School of Applied Sciences

Centurion University of Technology & Management

B.Sc. (Mathematics) CBCS syllabus

(2016-17 Admitted Batch Onward)

(Three years programme)

2016

B.Sc. Mathematics
(Three year programme 2016-17 admitted batch onward)
Course Structure

Semester-I

Sl. No	Code	Subject Name	L-T-P	Credits
1	BSFL1101	English	2-0-0	2
	FCBS0101	Environmental Science		
2	BSMA1101	Calculus	4-0-2	6
3	BSMA1102	Linear Algebra	4-0-2	6
4	GE-1[@]	Inter Disciplinary Subject		6
		Total		20

Semester-II

Sl. No	Code	Subject Name	L-T-P	Credits
1	BSFL1101	English	2-0-0	2
	FCBS0101	Environmental Science		
2	BSMA1201	Analysis-I	5-1-0	6
3	BSMA1202	Ordinary Differential Equations	4-0-2	6
4	GE-1[@]	Inter Disciplinary Subject		6
		Total		20

Note: [@] Generic Elective Subjects to be chosen from discipline other than Mathematics

Semester-III

Sl. No	Code	Subject Name	L-T-P	Credits
1	SEC-1[#]	Skill Enhancement Course-1	0-0-3	2
2	BSMA2301	Analysis-II	5-1-0	6
3	BSMA2302	Modern Algebra	5-1-0	6
4	BSMA2303	Partial Differential Equations and System of Ordinary Differential Equations	4-0-3	6
5	GE-3[@]	Inter Disciplinary Subject		6
		Total		26

Semester-IV

Sl. No	Code	Subject Name	L-T-P	Credits
1	SEC -2[#]	Skill Enhancement Course-2	0-0-3	2
2	BSMA2401	Numerical Analysis	4-0-3	6
3	BSMA2402	Advanced Analysis	5-1-0	6
4	BSMA2403	Programming in C	4-0-3	6
5	GE-4[@]	Inter Disciplinary Subject		6
		Total		26

Note: [#] Any two Skill Enhancement Courses to be chosen from the list given below

Skill Enhancement Courses

Sl. No	Code	Subject Name	L-T-P	Credits
1	BSMS2301	Communicative English and Writing Skill	0-0-3	2
2	BSMS2302	Fortran -95 Programme	0-0-3	2
3	BSMS2303	MAT LAB	0-0-3	2

Semester-V

Sl. No	Code	Subject Name	L-T-P	Credits
1	BSMA3501	Complex Analysis	5-1-0	6
2	BSMA3502	Probability and Statistics	5-1-0	6
3	BSMA3503	DSE-1:Programming in C++	4-0-3	6
4	BSMA3504/ BSMA3505	DSE-2: Integral Transforms / Mathematical Modelling	5-1-0	6
		Total		24

Semester-VI

Sl. No	Code	Subject Name	L-T-P	Credits
1	BSMA3601	Linear Programming	5-1-0	6
2	BSMA3602	Discrete Mathematics	5-1-0	6
3	BSMA3603/ BSMA3604	DSE-3: Hydrodynamics / Graph Theory	5-1-0	6
4	BSMA3605	DSE-4: Project Work	0-0-6	6
		Total		24

Core Courses

Semester – I

BSFL1101 English

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSFL1101	English	Theory	2	2-0-0

Module-I: Communication Skill
Communication: Definition, concept
Channels of Communication: Sender, receiver, channel, message, encoding, decoding, context, feedback
Verbal & Non-Verbal Communication: Spoken & written-advantages & disadvantages, Bias free English, Formal & informal style.

Module-II: Communicative Grammar
Time, Tense & Aspect
Verbs of state & events
Modality
Active & Passive voice
Antonyms, Synonyms, Homonyms, one word substitutions & correction of errors

Module-III: Sounds of English
Length of vowels:
Long vowels as in the words feel, food, shoot, card etc.
Short vowels as in the words pen, sun, cut, shut, etc.
Consonants
Stress pattern
Intonation: Rising & Falling.

Text Books:

Effective technical communication by M.A.Rizvi

Reference Books:

1. Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication.

