BABU BANARASI DAS UNIVERSITY, LUCKNOW

B. Sc. (Honours) Mathematics

Under Choice Based Credit System

COURSE STRUCTURE

(Effective from 2017-18)

Course	Code	Title	Teaching			Evaluation				Total	Credits
						Theory		Lab/Seminar/ Viva Voce/ Dissertation			
			L	T	P	CIA	ESE	CIA	ESE		
SEMESTER – I											
Core	BSM 1101	Calculus	5	1	-	40	60	-	-	100	6
Core	BSM1102	Algebra	5	1	-	40	60	-	-	100	6
GE		Generic Elective - I									6
AECC	BSAE 1101	Communicative English	2	-	-	40	60	-	-	100	2
GP	BSGP11	General Proficiency						100	-	100	1
											21
SEMESTER – II											
Core	BSM 1201	Real Analysis	5	1	-	40	60	-	-	100	6
Core	BSM 1202	Differential Equations	5	1	-	40	60	-	-	100	6
GE		Generic Elective - II									6
AECC	BSAE 1201	Environmental Studies	2	-	-	40	60	-	-	100	2
GP	BSGP 12	General Proficiency				-	-	100	-	100	1

											21
			SEMESTER – III								
Core	BSM 1301	Theory of Real Functions	5	1	-	40	60	-	-	100	6
Core	BSM 1302	Group Theory I	5	1	-	40	60	-	-	100	6
Core	BSM 1303	PDE and System of ODE	5	1	-	40	60	-	-	100	6
GE		Generic Elective - III									6
SEC		Skill Enhancement Course - I									2
GP	BSGP 13	General Proficiency	-	-	-	-	-	100	-	100	1
											27
			SEMESTER – IV								
Core	BSM 1401	Numerical Methods	5	1	-	40	60	-	-	100	6
Core	BSM 1402	Reimann Integration and Series of Functions	5	1	-	40	60	-	-	100	6
Core	BSM 1403	Ring Theory & Linear Algebra I	5	1	-	40	60	-	-	100	6
GE		Generic Elective - IV									6
SEC		Skill Enhancement Course - II									2
GP	BSGP 14	General Proficiency	-	-	-	-	-	100		100	1
											27
			SEMESTER – V								
Core	BSM 1501	Multivariate Calculus	5	1	-	40	60	-	-	100	6
Core	BSM 1502	Group Theory II	5	1	-	40	60	-	-	100	6
DSE		Discipline Specific Elective - I									6
DSE		Discipline Specific Elective - II									6

Lab	BSM S15	Seminar	-	-	-			100	-	100	2
											26

		SEMESTER – VI									
Core	BSM 1601	Metric Spaces & Complex Analysis	5	1	-	40	60	-	-	100	6
Core	BSM 1602	Ring Theory & Linear Algebra II	5	1	-	40	60	-	-	100	6
DSE		Discipline Specific Elective - III									6
DSE		Discipline Specific Elective - IV									6
Lab	BSM V16	Viva Voce	-	-	-	-	-	-	100	100	2
											26

ELECTIVE COURSES – B. Sc. (Honours) Mathematics

Code	Title	Teaching			Evaluation				Total	Credits
					Theory		Lab/Seminar/ Viva Voce/ Dissertation			
		L	T	P	CIA	ESE	CIA	ESE		
Generic Elective – I										
BSC 1101	Programming Fundamentals using 'C'	4	-	4	40	60	20	30	150	6
BSC1102	Computer System Architecture	5	1		40	60			100	6
Generic Elective – II										
BSC1202	Discrete Structures	5	1	-	40	60	-	-	100	6
BSC1201	Data Structures	4	-	4	40	60	20	30	150	6

	Generic Elective – III									
BSC1301	Programing in JAVA	4	-	4	40	60	20	30	150	6
BSC1302	Operating Systems	4	-	4	40	60	20	30	150	6
Generic Elective – IV										
BSC 1403	Database Management Systems	4	-	4	40	60	20	30	150	6
BSC 1402	Software Engineering	5	1		40	60			100	6

