Government General Degree College, Dantan-II
District- Paschim Medinipur, West Bengal

DEPARTMENT OF MATHEMATICS

PROGRAMME OFFERED: B.Sc.(HONOURS) in MATHEMATICS

UNDER CBCS

Model Reference: Syllabus for Mathematics (Honours), Vidyasagar University, With effect 2017-2018

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The main components of this syllabus are as follows:

1. Core Course

2. Elective Course

3. Ability Enhancement Course

1. Core Course (CC)
A course that should compulsorily be studied by a candidate as a core requirement is termed as a core course.

2. Elective Course

2.1 Discipline Specific Elective (DSE) Course: A course, which may be offered by the main discipline/subject of study, is referred to as Discipline Specific Elective.

2.2 Generic Elective (GE) Course: An elective course, chosen generally from an unrelated discipline/subject of study with intention to seek an exposure, is called a Generic Elective Course.

3. Ability Enhancement Course (AEC)
The Ability Enhancement Course may be of two kinds:

3.1 Ability Enhancement Compulsory Course (AECC)

3.2 Skill Enhancement Course (SEC)
Details of Courses of B.A./B.Sc. (Honours) under CBCS

Course		Credit		Marks
1	Core Course (14 papers)	Theory + Practical 14×(4+2)=84	Theory + Tutorial 14x(5+1)=84	14x75=1050
2	Elective Course (8 Papers)			
	A.DSE(4 Papers)	4×(4+2)=24	4×(5+1)=24	4x75=300
	B.GE(4 Papers)	4×(4+2)=24	4×(5+1)=24	4x75=300
3	Ability Enhancement Course			
	A. AECC (2 Papers) AECC1 (ENVS) AECC2(English/MIL)	 4×1=4 2×1=2	 4×1=4 2×1=2	 100 50
	B. SEC(2 Papers)	2×2=4	2×2=4	2x50=100
	Total Credit:	142	142	**Total Marks=1900**

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Semester-wise Course Structures

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total Class hrs./ week	Marks	Credit
I	CC	CC01	Calculus, Geometry & Differential Equations	5:1:0	6	75	6
		CC02	Algebra	5:1:0	6	75	6
	AECC		English/Modern Indian Language	1:1:0	2	50	2
	GE		To be offered by other discipline.				6
II	CC	CC03	Real Analysis	5:1:0	6	75	6
		CC04	Differential Equations and Vector Calculus	5:1:0	6	75	6
	AECC		Environmental Studies	4:0:0	4	100	4
	GE		To be offered by other discipline				
III	CC	CC05	Theory of Real Functions & Introduction to Metric Spaces	5:1:0	6	75	6
		CC06	Group Theory-I	5:1:0	6	75	6
		CC07	Numerical Methods & Numerical Methods Lab	4:0:4	8	75 (50+25)	6
	Choose any one from the following courses for Skill Enhancement Courses (SECs).						
	SEC	SEC11	Object Oriented Programming in C++	1:1:0	2	50	2
		SEC12	Logic and Sets	1:1:0	2	50	2
	GE		To be offered by other discipline.				
IV	CC	CC08	Riemann Integration and Series of Functions	5:1:0	6	75	6
		CC09	Multivariate Calculus	5:1:0	6	75	6
		CC10	Ring Theory and Linear Algebra-I	5:1:0	6	75	6
	Choose any one from the following courses for Skill Enhancement Courses (SECs).						
	SEC	SEC21	Graph Theory	1:1:0	2	50	2
		SEC22	Operating	1:1:0	2	50	2