2. Communicative Grammar of English Geoffery Leech

FCBS0101 Environmental Science

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
FCBS0101	Environmental Science	Theory	2	2-0-0

Course Objectives:

1. To understand the concept of multi-disciplinary nature of Environmental Science where different aspects are dealt with a holistic approach.
2. Students will develop a sense of community responsibility by becoming aware of environmental issues in the larger social context.
3. One must be environmentally educated.

MODULE-I

Environment and its multidisciplinary nature; Need for public awareness; Renewable and non -renewable resources–forest, water, mineral, land, food and energy resources; Structure and function of ecosystems of forest, grass land, desert and aquatic types.

MODULE -II

Biodiversity and its conservation: Biodiversity at global, national and local levels; Threats to biodiversity - Habitat loss; wild life poaching and man - wildlife conflicts; Endangered and endemic species; conservation measures.

Causes, effects and control measures of pollution, air, water and noise pollution; Nuclear hazards; solid-waste management–Causes, effects and control measures; Management of disasters due to natural causes of floods, earthquakes, cyclones and landslides.

MODULE-III

Social issues and the environment; Sustainable environment, Water conservation measures; Rain water harvesting; Resettlement and rehabilitation of people; Climate change and global warming; Acid rain; Ozone layer depletion; water land reclamation; Consumerism and waste products; Features of Environment Protection Act, Air pollution and Control of Pollution Acts; Water Pollution and its Control Act. Effects of Pollution explosion on environment and public health; Need for value education to Protect environment and resources.

Learning Outcomes:

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Design and evaluate strategies, technologies and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Text Book:

1. Anubhav Kaushik & C.P. Kaushik: Environmental Studies-New age International Publishers.

Reference Books:

1. Benny Joseph: Environmental Studies-Tata Mac Graw Hill
2. E. Bharucha: Text book of Environmental Studies for under graduate courses– Universities Press. (Book prepared by UGC Committee.

BSMA1101 Calculus

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA1101	Calculus	Theory + Practice	6	4-0-2

Module-I

Curvature, Asymptotes, Tracing of Curves: Cartenary, Cycloid, Folium of Descartes Astroid, Limacon, Cissoids, Cardioid, Lemniscate and Loops.

Module-II

Reduction Formulae, Rectification, Quadrature, Volume and Surface area of solids of revolutions.

Module-III

Vector Calculus: Vector valued functions of scalar variables, Differential operators, Integral transformations: Line Integrals, Surface Integrals, Volume Integrals, Green's Theorem, Gauss's Theorem, Stokes' Theorem (without proof).

List of Practical (Using any software)
Practical/ Lab work to be performed on a Computer.

1. Plotting the graphs of the functions e^{ax+b}, log (ax + b). 1/(ax + b), sin (ax + b), cos(ax + b), |ax +b| and to illustrate the effect of a and b on the graph.
2. Plotting the graphs of the polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
3. Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).
4. Obtaining surface of revolution of curves.
5. Tracing of conics in Cartesian coordinates/polar coordinates.
6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic, cone, elliptic, paraboloid, hyperbolic paraboloid using Cartesian coordinates.

Text Books:

Module I:-

1) A Text book of Calculus Part – II : Shantinarayan
   Chapter : 8 (Art. 24, 25, 26),
2) A Text book of Calculus Part-III : Shantinarayan
   Chapters : 1 (Art 1, 2,3), 3(Art 7,8,9)

Module II:-

3) A Text book of Calculus Part – II : Shantinarayan
   Chapter :10 (Art.33,34,35,36,37,38)
4) A Text book of Calculus Part-III : Shantinarayan
   Chapters : 4(Art 10,11,12) omitting Simpson's rule), 5(Arts 13,14),6(Arts 15,16).

