PROGRAM OUTCOME
&
COURSE OUTCOME
(ARTS)
DEPARTMENT OF MATHEMATICS
RADHA GOVINDA BARUAH COLLEGE

FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP)
SUBJECT: MATHEMATICS

Program Outcomes

PO-1: Introduce students to the fundamental tools of complex numbers, the theory of equations, matrices, and matrix methods for solving homogeneous linear equations involving up to four variables.

PO-2: Equip students with a comprehensive understanding of calculus as the "Mathematics of Change," enabling them to apply its principles to analyze and solve problems involving dynamic relationships between variables.

PO-3: Introduce students to the study of differential equations and their various solution methods, fostering a deeper understanding of their applications.

PO-4: Develop a rigorous understanding of the real line R and the concepts of convergence and divergence in sequences and series of real numbers.

PO-5: Provide students with a deep understanding of the complex plane and its related concepts, including differentiability of complex functions, Cauchy-Riemann equations, contour integrals, and the Cauchy-Goursat theorem.

PO-6: Introduce students to the basic tools of two-dimensional and three-dimensional coordinate systems, and familiarize them with the use of vector algebra in coordinate geometry.

PO-7: Develop students' understanding of integers, emphasizing their properties, representations, and number-theoretic analysis.

Course Outcomes

SEMESTER: I
MAT010104: Classical Algebra

CO-1: Employ De Moivre's theorem in number of applications to solve numerical problems.

CO-2: Learn the basic concepts of exponential, logarithmic and hyperbolic functions of complex numbers.

CO-3: Learn how to find the nature of the roots of a given polynomial equation by Descartes' rule, also learn about symmetric functions of the roots for cubic and biquadratic equations. Also, learn how to solve cubic and biquadratic equations.

CO-4: Recognize consistent and inconsistent systems of linear equations by row echelon form of the augmented matrix. Finding inverse and rank of a matrix.

SEMESTER: II
MAT020104: Calculus

CO-1: Understand continuity and differentiability in terms of limits.

CO-2: Describe asymptotic behavior in terms of limits involving infinity.

CO-3: Understand the importance of mean value theorems.

SEMESTER: III
MAT030104: Ordinary Differential Equations

CO-1: Learn basics of 1st order ordinarydifferential equations and 2nd order linear differential equations.

CO-2: Learn different techniques for solving thedifferential equations.

SEMESTER: IV
MAT040104: Real Analysis

CO-1: Understand many properties of the real line$\mathbb{R}$ such as completeness and Archimedean properties.

CO-2: Understand the definition of real sequences.

CO-3: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.

CO-4: Applylimit comparison tests for convergence, ratio, root, Raabe's, integral tests for convergence of an infinite series of real numbers.

CO-5: Learn alternating series, absolute convergence and conditional convergence of an infinite series of real numbers.

MAT040204: Complex Analysis (with practical)

CO-1: Learn the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.

CO-2: Learn some elementary functions and valuate the contour integrals.

CO-3: Understand the role of Cauchy-Goursat theorem and the Cauchy integral formula.

MAT040304: Analytical Geometry

CO-1: Learn about transform of coordinate systems.

CO-2: Learn about pair of straight lines.

CO-3: Have a clear understanding of the conic sections and relatedproperties.

CO-4: Recognize three dimensional surfaces represented by equations of the second degree.

CO-5: Learn two different systems of coordinates which are very useful to define the position of a point in space.

CO-6: Acquire basic concepts of Vector Algebra and understand the use of geometric view of vectors in Coordinate Geometry.

MAT040404: Number Theory

CO-1: Explain division algorithm, Euclid's algorithms and greatest common divisor.

CO-2: Explain the concepts of convergences and linear convergences.

CO-3: Explore the Chinese Remainder Theorem to solve simultaneous linear congruence.

CO-4: Explain Fermat's theorem and Wilson's theorem.

CO-5: Solve a range of problems in number theory.

CO-6: Apply mathematical ideas and concepts within the context of number theory.

CO-7: Communicate number theoretic techniques to a mathematical audience.

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SEMESTER-V

MAT-HC-5016: Complex Analysis (including practical)
CO-1: Learn the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
CO-2: Learn some elementary functions and valuate the contour integrals.
CO-3: Understand the role of Cauchy-Goursat theorem and Cauchy integral formula.
CO-4: Expand some simple functions as their Taylor and Laurent series, classifythe nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

MAT-HE-5016: Number Theory
CO-1: Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc.
CO-2: Know about number theoretic functions and modular arithmetic.
CO-3: Solve linear, quadratic and system of linear congruence equations.