	Discipline Specific Elective – I									
BSM 1551	Differential Geometry	5	1	-	40	60	-	-	100	6
BSM 1552	Number Theory	5	1	-	40	60	-	-	100	6
BSM 1553	Analytical Geometry	5	1	-	40	60	-	-	100	6
Discipline Specific Elective – II										
BSM 1554	Mathematical Modeling	5	1	-	40	60	-	-	100	6
BSM 1555	Boolean Algebra and Automata Theory	5	1	-	40	60	-	-	100	6
BSM 1556	Probability and Statistics	5	1	-	40	60	-	-	100	6
Discipline Specific Elective – III										
BSM 1651	Theory of Equations	5	1	-	40	60	-	-	100	6
BSM 1652	Linear Programming	5	1	-	40	60	-	-	100	6
BSM 1653	Industrial Mathematics	5	1	-	40	60	-	-	100	6
Discipline Specific Elective – IV										
BSM 1654	Graph Theory	5	1	-	40	60	-	-	100	6
BSM 1655	Mechanics	5	1	-	40	60	-	-	100	6
BSM 1656	Dissertation	-	-	-	-	-	50	50	100	6

Skill Enhancement Course – I										
BSS 1301	LaTeX and HTML	1	-	2	40	60	50	-	150	2
BSS 1311	Internet Technologies	2	-	-	40	60	-	-	100	2
Skill Enhancement Course – II										
BSS 1411	Linux / Unix Programming	1	-	2	40	60	50	-	150	2
BSS 1421	Programming in MATLAB	1	-	2	40	60	50	-	150	2

Semester	First		
Course Name	**Calculus**		
Category: Core		Code: **BSM1101**	Credits: 6
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Hyperbolic functions ([1] Chapter 3). Higher order derivatives, Leibniz rule and its applications to problems of the type $e^{ax+b}Sinx$, $e^{ax+b}Cosx$, $(ax+b)^n Sinx$, $(ax+b)^n Cosx$ ([2] Chapter 5), asymptotes ([2] Chapter 8). Concavity and inflection points. Curvature ([2] Chapter 9), curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves ([2] Chapter 10). L'Hospital's rule ([2] Chapter 14).

Module II: Reduction formulae, derivations and illustrations of reduction formulae of type $\int \sin nx dx$, $\int \cos nx dx$, $\int \tan nx dx$, $\int \sec nx dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x dx$ ([3] Chapter 1). Volumes by slicing, disks and washers methods, volumes by cylindrical shells ([4] Chapter 6). Parametric equations, Parameterizing a curve, arc length, arc length of parametric curves ([4] Chapter 10). Area of surface of revolution ([4] Chapter 6).

Module III: Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics, sphere, cone, cylinder([4] Chapter 10).

Module IV: Triple product ([4] Chapter 11), introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions, tangent and normal components of acceleration ([4] Chapter 12).

Text Books:
1. **Courant and F. John**, *Introduction to Calculus and Analysis* (Vol. I), Courant Institute of Math. Sci. New York, 1965.
2. **G. Prasad**, *A Text Book on Differential Calculus*, Pothishala Private Limited.
3. **G. Prasad**, *A Text Book on lntegral Calculus*, Pothishala Private Limited
4. **H. Anton, I. Bivens and S. Davis**, *Calculus* (10th Edition), John Wiley and sons (Asia), Pt Ltd., Singapore, 2002.

References:
1. **G.B. Thomas and R.L. Finney,** *Calculus***,** 9th Ed., Pearson Education, Delhi, 2005.
2. **M.J. Strauss, G.L. Bradley and K. J. Smith,** *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

Semester	First		
Course Name	**Algebra**		
Category: Core	Code: **BSM 1102**		Credits: 6
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Polar representation of complex numbers, n^{th} roots of unity, De Moivre's theorem for rational indices and its applications ([1] Chapter 2). Equivalence relations, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set ([2] Chapter 2, Chapter 3, Chapter 4, Chapter 5).