Module III:-

5) A Textbook of Vector Calculus by Shanti Narayan & P. K. Mittal, S. Chand & Co. , 2003

Chapters: 1, 6, 7 (7.1 to 7.6, 7.8 & 7.11)

Reference Books:

1. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education). Delhi, 2007, Chapters: 4(4.3,4.4,4.5&4.7), 9(9.4), 10(10.1-10.4).
2. H. Anton, I. Bivens and S. Davis, Calculus, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002. Chapters: 6. (6.2-6.5).7(7.8). 8(8.2-8.3, Pages:532-538), 11(11.1), 13(13.5)
3. G. B. Thomas and R. L. Finney. Calculus, 9th Ed., Pearson Education, Delhi, 2005
4. R. Courant and F. John Introduction to Calculus and Analysis (Volumes I & II). Springer-Verlag. New York. Inc., 1989

BSMA1102 Linear Algebra

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA1102	Linear Algebra	Theory+ Practice	6	4-0-2

Module-I

Vector spaces, definition and examples, subspaces, span of aset, linear dependence and independence, dimension and basis.

Module-II

Linear transformation, definition and examples, range and kernel, rank and nullity, the space L(U,V), composition of Linear maps, matrix and linear map, linear operations, matrix multiplication, rand and nullity of matrix, transpose of a matrix.

Module-III

Elementary row operations, Systems of linear equations, matrix inversion, determinants, minors and rank of a matrix, product of determinants, application to linear equations, Eigen value and Eigen vector.

Part-II

List of Practical (Using any software)
Practical/ Lab work to be performed on a Computer.

1. Matrix addition and multiplication.
2. Matrix Inversion and Transpose.
3. Eigen Values and Eigen vectors of Matrix
4. Solution of $AX=B$ using Gauss Elimination, GaussSeidal, Gauss-Jacobi and Gauss methods

Text Book:

1) An Introduction to Linear Algebra by V. Krishnamurty,V.P.Mainra, J.L.Arora, Affiliated East-West press Pvt.Ltd.
   Chapters: 3,4 (4.1 to 4.7), 5,6 (6.5 to 6.8)

Reference Books:

1) Basic Structures in Algebra, Part-I : J.N. Patnaik
2) Matrix Theory and Linear Algebra : I.N. Herstein and D.J. Winter (Ma Chilan Publishing company)
3) First course in Linear algebra : Bhattacharya, Jain and Nagpaul (New Age International)

SEMESTER –II

BSMA1201 Analysis-I

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA1201	Analysis-I	Theory	6	5-1-0

Module-I

Ordered field of Real numbers, l.u.b. and g.l.b. completeness of R(Not through Dedkind cuts), complex numbers, Inequalities, Metric properties of R, limit points, closed sets, open sets, Bolzano-Weirstrass theorem.

Module-II

Convergence of real sequence and series, monotonic sequences, Cauchy Criteria of convergence, limit superior, limit inferior, Tests of convergence of spaces of positive terms, comparison tests, Ratio test, Root test, Absolute convergence, Alternating series test.

Module-III

Limit and continuity of functions, properties of continuous functions, discontinuities, uniform continuity, Differentiability of real functions, Higher derivations, Leibnitz theorem, Mean value theorems, Taylor's theorem with reminder, Taylor's series.

Module-IV

Functions of several variables, Neighbourhood of points in R^2 and R^3 , Limit of a function, repeated limits, continuity, Partial derivatives, differentiability, Partial derivative of higher orders, Derivatives of composite functions, change of variables, Taylor's Theorem, Extreme value, Implicit functions (Statement of implicit function theorem only),Jacobians, derivatives of implicit functions, Lagrange's method of multipliers (application without proof).

Text Book:

1) Mathematical Analysis (Wiley Eastern) : S.C. Malik and S.Arora

Chapters: 1 (excluding 4.3 and 4.4), 2,3,4 (upto Art.5 and 10.1, 10.2), 5,6, 15 (upto Art. 10)

Reference Books:

1) Fundamentals of Real Analysis :S.L.Gupta&Nisha Rani
2) Mathematical Analysis-II : Sharma &Vasistha
3) Fundamental of Mathematical Analysis :G.das&S.Pattanayak

BSMA1202 Ordinary Differential Equations

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA1202	Ordinary Differential Equations	Theory+ Practice	6	4-0-2

Module-I

Differential equations and mathematical models.First order and first degree ODE (variables separable homogeneous, exact, and linear).Equations of first order but of higher degree. Applications of first order differential equations (Growth, Decay and Chemical Reactions, Heat flow, Oxygen debt, Economics).