MAT-HE-5026: Mechanics
CO-1: Know about the concepts in statics such as moments, couples, equilibrium in both two and three dimensions.
CO-2: Understand the theory behind friction and center of gravity.
CO-3: Know about conservation of mechanical energy and work-energy equations.
CO-4: Learn about translational and rotational motion of rigid bodies.

MAT-HE-5036: Probability and Statistics
CO-1: Learn about probability density and moment generating functions.
CO-2: Know about various univariate distributions such as Bernoulli, Binomial, Poisson, gamma and exponential distributions.
CO-3: Learn about distributions to study the joint behavior of two random variables.
CO-4: Measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
CO-5: Understand central limit theorem, which helps to understand the remarkable fact that**:** the empirical frequencies of so many natural populations, exhibit a bell-shaped curve, i.e., a normal distribution

MAT-HC-5026: Linear Algebra
CO-1: Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
CO-2: Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation.
CO-3: Compute the characteristic polynomial, eigenvalues, eigenvectors and eigenspaces as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
CO-4: Compute inner products and determine orthogonality on vector spaces, including Gram-Schmidt orthogonalization to obtain orthonormal basis.
CO-5: Find the adjoint, normal, unitary and orthogonal operators.

MAT-HE-5046: Linear Programming
CO-1: Learn about the graphical solution of linear programming problem with two variables.
CO-2: Learn about the relation between basic feasible solutions and extreme points.

CO-3: Understand the theory of the simplex method used to solve linear programming problems.
CO-4: Learn about two-phase and big-M methods to deal with problems involving artificial variables.
CO-5: Learn about the relationships between the primal and dual problems.
CO-6: Solve transportation and assignment problems.
CO-7: Apply linear programming method to solve two-person zero-sum game problems.

MAT-HE-5056: Spherical Trigonometry and Astronomy
CO-1: Learn about the properties of spherical and polar triangles
CO-2: Know about fundamental formulae of spherical triangles
CO-3: Learn about the celestial sphere, circumpolar star, rate of change of zenith distance and azimuth
CO-4: Learn about Kepler's law of planetary motion, Cassini's hypothesis, differential equations or fraction

MAT-HE-5066: Programming in C (including practical)
CO-1: Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving.
CO-2: Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples.
CO-3: Use of containers and templates in various applications in algebra.
CO-4: Use mathematical libraries for computational objectives.
CO-5: Represent the outputs of programs visually in terms of well formatted text and plots.
CO-6: In practical students learn about the roots of a quadratic equation, solution of an equation using N-R algorithm, sin(x), cos(x) with the help of functions

SEMESTER-VI

MAT-HC-6016: Riemann Integration and Metric Spaces
CO-1: Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.
CO-2: Know about improper integrals including, beta and gamma functions.
CO-3: Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
CO-4: Analyze how a theory advances from a particular frame to a general frame.
CO-5: Appreciate the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting.
CO-6: Know about Banach fixed point theorem, whose far-reaching consequences have resulted into an independent branch of study in analysis, known as fixed point theory.
CO-7: Learn about the two important topological properties, namely connectedness and compactness of metric spaces.

MAT-HE-6016: Boolean Algebra and Automata Theory
CO-1: learn about the order isomorphism, Hasse diagrams, building new ordered set.
CO-2: learn about the algebraic structure lattices, properties of modular and distributive lattices.
CO-3: get ideas about the Boolean algebra, switching circuits and applications of switching circuits.
CO-4: Appreciate the theory of automata and its applications

MAT-HE-6026: Bio-Mathematics
CO-1: Learn the development, analysis and interpretation of bio-mathematical models.
CO-2: Learn about the mathematics behind different bio-mathematical models
CO-3: Solve basic application-oriented mathematical problems in real life situation. Students also would be able to develop problem solving skills useful in future study.

MAT-HE-6036: Mathematical Modelling (including practical)
CO-1: Know about power series solution of a differential equation and learn about Legendre's and Bessel's equations.
CO-2: Use of Laplace transform and inverse transform for solving initial value problems.
CO-3: Learn about various models such as Monte Carlo simulation models, queuing models, and linear programming models.