Module II: 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 ([2] Chapter 2, Chapter 3, Chapter 4, Chapter 5).

Module III: 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 ([3] Chapter 1).

Module IV: Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n, dimension of subspaces of R^n and rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix ([3] Chapter 1, Chapter 2, Chapter 5).

Text Books:
1. **TituAndreescu and DorinAndrica,** *Complex Numbers from A to Z,* Birkhauser, 2006**.**
2. **Edgar G. Goodaire and Michael M. Parmenter,** *Discrete Mathematics with Graph Theory* (2nd Edition), Pearson Education (Singapore) Pvt. Ltd., Indian Reprint, 2002.
3. **David C. Lay,** *Linear Algebra and its Applications* (4th Edition), Pearson Education Asia, Indian Reprint, 2012.

Reference:
1. **S. Lipschutz, M. Lipson,** *Linear Algebra* (4th Edition), Schaum's Outlines.

Semester	Second		
Course Name	**Real Analysis**		
Category: Core		Code**: BSM 1201**	Credits: 6
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Idea of countable sets, uncountable sets and uncountability of R ([1] Chapter 1). Algebraic and Order Properties of R, δ-neighborhood of a point in R, Bounded above sets, Bounded below sets, Bounded sets, Unbounded sets, Suprema and Infima, The Completeness Property of R, The Archimedean Property ([1] Chapter 2).

Module II: Limit points of a set, Isolated points ([1] Chapter 4). Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, Limit Theorems, Monotone Sequences, Monotone Convergence Theorem ([1] Chapter 3).

Module III: Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy's sequence, Cauchy's Convergence Criterion ([1] Chapter 3).

Module IV: Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence ([1] Chapter 9).

Text Books:
1. **R.G. Bartle and D. R. Sherbert**, *Introduction to Real Analysis* (4th Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2011.

References:
1. **Gerald G. Bilodeau , Paul R. Thie, G.E. Keough,** *An Introduction to Analysis*, (2nd Edition), Jones & Bartlett, 2010.
2. **Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner,** *Elementary Real Analysis*, Prentice Hall, 2001.
3. **S.K. Berberian,** *A First Course in Real Analysis,* Springer Verlag, New York, 1994.

Semester	Second		
Course Name	**Differential Equations**		
Category: Core	Code: **BSM 1202**		Credits: 6
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: First order exact differential equations, integrating factors, rules to find an integrating factor ([1] Chapter 2). First order and higher degree equations solvable for x, y, p. Clairaut's form ([1] Chapter 2), general solution, singular solutions ([2] Chapter 1). Second order linear differential equation with constant coefficient ([2] Chapter 4).

Module II: Linear differential equation of higher order (homogeneous and non-homogeneous equations) with constant coefficients ([2] Chapter 5).The Cauchy-Euler equation ([2] Chapter 6). Solution of second order linear differential equations with variable coefficients (Method of reduction of order, removal of first derivative, changing independent variable and variation of parameters) ([2] Chapter 10).

Module III: Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel's equation and Legendre's equation, recurrence formulae, orthogonal properties, generating function ([2] Chapter 3).

Module IV: Laplace transform and inverse transform, properties, application to initial value problem up to second order ODE ([1] Chapter 9).

Text Books:
1. **S. L. Ross,** *Differential Equations*, (3rd Edition) John Wiley and Sons, India, 2004.
2. **M.D. Raisinghania,** *Ordinary and Partial Differential Equations,* S. Chand and Co. Ltd, 2013.

References:
1. **Belinda Barnes and Glenn R. Fulford,** *Mathematical Modeling with Case Studies, A Differential Equation Approach using Maple and Matlab*, 2nd Ed., Taylor and Francis group, London and New York, 2009.
2. **C.H. Edwards and D.E. Penny,** *Differential Equations and Boundary Value problems Computing and Modeling,* Pearson Education India, 2005.