PROGRAMME AND COURSE OUTCOMES

(FYUGP)

OF

DEPARTMENT OF MATHEMATICS

S. B. DEORAH COLLEGE

ULUBARI GUWAHATI-07

Course Outcomes of B.Sc./ B.Sc. (Honours)/ B.Sc (Honours) with Research

Subject: Mathematics

Semester	Course Category	Paper Code and Course Name	Outcomes
1st	Major/ Minor	MAT0100104 Classical Algebra	This course will enable the students to: CO1: Apply De Moivre's theorem to solve numerical problems in various applications. CO2: Demonstrate a comprehensive understanding of polar representation and roots of complex numbers. CO3: Explain and apply the basic concepts of exponential, logarithmic, and hyperbolic functions of complex numbers and also solve problems related to these functions and understand their properties. CO4: Apply Descartes' rule to determine the nature of roots of a given polynomial equation. CO5: Solve cubic and biquadratic equations using Cardan's and Euler's methods. CO6: Perform operations on matrices, including addition, transposition, symmetry, and multiplication. CO7: Determine the inverse and rank of matrices, and recognize their properties. CO8: Apply the row echelon form to identify consistent and inconsistent systems of linear equations. Solve systems of homogeneous linear equations with up to four variables.
1st	SEC	SEC0108303 Quantitative Aptitude and Reasoning	This course will enable the students to: CO1: Build analytical skills through the study of quantitative aptitude and develop logical reasoning thinking abilities through exercises and problems. Solve quantitative and reasoning problems efficiently. CO2: Demonstrate proficiency in number systems, ages, averages, time, and calendar concepts. Apply knowledge in ratios and proportions, profit and loss, simple and compound interest. CO3: Solve practical problem-solving questions related to age, speed and distance, averages, family tree, ratios and proportions, coding-decoding, time and calendar, simple interest, compound interest, profit and loss, seating arrangement, inductive reasoning, deductive reasoning,

			directions, alphanumeric series. CO4: Interpret and handle data effectively using diagrams and charts.
2nd	**Major/ Minor**	**MAT0200104** **Calculus**	This course will enable the students to: CO1: Understand and apply different approaches to the concept of limits. CO2: Demonstrate knowledge of the continuity of a function and its properties. Apply the Intermediate Value Theorem to analyse continuous functions. CO3: Define differentiability and apply it to functions. CO4: Understand and apply Leibnitz theorem. Explore successive differentiation and recursion formulae for higher derivatives. CO5: Derive and illustrate reduction formulae for various integral types, including $\int \sin^n x\,dx, \int cos^n x\,dx, \int tan^n xdx, \int sec^n x\,dx, \int (logx)^n d$ $\int \sin^n x \cos^m xdx$ CO6: Understand and apply Rolle's theorem, Lagrange's mean value theorem, and their geometrical interpretations. Explore Maclaurin and Taylor polynomials, including sigma notations. Apply Taylor's formula with remainder and introduction of Maclaurin and Taylor series. CO7: Understand functions of two or more variables. CO8: Apply partial differentiation up to the second order.

Course Outcomes of B.Sc./ B.Sc. (Honours)/ B.Sc (Honours) with Research			
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3rd	**Major/Minor**	**MAT0300104** **Ordinary Differential Equations**	This course will enable the students to: CO1: Grasp the fundamental concepts of ordinary differential equations, including their classification, origins, and applications. CO2: Become proficient in solving first-order ordinary differential equations using various techniques such as exact equations, integrating factors, and reduction of order methods. CO3: Achieve a deep understanding of second-order linear differential equations, particularly those with constant coefficients. Solve both homogeneous and non-homogeneous equations using method of undetermined coefficients and method of variation of parameters. CO4: Apply differential equations to model real-world problems, recognizing their significance in various scientific and engineering disciplines. CO5: Understand the concept of Wronskian and its properties, which are crucial for analyzing systems of linear differential equations and determining linear dependence/independence of solutions. CO6: Learn about the Cauchy-Euler equations and their applications in solving differential equations with variable coefficients.
4th	**Major/Minor**	**MAT0400104** **Real Analysis**	This course will enable the students to: CO1: Develop a comprehensive understanding of the real line $\mathbb{R}$, including its algebraic and order properties, absolute value, bounded sets, supremum, infimum, completeness property, Archimedean property, density theorem, intervals, nested interval theorem, and uncountability. CO2: Define sequences in terms of functions from $\mathbb{N}$ to a subset of $\mathbb{R}$. They will recognize and analyze various properties of sequences such as boundedness, convergence, divergence, Cauchy sequences, monotonic sequences, and subsequences. CO3: Learn about the limit of a sequence and understand the concepts of limit superior, limit inferior, and how to calculate the limit of a bounded sequence. CO4: Be proficient in determining convergence and