MAT-HE-6046: Hydromechanics
CO-1: Know about Pressure equation, rotating fluids.
CO-2: learn about Fluid pressure on plane surfaces, resultant pressure on curved surfaces, Gas law, mixture of gases
CO-3: learn about the Eulerian and Lagrangian method.
CO-4: learn about equation of continuity, examples, acceleration of a fluid at a point

MAT-HC-6026: Partial Differential Equations (including practical)
CO-1: Formulate, classify and transform first order PDEs into canonical form.
CO-2: Learn about method of characteristics and separation of variables to solve first order PDE's.
CO-3: Classify and solve second order linear PDE's.
CO-4: Learn about Cauchy problem for second order PDE and homogeneous and non-homogeneous wave equations.
CO-5: Apply the method of separation of variables for solving many well-known second order PDEs.

MAT-HE-6056: Rigid Dynamics
CO-1: Know about find the moments and products of inertia.
CO-2: learn about the motion of the center of inertia.
CO-3: learn about the D'Alembert's principle and Lagrange's equations.
CO-4: learn about motion of a body in 2-dimension.

MAT-HE-6066: Group Theory II
CO-1: Learn about automorphisms for constructing new groups from the given group.
CO-2: Learn about the fact that external direct product applies to data security and electric circuits.
CO-3: Understand fundamental theorem of finite abelian groups.
CO-4: Be familiar with group actions and conjugacy in S_n.
CO-5: Understand Sylow's theorems and their applications.

MAT-HE-6076: Mathematical Finance
CO-1: Know the basics of financial markets and derivatives including options and futures.
CO-2: Learn about pricing and hedging of options, as well as interest rate swaps.
CO-3: Learn about no-arbitrage pricing concept and types of options.
CO-4: Learn stochastic analysis (Ito formula, Ito integration) and the Black−Scholes model.

CO-5: Understand the concepts of trading strategies and valuation of currency swaps.

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FOUR YEAR UNDERGRADUATE PROGRAMME(B.COM)
MATHEMATICS/STATISTICS

PROGRAMME OUTCOMES
(Based on 'Business Mathematics' & 'Business Statistics' Courses)

PO-1:Develop the ability to apply a wide range of mathematical and statistical techniques to solve complex business challenges, enabling them to analyze data, forecast trends, and make strategic decisions that drive business success in areas such as finance, marketing, and operations.

PO-2:Develop proficiency in using data analysis, probability models, and financial calculations to extract actionable insights, optimize resources, and enhance business performance.

COURSE OUTCOMES

SEMESTER: I
COURSE NAME: BUSINESS MATHEMATICS(Multi-Disciplinary)
COURSE CODE: MDC010403
CREDIT: 3

CO-1: Apply business mathematics concepts such as linear and quadratic equations, time and work problems, profit/loss calculations, ratio and proportion, and the analysis of shares in solving real-world business and commerce problems.

CO-2: Analyze and calculate simple and compound interest, present and future values of annuities, and understand the application of depreciation and sinking funds in business finance.

CO-3: Utilize matrix operations, determinants, and Cramer's Rule to solve systems of linear equations in business applications, enhancing decision-making processes in business analysis.

CO-4: Apply differential calculus concepts such as limits, derivatives, and partial differentiation to analyze business functions, including maximizing profit, minimizing cost, and conducting marginal analysis for business decision-making.

CO-5: Use integral calculus to solve problems involving area under curves and marginal analysis, with a focus on business applications, including cost and revenue analysis.

CO-6: Formulate and solve linear programming problems (LPP) using graphical methods to optimize business operations, including resource allocation and cost minimization.

SEMESTER: III
COURSE NAME: BUSINESS STATISTICS (Multi-Disciplinary)
COURSE CODE: MDC030403
CREDIT: 3

CO-1: Understand the classification of data and apply various measures of central tendency, variation, skewness, and kurtosis to describe data distributions.

CO-2: Comprehend probability theory, calculate event probabilities, and explore key probability distributions, including Binomial, Poisson, and Normal distributions.

CO-3: Analyze relationships between variables through correlation and regression techniques, understanding the principles of least squares and the connection between correlation and regression coefficients.
CO-4: Grasp the concepts of sampling methods, sampling distributions, point and interval estimation, and hypothesis testing techniques, including errors and significance levels.

CO-5: Analyze time series data, identify trends, and apply methods like least squares and moving averages to model and forecast time-based patterns.

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