CBCS SYLLABUS

FOR

THREE YEARS UNDER-GRADUATE COURSE

in

B. Sc. Mathematics (HONOURS)

(*w.e.f. A.Y. 2022-2023*)

BANKURA UNIVERSITY

BANKURA

WEST BENGAL

PIN 722155

STRUCTURE IN MATHEMATICS (HONOURS)

SEMESTER –I

Course Code	Course Title	Credit	Marks			No. of Hours		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SH/MTH/ 101/C-1	Calculus, Geometry & Vector Analysis	06	10	40	50	05	01	00
SH/MTH/ 102/C-2	Algebra	06	10	40	50	05	01	00
SH/MTH/ 103/GE-1	Calculus, Geometry & Vector Analysis	06	10	40	50	05	01	00
ACSHP/104/ AECC-1	Environmental Studies	04	10	40	50	03	01	00
Total in Semester - I		**22**	**40**	**160**	**200**	**18**	**04**	**00**

SEMESTER –II

Course Code	Course Title	Credit	Marks			No. of Hours		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SH/MTH/ 201/C-3	Real Analysis	06	10	40	50	05	01	00
SH/MTH/ 202/C-4	Group Theory-I	06	10	40	50	05	01	00
SH/MTH/ 203/GE-2	Algebra	06	10	40	50	05	01	00
ACSHP/204/ AECC-2	English/Hindi/MIL	02	10	40	50	01	01	00
Total in Semester - II		**20**	**40**	**160**	**200**	**16**	**04**	**00**

SEMESTER –III

Course Code	Course Title	Credit	Marks			No. of Hours		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SH/MTH/ 301/C-5	Theory of Real Functions	06	10	40	50	05	01	00
SH/MTH/ 302/C-6	Ring Theory & Linear Algebra-I	06	10	40	50	05	01	00
SH/MTH/ 303/C-7	ODE & Multivariate Calculus-I	06	10	40	50	05	01	00
SH/MTH/ 304/GE-3	Real Analysis	06	10	40	50	05	01	00
SH/MTH/ 305/ SEC-1	**Any one of the following** • Mathematical Logic • Programming Using C	04	10	40	50	03	01	00
Total in Semester - III		**28**	**50**	**200**	**250**	**23**	**05**	**00**

SEMESTER –IV

Course Code	Course Title	Credit	Marks			No. of Hours		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
SH/MTH/ 401/C-8	Riemann Integration and Series of Functions	06	10	40	50	05	01	00
SH/MTH/ 402/C-9	PDE & Multivariate Calculus-II	06	10	40	50	05	01	00
SH/MTH/ 403/C-10	Mechanics	06	10	40	50	05	01	00
SH/MTH/ 04/GE-4	ODE & Multivariate Calculus-I	06	10	40	50	05	01	00
SH/MTH/ 405/ SEC-2	**Any one of the following** • Graph Theory • Operating System: Linux	04	10	40	50	03	01	00
	• Programming Using C-Practical	04	10	40	50	01	01	04
Total in Semester - IV		**28**	**50**	**200**	**250**	**23**	**05**	**04**

2.2 Core T2-Algebra

Algebra	
	6 Credits
Course Objectives: The main objective of this course is to give a deep insight of the roots of real and complex polynomials and learn various methods of obtaining roots. Employ De Moivre's theorem in a number of applications and able to knowledge to solve the system of linear equations.	
Course Specific Outcomes: After completion of this course a student would recognize the idea of consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank. Also, they would be able to find out the eigenvalues and corresponding eigenvectors for a square matrix.	
Unit 1	
Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Theory of equations: Relation between roots and coefficients, Transformation of equation, Location of roots: Descartes rule of signs, Sturm's theorem, Cubic and biquadratic equation, Cardon's, Ferrai's and Euler's method. Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality.	
Unit 2	
Equivalence relations, partial order relation, poset, linear order relation. Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm. Prime numbers and their properties, Euclid's theorem. Congruence relation between integers. Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.	
Unit 3	
Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence.	
Unit 4	
Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspace of $\mathbb{R}^n$, dimension of subspaces of $\mathbb{R}^n$, Geometric significance of subspaces. Rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.	
Reference Books	

- T. Andreescu and D. Andrica, Complex Numbers from A to Z, Birkhauser, 2006.
- E.G. Goodaire and M.M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
- D.C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
- K.B. Dutta, Matrix and Linear Algebra. Prentice Hall India Pvt., Ltd., 2004.
- K. Hoffman and R. Kunze, Linear Algebra. 2nd Ed., Prentice Hall India Pvt., Ltd., 2015
- W.S. Burnstine and A.W. Panton, Theory of Equations. 7th Ed. Hodges, Figgis and Company, 1924

2.3 Core T3–Real Analysis

Real Analysis	
	6 Credits
Course Objectives: This course will enable the students to i) understand many properties of the real line $\mathbb{R}$ and learn to define sequences in terms of functions from $\mathbb{N}$ to a subset of $\mathbb{R}$. ii) recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence. iii) recognize the series, properties of series and different test for convergence of series.	
Course Specific Outcomes: The student acquires deep learning of real analysis starting with ε-δ concepts and acquires the knowledge of series and sequences which are very much important for basic starting of this course.	
Unit 1	
Review of Algebraic and Order Properties of $\mathbb{R}$, Intervals, ε-neighbourhood of a point in $\mathbb{R}$, Idea of countable sets, uncountable sets and uncountability of $\mathbb{R}$. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, Completeness Property of $\mathbb{R}$ and its equivalent properties, The Archimedean Property, Density of Rational (and Irrational) numbers in $\mathbb{R}$. Limit points of a set, Isolated points, Interior points, Open set, closed set, the union and intersection of open and closed sets, derived set, Dense sets with examples, Illustrations of Bolzano-Weierstrass theorem for sets, compact sets in $\mathbb{R}$, Heine-Borel Theorem.	
Unit 2	
Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, uniqueness of limit, Limit Theorems. Sandwich rule. Nested interval theorem, Monotone Sequences, Monotone Convergence Theorem. Subsequences, lim inf, lim sup, A bounded sequence $\{x_n\}$ is convergent if and only if lim sup x_n= lim inf x_n. Divergence Criteria. Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion. Cauchy's first and second limit theorems with applications.	