Module-II

Second order linear equations (homogeneous and non-homogeneous) with constant coefficients, second order equations with variable coefficients, variation of parameters, method of undetermined coefficients, equations reducible to linear equations with constant coefficients, Euler's equation. Applications of second order differential equations.

Module-III

Power series solutions of second order differential equations.Legendre's Equation and its simple properties, Bessel's Equation and Bessel's Function.

List of Practical (Using any software)

Practical/ Lab work to be performed on a Computer.

1. Plotting of second order solution of family of differential equations.
2. Plotting of third order solution of family of differential equations.
3. Growth model (exponential case only).
4. Decay model (exponential case only).
5. Oxygen debt model.
6. Economic model.
7. Vibration problems.

Text Book:

1. J. Sinha Roy and S. Padhy, A Course of Ordinary and Partial Differential Equations, Kalyani Publishers, New Delhi.
   Chapters: 1, 2(2.1 to 2.7), 3, 4(4.1 to 4.7), 5, 7(7.1-7.4)

Reference Books:

1. Martin Braun, Differential Equations and their Applications, Springer International.
2. M. D. Raisinghania-Advanced Differential Equations, S. Chand & Company Ltd., New Delhi.
3. G. Dennis Zill-A First Course in differential Equations with Modeling Applications, Cengage Learning India Pvt. Ltd.
4. Text Book of Differential Equations : N.M. Kapoor
5. Introductory course in Differential Equations : D.A. Murray
6. S. L. Ross, Differential Equations, John Wiley & Sons, India, 2004.

Semester – III

Core courses

BSMA2301 Analysis-II

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2301	Analysis-II	Theory	6	5-1-0

Module-I

Riemann Integration; Definitions and existence of the integral Inequalities of Upper and Lower Sums; Riemann Conditions of Integrability. Riemann Sum and Definition of Riemann Integral Through Riemann Sums; Equivalence of Two Definitions; Riemann Integrability of Monotone and Continuous Functions, Properties of the Riemann Integral; Definition and Integrability of Piecewise Continuous and Monotone Functions.Intermediate Value Theorem for Integrals; Fundamental Theorems of Calculus.

Module-II

Improper Integrals; Convergence of Beta And Gamma Functions, Implicit functions

Module-III

Double integration over rectangular region and over non-rectangular region, double integrals in polar co-ordinates change of variable in double integrals

Module-IV

Triple integrals, triple integrals over a parallelepiped and solid regions, volume by triple integrals, cylindrical and spherical co-ordinates, change of variable in double integrals and triple integrals.

Text Book:

Book Recommended:- 1.S.C Mallik & S. Arora ,Mathematical Anyalysis ,New Age Pub. House New Delhi . Chapters: 9,10,11(3.3,4.3) 12(12.1 to 12.4), 13 Appendix-I.
16,17,18

Reference Books:

1. M.J. Strauss, G.L. Bradley and K.J. Smith, Calculus 3rd Ed. Dorling Kindersley(India) Pvt. Ltd. (Pearson Education), Delhi, 2007, (Chapters: 11(11.1,11.2,1.6,11.7(Pages 598-605), 11.8(Page 610-614), 12(12.1, 12.3, 12.4(Pages 652-660), 12.5, 12.6), 13(13.1-13.3, 13.4 (Pages 712-716, 718-720), 13.5(pages 723-726, 729-730), 13.6(Pages 733-737), 13.7(Pages 742-745).
2. Topics In Calculus By R.K Panda & P.K Satapathy, S.G Publication , Puri

BSMA2302 Modern Algebra

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2302	Modern Algebra	Theory	6	5-1-0

Module-I

Definition and examples of groups including permutation groups and quotient groups, elementary properties of groups.Subgroups and examples of subgroups.

Module-II

Properties of Cyclic groups, Classification of Subgroups of Cyclic groups of Group A, cycle notation properties of Permutations, Even and Odd Permutations, Alternating Group of Degree *n*. Properties of Cosets, Lagrange's Theorem and Consequences, Fermat's little theorem, Application of cosets to permutation groups.