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			System(Linux				
		SEC23	Computer Graphics	1:1:0	2	50	2
	GE		To be offered by other discipline				
V	CC	CC11	Partial Differential Equations and Applications	5:1:0	6	75	6
		CC12	Mechanics-I	5:1:0	6	75	6
	Choose any one from the following courses for Discipline Specific Electives (DSECs).						
	DSE	DSE11	Linear Programming	5:1:0	6	75	6
		DSE12	Point Set Topology	5:1:0	6	75	6
		DSE13	Theory of equation	5:1:0	6	75	6
	Choose any one from the following courses for Discipline Specific Electives (DSECs).						
	DSE	DSE21	Probability & Statistics	5:1:0	6	75	6
		DSE22	Boolean Algebra and Automata Theory	5:1:0	6	75	6
		DSE23	Portfolio Optimization	5:1:0	6	75	6
VI	CC	CC13	Metric Spaces and Complex Analysis	5:1:0	6	75	6
		CC14	Ring Theory and Linear Algebra-II	5:1:0	6	75	6
	Choose any one from the following courses for Discipline Specific Electives (DSECs).						
	DSE	DSE31	Mechanics-II	5:1:0	6	75	6
		DSE32	Number Theory	5:1:0	6	75	6
		DSE33	Industrial Mathematics	5:1:0	6	75	6
	Choose any one from the following courses for Discipline Specific Electives (DSECs).						
	DSE	DSE41	Mathematical Modeling	5:1:0	6	75	6
		DSE42	Differential Geometry	5:1:0	6	75	6
		DSE43	Bio Mathematics	5:1:0	6	75	6

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PROGRAMME OUTCOME (PO):

PO1: Choice Based Credit System (CBCS) was introduced in the session 2017-2018

PO2: CBCS has brought a radical change in the undergraduate teaching and learning

PO3: A student gets ample scope to pursue his/her areas of interest

PO4: Besides Mathematics as core subject a student can choose tow elective courses of his/her choice as generic courses which help broaden his/her knowledge

PO5: In each semester students have to take 4/5 courses so that they can learn the subjects in a relaxed manner

PO6: Students have to take a compulsory course in Ehvironmental Science so that they become aware of the major environmental issues

PO7: Students' language skills are nurtured in a compulsory language course

PO8: The holistic approach of the programme Enables a student to acquire theoretical as well as practical knowledge in his/her area of interest and also makes him/her a responsible citizen

PROGRAMME SPECIFIC OUTCOME (PSO):

PSO1: Foundation in basic Mathematics namely Algebra, Geometry and Analysis and their applications in various fields of knowledge are the main focus of the programme

PSO2: Instil analytical thinking

PSO3: Appreciation of interconnections among different branches of Mathematics

PSO4: Strengthen theoretical understanding through problem solving

PSO5: Acquire sufficient knowledge for pursuing higher studies in mathematics as well as other branches of science

COURSE OUTCOME(C O):

SEMESTER-I		
Course	**Course Name**	**Course Outcome**
CC01	**Calculus, Geometry & Differential Equations**	CO1: Mainly recapitulation of what a student learnt in +2 level about each of the topics in this course CO2: Applications of Calculus in studying the properties of plane curves are shown through examples CO3: Study the properties of elementary plane curves in two dimensions and those of surfaces in three dimensions

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		CO4: Introductory knowledge in Ordinary Differential Equations CO5: Use of software for studying curves and surfaces and solutions of Differential Equations
CC02	**Algebra**	CO1: Introduction to Classical Algebra, Number Theory and Linear Algebra CO2: Understanding basics of Algebra of Complex Numbers, solutions of polynomial equations and inequalities each of which is required for future courses CO3: Foundational knowledge in Classical Number Theory giving stress on some important results which will be used in futures courses CO4: Elementary Knowledge in Linear Algebra is developed through problem solving and geometric interpretations of basic ideas
SEMESTER-II		
Course	**Course Name**	**Course Outcome**
CC03	**Real Analysis**	CO1: Thorough and rigorous study of Real analysis begins with this course CO2: Foundation of Real Number System CO3: Introductory knowledge in sequence of real numbers CO4: Introductory knowledge in series of real numbers giving special attention to convergence tests which are required for future

