEs and its Applications: Linear partial differential equations with constant coefficients. Classifications of 2nd order PDE. Method of separation of variables for solving partial differential equations, Its applications to solve Heat conduction equation, Wave equation, steady state heat equation (Laplace equation) through Fourier series.

Textbook

R. K. Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications.

Reference Books

[1] G.F. Simmons, *Differential Equations*. Tata Mc Graw-Hill Publishing Company Ltd., 1981.

[2] E. Kreyszig, *Advanced Engineering Mathematics*. John Wiley and Sons, 2005.

[3] W.E. Boyce and R.C. DiPrima, *Elementary differential equations and Boundary Value Problems*. John Wiley and Sons, 8th Edition, 2010.

MA 202 (Quantitative Techniques)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Zeroes of transcendental and polynomials, Bisection method, Regular-falsi method and Newton-Raphson method, Secant Method, Rate of convergence of above methods, Error Analysis.

Unit II
Interpolation, Finite differences, difference tables, Newtons forward and backward interpolation, Divided differences, Lagranges and Newtons divided difference formula for unequal intervals. Numerical differentiation, Numerical integration, Newton-Cote quadrature formula, Trapezoidal, Simpsons one third and three-eight rules.

Unit III
Solution of system of linear equations, Gauss- Seidal method, Gauss-Jordan Method, Crout method, Jacobi Iteration method. Numerical Solutions of Ordinary Differential Equations and Partial Differential Equations: Picard's Method, Euler's Method, Modified Euler's Method, Runge-Kutta. Numerical solutions of parabolic and elliptic partial differential equations, Introduction to finite element method

Unit IV
Probability, Conditional Probability, Bay's Theorem, Random varaiable, Probability density function, Binomial distributions, Poisson distributions and Normal distributions,

Unit V
Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves, Correlation, Regression analysis: Linear, Nonlinear and multiple. Sampling theory, Tests of significations: Chi-square test, t-test, Analysis of variance (one way), Time series and forecasting, Statistical quality control methods, Control charts, R, p, np, and c charts. Introduction to Stochastic process

Textbook

E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 2005.

Reference Books

[1] E. Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 2005.

[2] R. S. Gupta, *Elements of Numerical Analysis*, Macmillan, 2009

[3] R. A. Johnson *Miller & Freund's Probability and Statistics for Engineerings* Prearson, 2001

MA 203 (Quantative Techniques in Biotechnology)   **Credit (L-T-P) : 4 (3- 1- 0)**

Unit I
Frequency Distribution, Graphic representation of a frequency distribution, Measures of Central tendency, Moments, moment generating functions, Central Moments, Non- Central Moments, Measures of Dispersion, Measures of Skewness, Measures of Kurtosis

Unit II
Curve fitting, Method of Least squares, Fitting of Straight lines, Polynomials, Exponential Curves, Linear Correlation, Correlation Coefficient, Properties of Correlation Coefficient, Rank Correlation Coefficient, Regression Analysis: Linear & Non linear. Time series and forecasting.

Unit III
Introduction, Experiments, Outcomes, Events, Definition of Probability, Conditional Probability, Independent Events, Total Probability, Bayes Theorem.

Unit IV
Random Variable, Discrete Random Variable, Probability Function, Continuous Random Variable, Probability Density Function, Discrete Distributions, Continuous Distributions, Mathematical Expectation, properties of Expectation, Two Dimensional Random Variables, Joint Probability Density Functions, Marginal Probability Distribution, Conditional Probability Distribution.

Unit V
Binomial Distribution, Poisson Distribution, Normal Distribution Sampling theory, Tests of significations, Chi-square test, t-test, Analysis of variance (one way), Statistical quality control methods, Control charts, R, p, np, and c charts.

Textbook

J. N. Kapoor, Mathematical Statistics, S. Chand Publication, 2004.

Reference Books

[1] V. K Rohatgi, An Introduction to Probability Theory and Mathematical Statistics, John Wiely & Sons 1976.

[2] Marylees Miller, John E. Freund, Irwin Miller, Mathematical Statistics: With Applications, Prentice Hall 2003.