Module-III

External direct product of a finite number of groups, normal subgroups, Cauchy's theorem for finite abeliangroups, Group Homomorphism, Properties of Homomorphism, Isomorphism: Definition and examples,Cayleys Theorem.

Module-IV

Ring theory-definitions and examples, some special classes of Rings, Homomorphism, Ideals,Quotient Rings.

Text Book:

1. Joseph A. Gallian, Contemporary Abstract Algebra(4th Edn.), Narosa Publishing House, New Delhi.
Chapters: I, II,III,IV,V,VI(up to Theorem 6.2 only), VII, VIII, IX, XC
2. Topics in algebra-I.N.Herstein (Vikas Pub. House)
Chapters: 1, 2 (2.1 to 2.7), 3(3.1 to 3.4)

Reference Books:

1. University Algebra – N.S. Gopalkrishna (Wiley Eastern)
2. Modern Algebra – Vatsa and Vatsa (New Age International)

BSMA2303 Partial Differential Equations and System of Ordinary Differential Equations

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2303	Partial Differential Equations and System of Ordinary Differential Equations	Theory+ Practice	6	4-0-3

Module-I

Systems of Linear Differential Equations, Homogeneous Linear Systems with Constant Coeffcients (Two Equations in Two Unknown Functions). Simultaneous Linear First Order Equations in Three Variables, Methods of Solution, Pfaffian differential equations, Methods of Solutions of Pfaffian Differential Equations in Three Variables.

Module-II

Formation of first order partial differential equations, linear and non-linear partial differential equations of first order, special types of first-order equations, solutions of partial differential equations of first order satisfying given conditions. Linear partial differential equations with constant coeffcients, equations reducible to linear partial differential equations with constant coefficients, partial differential equations with variable coefficients, separation of variables, non-linear equation of the second order.

Module-III

Laplace Equation, Solution of Laplace equation by separation of variables, One dimensional wave equation, Solution of wave equation by separation of variables, Diffusion Equation, Solution of one-dimensional diffusion equation using separation of variables.

List of Practical (Using any software)
Practical/ Lab work to be performed on a Computer.

1. To find the general solution of the non-homogeneous system of the form:
$$\frac{dx}{dt} = a_1x + b_{1y} + f_1(t)_1 \frac{dy}{dt} = a_2x + b_2y + f_2(t)$$
with given conditions.
2. Plotting the integral surfaces of a given first order PDE with initial data.
3. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated condition

$(a) u(x,0) = \varphi(x), u_t(x,0) = \psi(x), x \epsilon R, t > 0$
$(b) u(x,0) = \varphi(x), u_t(x,0) = \psi(x), u_x(0,t) = 0, x \epsilon (0,\infty), t > 0.$
$(c) u(x,0) = \varphi(x), u_t(x,0) = \psi(x), u(0,t) = 0, x \epsilon (0,\infty), t > 0$
$(d) u(x,0) = \varphi(x), u_t(x,0) = \psi(x), u(0,t) = 0, u(1,t) = 0, 0 < x < 1, t > 0$

4. Solution of wave equation $\frac{\partial u}{\partial t} - k^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated condition

$(a) u(x,0) = \varphi(x), u(0,t) = a, u(1,t) = b, 0 < x < 1, t > 0$
$(b) u(x,0) = \varphi(x), x \epsilon R, 0 < t < T.$
$(c) u(x,0) = \varphi(x), u_t(x,0) = \psi(x), u(0,t) = 0, x \epsilon (0,\infty), t > 0$
$(d) u(x,0) = \varphi(x), u(0,t) = a, x \epsilon (0,\infty), t \geq 0$

Text Books:

1) J. Sinha Roy and S.Padhy, A course on ordinary and partial differential equation, Kalyani Publisers, New Delhi, Ludhiana,2012
Chapters: 8(8.1-8.3),11,12, 13(13,1-13.5), 15(15.1,15.5) 16(16.1,16.1.1), 17(17.1, 17.2,17.3)

