DEPARTMENT OF MATHEMATICS
ABHEDANANDA MAHAVIDYALAYA, SAINTHIA
ACADEMIC PLAN (SUGGESTIVE), 2018-19

Semester:	I
Courses:	CORE COURSE (BMH1CC01) - Calculus, Geometry & Differential Equations
TotalMarks:	75
Total credit:	06
Total no. of lectures:	60
Objective:	To have a tentative course of action well in advance through the said Academic Plan to be able to: • execute the new CBCS with ease • finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher
Evalution method:	C1- 10% of the total marks (class test/assignment/seminar + attendance) C2- 10% of total marks (class test/assignment/seminar + attendance) C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination
C1:	8^{th} week from the beginning of the semester Completion of 25% of the total course syllabus Around 3^{rd} week of September 2017
C2:	16^{th} week from the beginning of semester Completion of 50% of the syllabus Around 3^{rd} week of November 2017
C3:	21^{st}-23^{rd} week 75% of the syllabus completed Around Last Week of December, 2018

Syllabus BMH1CC01	**UNIT-1** Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type , concavity and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences. **UNIT-2** Reduction formulae, derivations and illustrations of reduction formulae for the integration of sin nx, cosnx, tan nx, sec nx, $(\log x)_n$, $\sin_n x \sin_m x$, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution. **UNIT-3.** Reflection properties of conics, translation and rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, Generating lines, classification of quadrics, Illustrations of graphing standard quadric surfaces like cone, ellipsoid **UNIT-4** Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.
Texts prescribed by university for uniformity in translation and ease of access	1. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004 2. S. Goldberg, Calculus and Mathematical analysis 3. Murray, D., Introductory Course in Differential Equations, Longmans Green and Co.

	4.Murray, D., Introductory Course in Differential Equations, Longmans Green and Co. 5. T. Apostol, Calculus, Volumes I and II.

ACADEMIC PLAN	
Semester Begins	Fourth Week of July 2017
Number of lectures/week (1hr/lecture)	6/weak
Tentative no. of classes/topic taken and syllabus covered before C1 **25 % of CC-I should have been covered**	12 classes will be taken and UNIT-4 should be covered
August 2018	Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation
September 2018	Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.
Tentative no. of classes/topic taken and syllabus covered before C2 **50% of CC1 should have been covered**	18 classes will be taken and UNIT-1 & 2 should be covered
November 2018	Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type , concavity and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates,

December 2018	tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences. Reduction formulae, derivations and illustrations of reduction formulae for the integration of sin nx, cosnx, tan nx, sec nx, $(\log x)^n$ parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Keeping record marks for C2

Semester:	I
Courses:	CORE COURSE (BMH1CC02) - Algebra
Total Marks:	75
Total credit:	06
Total no. of lectures:	60
Objective:	To have a tentative course of action well in advance through the said Academic Plan to be able to: • execute the new CBCS with ease • finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher
Evalution method:	C1- 10% of the total marks (class test/assignment/seminar + attendance) C2- 10% of total marks (class test/assignment/seminar + attendance) C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination
C1:	8^{th} week from the beginning of the semester Completion of 25% of the total course syllabus Around 3^{rd} week of September 2017
C2:	16^{th} week from the beginning of semester Completion of 50% of the syllabus Around 3^{rd} week of November 2017
C3:	21^{st}-23^{rd} week 75% of the syllabus completed Around Last Week of December, 2018

Syllabus BMH1CC02	**UNIT-1** Polar representation of complex numbers, n-th roots of

	unity, De Moivre's theorem for rational indices and its applications. Theory of equations: Relation between roots and coefficients,Transformation of equation,Descartes rule of signs, Cubic and biquadratic equations, reciprocal equation,separation of the roots of equations,Strum's theorem, Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality **UNIT-2** Equivalence relations and partitions, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set. Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm. 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. Vector spaces, Subspaces of R_n, dimension of subspaces of R_n, 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.
Texts prescribed by university for uniformity in translation and ease of access	1. K.B. Dutta, Matrix and linear algebra 2. K. Hoffman, R. Kunze, Linear algebra. 3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007

ACADEMIC PLAN	

Semester Begins	Fourth Week of July 2017
Number of lectures/week (1hr/lecture)	6/week
Tentative no. of classes/topic taken and syllabus covered before C1 **25 % of CC02 should have been covered**	12 classes will be taken and UNIT-2 should be covered
August 2018	Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, liminf, lim sup. Limit Theorems
September 2018	Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria. Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences.Cauchy sequence, Cauchy's Convergence Criterion
Tentative no. of classes/topic taken and syllabus covered before C2 **50% of CC02 should have been covered**	18 classes will be taken and UNIT-3 & 4 should be covered
November 2018	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,
December 2018	Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices, Vector spaces, Subspaces of R_n, dimension of subspaces of R_n, 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 Keeping record marks for C2