			divergence of infinite series. They will apply various tests including the comparison test, limit comparison test, ratio test, root test, integral test, Raabe's test, and the Cauchy criterion for convergence. CO5: Understand absolute convergence, alternating series, and the conditions under which series exhibit conditional (non- absolute) convergence. CO6: Be familiar with important theorems and criteria related to sequences and series, such as the monotone convergence theorem, Bolzano-Weierstrass theorem for sequences, Cauchy's convergence criterion, Leibniz test, rearrangement theorem, and properties of divergent sequences.
4th	**Major/Minor**	**MAT0400204** **Complex Analysis**	This course will enable the students to: CO1: Develop a deep understanding of the complex plane and various related concepts including functions of complex variables, mappings, limits, continuity, derivatives, and polar co-ordinates. CO2: Learn the significance of differentiability of complex functions, leading to an understanding of the Cauchy-Riemann equations and their applications. CO3: Grasp the concepts of analytic functions, harmonic functions, and their properties, including zeros, singularities, and derivatives. To understand the behavior of elementary functions such as exponential, logarithmic, and trigonometric functions in the complex plane. CO4: Learn about contours, contour integrals, antiderivatives, and upper bounds for the moduli of contour integrals. CO5: Understand the importance of the Cauchy-Goursat theorem, the Cauchy integral formula, and their applications in complex analysis. CO6: Be able to differentiate between simply connected and multiply connected domains and understand their implications in complex analysis. CO7: Have laboratory works by using software like MATLAB, Mathematica, or Maple, students will gain practical experience in modeling and analyzing complex functions, performing calculations involving complex numbers, and visualizing complex functions and contours.
4th	**Major/Minor**	**MAT0400304**	This course will enable the students to:

		Analytical Geometry	CO1: Develop an understanding of coordinate transformations and invariants under orthogonal transformations. CO2: Gain knowledge about pairs of straight lines and their properties. CO3: Acquire knowledge about conic sections including parabolas, ellipses, and hyperbolas, along with their properties such as tangent, normal, and asymptotes. CO4: Understand general conics, conditions of tangency, pole and polar, and reduction to standard forms. CO5: Recognize quadric surfaces such as spheres, cylinders, and cones. CO6: Understand cylindrical and spherical polar coordinates. CO7: Understand rectangular coordinates in 3-space and the geometric interpretation of vectors. CO8: Learn about vectors in co- ordinate systems, including dot product, cross product, and their geometrical properties. CO9: Apply vectors in coordinate systems to determine vectors by length and angle, triple product, and parametric equations of lines in 2-space and 3- space.
4th	**Major/Minor**	**MAT0400404 Number Theory**	This course will enable the students to: CO1: Explain fundamental concepts such as the division algorithm, Euclid's algorithm, and the greatest common divisor. CO2: Understand and apply the principles of congruences, linear congruences. CO3: Understand congruence modulo of a fixed positive integer and its basic properties. Explore binary and decimal representations of integers and apply them in solving linear congruences. CO4: Explore the Chinese Remainder Theorem to solve simultaneous linear congruences. CO5: Explore and comprehend number theoretic principles such as Fermat's theorem and Wilson's theorem. CO6: Understand various number theoretic functions including the sum and number of divisors of a positive integer, multiplicative functions, and the Mobius function. CO7: Apply the Mobius inversion Formula and understand the properties of the greatest integer function. Utilize Euler's Theorem and understand properties of Euler's Phi function.