Reference Books

1. Loknath Sahoo, Calculus and ordinary differential equations, Kalyani Publication, Reprint-2017
2. TynMyint-U and Lokenath Debnath, Linear Partial differential Equations for scientists and engineers, 4thendition, springer, Indian reprint, 2006
3. S.L. Ross, Differential Equations, 3rd Ed., John wiley and sons, India, 2004

Semester – IV

Core Courses

BSMA2401 Numerical Analysis

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2401	Numerical Analysis	Theory+ Practice	6	4-0-3

Module – I

Number system and Errors, Binary numbers, octal numbers, hexa-decimal numbers. Floating point Arithmetic, K – digit Arithmetic, Errors, Sources of Errors. Numerical Solution of non-linear equations, method of bisection, Regula-falsi method, Secant method, Newton – Raphson method, Fixed point iteration method.

Module – II

Polynomial Interpolation, Existence and uniquencess of interpolating polynomials, Lagranges Interpolating polynomial, Error in Interpolation.Newtons Divided Difference Interpolating Polynomial, Forward and backward Difference operators. Newton's Forward and backward Difference Interpolation formula.

Module – III

Numerical Integration, some Simple Quadrature Rules, Newton's-Cotes Rule. Compound Quadrature rules, Gauss – Legendre Rules, Numerical solution of Differential Equation, Picard's method, Euler's method, Runge-Kutta 2nd& 4th order methods

List of Practical (Using any software)
Practical/ Lab work to be performed on a Computer.

1. Calculate the sum
   1/1+1/2+1/3+1/4+----------+1/N.
2. To find the absolute value of an integer.
3. Enter 100 integers into an array and sort them in an ascending order.
4. Bisection method.
5. Newton raphson method.
6. Secant method.
7. Regulafalsi method.
8. LU Decomposition method.
9. Gauss-jacobi method.
10. SOR method or Gauss-Siedel method.
11. Lagrange interpolation or Newton interpolation.
12. Simpsons rule

Note: For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, arrays should be introduced to the students.

Text Books:

1. A Course on Numerical Analysis : B. P. Acharya & R. N.Das, Kalyani Publisher
   Chapters – 1 , 2 (2.1 – 2.4, 2.6, 2.8, 2.9), 3 (3.1 to 3.4, 3.6 to 3.8). 6 (6.1- 6.3, 6.5, 6.10, 6.11), 7 (7.1, 7.2, 7.3,7.4& 7.7)

Reference Books:

1. M.K. Jain, S.R.K. IyengarAnd R.K. Jain, Numerical Methods For Scientific And Engineering Computation, 6th Ed., New Age International Publisher, India, 2007.
2. John H. Mathews And Kurtis D. Fink, Numerical Methods Using MatLab, 4th Ed., Phi Learning Private Limited, 2012.

BSMA2402 Advanced Analysis

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2402	Advanced Analysis	Theory	6	5-1-0

Module-I

Metric Spaces: Definition and examples, open and closed spheres, neighborhoods, Interior points, open set, closed set, boundary points, limit points and isolated points, closure of a set, dense sets,

Module-II

Separable metric spaces, sequences in metric space, convergent sequences, cauchy sequences, complete metric space, distance between sets and diameter of a set, subspaces,

Module-III

Cantor's theorem. Continuous functions, definition and characterizations, sequential criterion and other characterizations of continuity, uniform continuity, homeomorphism,

Module-IV

Connectedness, connected subsets of separated sets, disconnected sets, contraction mappings, Banach fixed point theorem.

Book Prescribed

1. P.K. Jain and K. Ahmad, Metric Spaces, Narosa Publishing House, New Delhi. Chapters: 2(1-9, 12), 3(1-4), 4(1-4), 6(1-2, 4), 7(1 Only).

2. Methods of Real analysis-R.G. Goldberg
   Chapters: 4, 5, 6 (up to 6.8) and 10(10.1 to 10.2).

Books for Reference

1. S.C. Malik and S. Arora – Mathematical Analysis (New Age International)
2. Principles of Mathematical Analysis – Walter Rudin, III Edition, McGRAW-Hill Book Co.