Semester:	III
Courses:	CORE COURSE (BMH1CC05) - **Theory of Real Functions & Introduction to Metric Space**
TotalMarks:	75
Total credit:	06
Total no. of lectures:	60
Objective:	To have a tentative course of action well in advance through the said Academic Plan to be able to: • execute the new CBCS with ease • finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher
Evalution method:	C1- 10% of the total marks (class test/assignment/seminar + attendance) C2- 10% of total marks (class test/assignment/seminar + attendance) C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination

Classes begin Fourth Week of July , 2018

C1:	8^{th} week from the beginning of the semester Completion of 25% of the total course syllabus
C2:	16^{th} week from the beginning of semester Completion of 50% of the syllabus
C3:	21^{st}-23^{rd} week 75% of the syllabus completed

Syllabus BMH1CC05	**Unit -1**: Limits of functions (ε - δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for

	continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, theorems on uniform continuity. **Unit -2** : Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum, Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Application of differential calculus : Curvature. **Unit-3**: Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1 + x)$, $1/ax+b$ and $(1 +x)_n$. Application of Taylor's theorem to inequalities. **Unit-4** : Metric spaces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces.
Texts prescribed by university for uniformity in translation and ease of access	1. W. Rudin, Principles of Mathematical Analysis, Tata McGraw-Hill, 2017. 2. A, Mattuck, Introduction to Analysis, Prentice Hall, 1999. 3. S.R. Ghorpade and B.V. Limaye, a Course in Calculus and Real Analysis, Springer

ACADEMIC PLAN	,

Semester Begins	From Fourth Week of July, 2018
Number of lectures/week (1hr/lecture)	6/week
Tentative no. of classes/topic taken and syllabus covered before C1 **25 % of CC05 should have been covered**	12 classes will be taken and UNIT-1 should be covered
July - August, 2018	, Limits of functions (ε - δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity
September - October, 2018	Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, theorems on uniform continuity
Tentative no. of classes/topic taken and syllabus covered before C2 **50% of CC-05 should have been covered**	18 classes will be taken and UNIT-2 & 3 should be covered
November, 2018	Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum, Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Application of differential calculus : Curvature
December 2018	Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, $\ln(1 + x)$, $1/ax+b$ and $(1 +x)_n$. Application of Taylor's theorem to inequalities.

Semester: III

Courses: CORE COURSE (BMH1CC06) - **Group Theory–I**
Total credit: 06

Total no. of lectures: 60

Objective: To have a tentative course of action well in advance through the said Academic Plan to be able to:

- execute the new CBCS with ease
- finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher

Evalution method: C1- 10% of the total marks (class test/assignment/seminar + attendance)

C2- 10% of total marks (class test/assignment/seminar + attendance)

C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination

Classes begin from Fourth Week of July, 2018

C1: 8^{th} week from the beginning of the semester

Completion of 25% of the total course syllabus

C2: 16^{th} week from the beginning of semester

Completion of 50% of the syllabus

C3: 21^{st}-23^{rd} week

75% of the syllabus completed

Syllabus BMH1CC06	**Unit-1 :**Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups. **Unit-2:**Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups. **Unit-3 :**Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations, properties of permutations, even and odd permutations,

	alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. **Unit-4:** External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. **Unit-5:** Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.
Texts prescribed by university for uniformity in translation and ease of access	1. Joseph J. Rotman, An Introduction to the Theory of Groups, 4th Ed., 1995. 2. I.N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975. . 3. D.S. Malik, John M. Mordeson and M.K. Sen, Fundamentals of Abstract Algebra, 1997.

ACADEMIC PLAN	
Semester Begins	Fourth Week of July, 2018
Number of lectures/week (1hr/lecture)	6/week
Tentative no. of classes/topic taken and syllabus covered before C1 **25 % of CC06 should have been covered**	12 classes will be taken and UNIT-2 should be covered
July- August, 2018	Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.
September - October, 2018	Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups
Tentative no. of classes/topic taken and syllabus covered before C2 **50% of CC-06 should have been covered**	18 classes will be taken and UNIT-2 & 4 should be covered

November-December, 2018	Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem. External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.