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		courses
CC04	Differential equation &Vector Calculus	CO1: Advancement of the previous course in Ordinary Differential Equations through theoretical aspects and applications of them CO2: Applications of Ordinary Differential equations in designing and solving problems in various branches of science CO3: Using software to demonstrate the solutions of the equations studied in the course CO4: Introductory course in Vector Calculus

SEMESTER-III

Course	Course Name	Course Outcome
CC05	**Theory of Real Functions & Introduction to Metric Spaces**	CO1: This, being a second course in Real Analysis, introduces Continuity, Differentiability and applications along with Taylor's Series CO2: Limits and Continuity are thoroughly studied giving sufficient knowledge of theoretical aspects and use them in problem solving CO3: Introduction to Uniform Continuity CO4: Enrich theoretical understanding of the concept of Derivative and its applications in the study of the geometric properties of curves CO5: Elaborate study of Taylor's series and Maclaurine's Series expansions of functions and their applications

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		CO6: As a beginning, Metric space is defined and examples of various metric spaces are given. Basic ideas in the topology of metric spaces are thoroughly discussed. Separable metric spaces are introduced
CC06	**Group Theory-I**	CO1: Introduction to Groups, Subgroups, Cyclic groups, External direct product and Group Homomorphism. CO2: Special emphasis is given on examples of some important finite groups CO3: In depth study of Permutation Groups CO4 Proving Number theoretic results using Group Theory CO5: The course culminates in proving the three Isomorphism Theorems and their applications
CC07	**Numerical Methods & Numerical Methods Lab**	CO1: Discussion of various approximation techniques CO2: Using the techniques in interpolations, differentiations, integrations, solutions of system of linear algebraic equations and differential equations CO3: Introduction of C programming CO4: Development of skills in writing algorithms in C CO5: Using the skills in solving numerical problems through writing programmes and running them on

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		computer
SEC1	**Logic and Sets**	CO1: Concept of mathematical reasoning is discussed. As an introductory course in logic, basic concepts like connectives, predicate, and quantifiers etc. are explored. CO2: All basic concepts of intuitive set theory are covered. Various operations on sets, partition, and various types of relations are discussed
SEMESTER-IV		
Course	**Course Name**	**Course Outcome**
CC08	**Riemann Integration & Series of Functions**	CO1: Introduces Riemann Integration and Series of Functions in this third course in Real Analysis CO2: Riemann Integration is taught rigorously with special emphasis on Riemann Integrable functions which culminates in the proof of The Fundamental theorem of Integral Calculus CO3: Brief exposure to Improper Integration is given CO5:Thoroughly introduces series of functions CO6: Uniform convergence is taught in detail CO7: Short introductions are given to Fourier Series, Power Series and Weierstrass Approximation theorem
CC09	**Multivariable Calculus**	CO1: Analysis of the functions of several variables are rigorously taught CO2: Partial Derivatives, total differentiation, directional derivatives.

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		gradient, tangent planes are discussed with geometric interpretations CO3: Double Integration and Triple Integration are introduced and their applications in finding surface areas of plane regions and volumes of solids are discussed CO4: Vector Field, Divergence, Curl and Line Integrals are introduced. Applications of line integrals in finding mass and work are discussed CO5: Brief introductions to Green's Theorem, Stoke's Theorem and Divergence theorem are given
CC10	**Ring Theory & Linear Algebra-I**	CO1: Basic Ring Theory is introduced rigorously and the concepts of ideal, factor ring, prime ideal and maximal ideals are discussed giving emphasis on examples and problem solving CO2: Ring homomorphisms along with three Isomorphism Theorems are discussed in detail CO3: The concepts introduce in an informal way in CC2, are discussed in a formal manner with the introduction of Vector Spaces and their properties which are rigorously discussed CO4: Linear Transformations and their properties along with their matrix representations are discussed rigorously
SEC2	**Graph Theory**	CO1: The ideas of basic