BSMA2403 Programming in C

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2403	Programming in C	Theory+ Practice	6	4-0-2

Module-I

Basics and Introduction to C, The C declaration Data Types, Operators and Expressions, Input and Output in C, Arithmetic Operators and Operators Precedence, Variables and Constant Declarations, Expressions,

Module-II

Decision statements, Loop Control. If-Else Statement, Switch and Break Statements for, While and Do-While Loops and Continue Statement, Nested Control Statement,

Module-III

Data structure: array, Functions Value Returning Functions, One Dimensional Array, Two Dimensional Array

Text Book:

Programming in C by Ashok N. Kamthane , Pearson
Chapters 1, 2, 3, 4, 5, 6, 7, 10.

Reference Books:

1. Let us C (third Editions): by Yashvant Kanetkar, BPB Publication., Chapter: 1, 2,3,4,5,6,7,8.

List of Practical

Practical/ Lab work to be performed on a Computer.

1. Write a programme and draw the flow chart for searching of primes less than or equal to 1000(N).
2. Write a programme and draw the flow chart for arranging a given set of numbers in ascending or descending order.
3. Write a programme and draw the flow chart for searching of odd numbers and its sum less than or equal to 1000(N).
4. Write a programme and draw the flow chart to find the sum of digits of a number.
5. Write a programme and draw the flow chart to evaluate the area under the curve Y= ax+b and X-axis between the limits X= 0 and X= 10 using Trapezoidal rule.
6. Write a programme and draw the flow chart to evaluate the integral [f(x) dx] using Simpson's rules.
7. Write a programme and draw the flow chart to solve a quadratic equation.
8. Write a programme and draw the flow chart to evaluate the product of two matrices.
9. Write a programme and draw the flow chart to find the sum of odd/even natural numbers.
10. Write a programme and draw the flow chart to find the Armstrong Number between1 to 100.

Skill Enhancement Courses (Any two of the following)

BSMA2001Communicative English and Writing Skill

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2001	Communicative English and Writing Skill	Practice	2	0-0-3

Module-I: Communication in Organizational Setting
General Communication & Business Communication, Internal & External Communication Dimensions of Communication in an Organization: Upward, Downward, Horizontal & Grapevine 7 Cs of Communication, Barriers of Communication

Module-II: Writing Skill
Paragraph writing: Topic sentence & Main idea, Cohesion & Coherence: Sentence linkers
E-mails & Business letters, Preparing business reports & proposals, Note making & summarizing
Preparing resume, CV & Cover letters

Module-III: Presentation
Meeting documentation: Preparing an agenda, drafting resolutions & writing minutes Presentations: Oral & Written Interviews: Types, decorum & other formalities Group discussions.

Text Books:
Effective technical communication by M.A.Rizvi
Reference Books:
Business communication by Urmila Rai &S.M.Rai Communicative English & Business Communication by R.K.Panda, J.Khuntia, M.Pati, Alok Publication

BSMA2002 Fortran-95 Programme

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2002	Fortran -95 Programme	Practice	2	0-0-3

Module-I
Fundamentals of computer Programming
Module-II
Logical Operations and control structures
Module-III
Arrays
Module-IV
Procedures, Modules and derived types
Text Books:
1. Introduction to computer Programming Using FORTRAN 95,Astudent guide
   Chapters 1, 2, 3, 4, 5

Reference book:
1. Problem solving with FORTRAN 95 for Scientists and Engineers, SPRINGER ,By David R. Brooks

BSMA2003 MAT LAB

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA2003	MAT LAB	Practice	2	0-0-3

Module-I
Starting with MATLAB, Creating Arrays

Module-II

Mathematical operations with arrays, Programming in Matlab, User defined functions

Module-III

Polynomial curve fitting, Application of Numerical Analysis, Symbolic Math

Module-IV

Two-dimensional and Three-dimensional plots

Text Books:

1. MATLAB, An Introduction with application by Amos Gilat
   Wiley Student Edition
   Chapters 1,2,3,4,5,6,7,8,9,10,11

Reference Books:

1. Getting started with Matlab by RudraPratap, Oxford University Press
   Chapters 1,2,3,4,5,6,7,8,9

Semester – V

Core Courses

BSMA3501 Complex Analysis

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3501	Complex Analysis	Theory	6	5-1-0

Module-I

Properties of Complex Numbers, regions in the complex plane, functions of complex variable, mappings.limit and continuity of complex functions derivatives, differentiation formulas, cauchy-riemann equations, sufficient conditions for differentiability, polar co-ordinates.