Semester: III

Courses: CORE COURSE (BMH1CC07) - **Numerical Methods & Numerical Methods Lab (Theory-40, Practical-20)**

Total credit: 06

Total no. of lectures: 60

Objective: To have a tentative course of action well in advance through the said Academic Plan to be able to:

- execute the new CBCS with ease
- finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher

Evalution method: C1- 10% of the total marks (class test/assignment/seminar + attendance)

C2- 10% of total marks (class test/assignment/seminar + attendance)

C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination

Classes begin from Fourth Week of July, 2018

C1: 8th week from the beginning of the semester

Completion of 30% of the total course syllabus

C2: 16th week from the beginning of semester

Completion of70% of the syllabus

C3: 21st-23rd week

100% of the syllabus completed

Syllabus BMH1CC07	**Unit-1**: Algorithms, Convergence, Errors: Relative, Absolute. Round off, Truncation. **Unit-2** : Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regulafalsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods. **Unit -3** : System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU Decomposition. **Unit-4**: Interpolation: Lagrange and Newton's methods, Error bounds, Finite difference operators. Gregory forward and backward difference interpolations. Numerical differentiation: Methods based on interpolations, methods based on finite differences. **Unit – 5 :** Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's 1/3rd rule, Gauss quadrature formula. The algebraic eigenvalue problem: Power method. **Unit – 6:** Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four. **Unit -7: Numerical Practical**

	Lab notebook & Viva Voce : 5 marks Numerical Problem : 15 marks (Program:10, Result:5) **List of practical (using C programming)** 1. Solution of transcendental and algebraic equations by (a) Newton Raphson method. (b) Regula Falsi method. 2. Solution of system of linear equations (a) Gaussian elimination method (b) Gauss-Seidel method 3. Interpolation : Lagrange Interpolation 4. Numerical Integration (a) Trapezoidal Rule (b) Simpson's one third rule 5. Solution of ordinary differential equations : Runge Kutta method
Texts prescribed by university for uniformity in translation and ease of access	1 Scarborough, James B., Numerical Mathematical Analysis, Oxford and IBH publishing co, 1966.Eastern Limited, India, 1975. . 2. Yashavant Kanetkar, Let Us C , BPB Publications, 2016.

ACADEMIC PLAN	
Semester Begins	Fourth Week of July, 2018
Number of lectures/week (1hr/lecture)	6/week
Tentative no. of classes/topic taken and syllabus covered before C1 **30 % of CC07 should have been covered**	16 classes will be taken and UNIT-1-3 should be covered
July- August, 2018	Algorithms, Convergence, Errors: Relative, Absolute. Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regulafalsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods.
September - October, 2018	System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU Decomposition.

Tentative no. of classes/topic taken and syllabus covered before C2 **70% of CC-7 should have been covered**	18 classes will be taken and UNIT-4-7 should be covered
November-December, 2018	Interpolation: Lagrange and Newton's methods, Error bounds, Finite difference operators. Gregory forward and backward difference interpolations. Numerical differentiation: Methods based on interpolations, methods based on finite differences. Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's 1/3rd rule, Gauss quadrature formula. The algebraic eigenvalue problem: Power method. **10L** **Unit – 6:** Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four. **5L** **Unit -7: Numerical Practical**

Semester: III

Courses: **BMH3SEC11: Logic and Sets (Marks: 50)**

Total credit: 02

Total no. of lecture 40

Objective: To have a tentative course of action well in advance through the said Academic Plan to be able to:

- execute the new CBCS with ease
- finish syllabus and conduct evaluations on time to the satisfaction of both the student and the teacher

Evalution method: C1- 10% of the total marks (class test/assignment/seminar + attendance)

C2- 10% of total marks (class test/assignment/seminar + attendance)

C3- 60 marks [(10x2) + (4x5) + (2x10)]- semester-end examination

Classes begin from Fourth Week of July, 2018

C1: 8^{th} week from the beginning of the semester

Completion of 30% of the total course syllabus

C2: 16th week from the beginning of semester

Completion of70% of the syllabus

C3: 21st-23rd week

100% of the syllabus completed

Syllabus BMH3SEC11	**Unit 1 :** Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations. **Unit 2 :** Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. **Unit 3 :** Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set. Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation. Partial ordering relations, n- ary relations.
Texts prescribed by university for uniformity in translation and ease of access	1. R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998. 2. S.K.Mapa : Higher Algebra

ACADEMIC PLAN	
Semester Begins	Fourth Week of July, 2018
Number of lectures/week (1hr/lecture)	2/week

Tentative no. of classes/topic taken and syllabus covered before C1 **30 % of SEC11 should have been covered**	10 classes will be taken and UNIT-1-2 should be covered
July- August, 2018	Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.
September - October, 2018	Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.
Tentative no. of classes/topic taken and syllabus covered before C2 **70% of SEC-11 should have been covered**	18 classes will be taken and UNIT-3 should be covered
November-December, 2018	Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set. Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation. Partial ordering relations, n- ary relations.