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		properties of graphs, pseudo graphs, complete graphs, bipartite graphs isomorphism of graphs are discussed CO2 : Some concepts of Eulerian circuits, Eulerian graph, semi-Eulerian graph, Hamiltonian cycles, Representation of a graph by a matrix and weighted graph are discussed CO3 : Preliminary ideas on Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, arshall algorithm are given

SEMESTER-V

Course	Course Name	Course Outcome
CC11	**Partial Differential Equations and Applications**	CO1: In this final course on Real Analysis, classification and various techniques of solving Partial Differential Equations are discussed CO2: Three widely used PDEs viz. Heat Equation, Wave Equation and Laplace Equation are derived and method for solving them are developed CO3: Applications of using PDEs in designing and solving physical problems like central force, constrained motion, Kepler's Law are discussed
CC12	**Mechanics I**	CO1: The concepts of Co-planar forces, Astatic equilibrium, Friction, Equilibrium of a particle on a rough curve, Virtual work, Stable and unstable equilibrium and equilibrium of flexible string have been discussed. CO2: Simple harmonic

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		motion, Damped and forced vibrations, Motion of a projectile in a resisting medium. Motion of a particle under central force, Keplar's laws of motion, Motion under the inverse square law, Motion of artificial satellites is widely described. CO3: The ideas about degrees of freedom, Moments and products of inertia, Momental Ellipsoid, Principal axes, D'Alembert's Principle, Motion of a rigid body in two dimensions under finite and impulsive forces, Conservation of momentum and energy are introduced
DSE1	**Linear Programming**	CO1: This is a course on applied mathematics where application of linear algebra in Linear Programming is outlined. CO2: Simplex method is thoroughly discussed. CO3: Here students come to know how algorithms are used to solve problems and they see it work in transportation and assignment problems CO3: Brief introduction to Game theory is given through formulation and solution of two person zero sum games, games with mixed strategies
DSE2	**Probability and Statistics**	CO1 : Ideas on sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, mathematical expectation, moments, moment generating

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		function are discussed CO2: The concepts of characteristic function and various distributions like uniform, binomial, Poisson, geometric, negative binomial, normal, exponential are introduced CO3: Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, linear regression for two variables are discussed
SEMESTER-VI		
Course	**Course Name**	**Course Outcome**
CC13	**Metric Spaces & Complex Analysis**	CO1: This second and final course in Metric Spaces, begins with sequences in metric spaces and gives natural introduction to Complete Metric Spaces. Continuity and Uniform continuity are discussed in detail. CO2: Connectedness and Compactness are introduced. theorems like Heine-Borel Property and FIP and their implications are discussed CO3: Homeomorphisms and Contraction mappings are introduced. Banach Fixed Point theorem is proved and its application in ODE are shown CO4: As an introductory course in Complex Analysis, all the basic concepts like limits, continuity, derivatives, integration sequences and series are

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		thoroughly discussed
CC14	**Ring Theory and Linear Algebra-II**	CO1: In this second course in Ring Theory, being advanced in nature, polynomial rings are explored extensively and Unique Factorization Domain, Euclidean Domain are briefly discussed CO2: In this second course in Linear Algebra, Dual Space and Inner Product Spaces are discussed in detail CO3: Basics of Linear Operator theory are developed and short introductions to orthogonal projection and Spectral theory are given
DSE3	Number Theory	**CO1: Discussion of various theorems related integers.** **CO2: Introduction to some functions releted integers** **CO3: Development of integer numbers using functions and theorems** **CO4: Application of integer numbers**
DSE4	Mathematical Modelling	**CO1: Discussion of various methods like Power series solution and Laplace and Inverse Laplace transform to solve different type of initial value differential equation problem upto second order like Bessel's equation and Legendre's equation.** **CO2:Discussion of various method of generating random numbers like middle square method , linear congruence, queuing models, harbor system, morning rush hour.**

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		CO3: Introductory knowledge of different optimization model like Linear programming model, Geometric solution, Algebraic solution, Simplex method, Sensitivity Analysis. CO4: Use of software for studying curves and surfaces and solution of differential equation.

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