Module-II

Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of these functions, definite integrals of functions. Contours, contour integrals and its examples, upper bounds for moduli of contour integrals theorem on anti derivatives. Cauchy- goursat theorem (statement only), cauchy integral formula

Module-III

Liouvilles Theorem and the fundamental theorem of algebra. Convergence of sequences and series, taylor series and its examples. Laurent series (without proof) and its examples, absolute and uniform convergence of power series.

Module-IV

Conformal Mapping, Bilinear Transformation

Text Book:

1. James Ward Brown and Ruel V. Churchill, Complex Variables And Applications, 8th Ed., Mcgraw Hill International Edition, 2009. Chapters: 1(11 Only), 2(12,13), 2(15-22, 24, 25), 3(29, 30, 34) 4(37-41, 43-46, 50-53), 5(55-60, 62,63,66).

Reference Books:

1. Complex Analysis – L. V. Ahlfors,Mc – Graw – Hill international Editions
   (Vikas Publications – Second Edition)

Chapters : 1,3 (Subsections 2.1,2.2,2.3,3.1,3.2,3.3,3.4 only) 2,4 (Subsections 1,2,3 only)

BSMA3502 Probability and Statistics

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3502	Probability and Statistics	Theory	6	5-1-0

Module-I

Sample Space, Probability axioms, Independent events, conditional probability and Bayes' theorem, Real random variables(discrete and continuous), Cumulative distribution function, Expectation of random variables, some special expectations.

Module-II

Multivariate distributions, Joint cumulative distribution functions, Joint Probability distributions, Marginal and conditional distributions, some probability distributions(Discrete case), uniform distribution, binomial distribution, negative binomial and geometric distributions poisson distribution.

Module-III

Some probability distributions(Continuous case), uniform, Gamma, Exponential, Beta Distributions, Normal distributions, Normal approximation to the Binomial distributions Bivariate normal distribution.

Module-IV

Distribution of two random variables, expectation of function of two random variables, moment generating functions, conditional distributions and expectations, correlation coefficient, co-variance independent random variables, linear regression of two variables. Limit theorems, Markov's inequality, Chebyshev's inequality.

Text Book:

1. Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7th Ed., Pearson Education, Asia, 2006. Chapters: 2(excluding Art 9),3(Excluding Art 8), 4, 5(5.1,5.2,5.4,5.5,5.7), 6(6.1-6.7), 14(14.1,14.2)

2. Sheldon Ross, Introduction to Probability Models, 9th Ed., Academic Press, Indian Reprint, 2007 Chapters:8(8.1-8.4(upto page 428)), 9(9.1,9.2).

Reference Books:

1) Statistical Methods By S.P. Gupta (31st Edition) ; Publisher: Sultan Chand & Sons
   Chapters of Volume-II:1, 2 (Except Multinomial& Negative Binomial Distributions),3(Except Tests of Significance for Attributes)
   10(Only Karl Pearson's Coefficient of Correlation)
   11(Upto Regression equations of Y on X and X on Y)

2) Mathematical Statistics By S.C. Gupta & V.K. Kapur(10th Edition); Publisher: Sultan Chand & Sons
   Chapters:5(5.3,5.3.1,5.3.2,5.4,5.4.1,5.4.3),7(7.3.1),8(8.2.1),9(9.1.1),
   12(12.1to12.8,12.13,12.14),

Discipline Specific Elective – 1

BSMA3503 Programming in C^{++}(Compulsory)

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3503	Programming in C++	Theory+ Practice	6	4-0-3

Module-I

Introduction To Structured Programming: Data Types- Simple Data Types, Oating Data Types, Character Data Types, String Data Types.Arithmetic Operators and Operators Precedence, Variables and Constant Declarations, Expressions, Input Using The Extraction Operator >>and Cin, Output Using The Insertion Operator << and Cout

Module-II

Preprocessor Directives, Increment(++) And Decrement({) Operations, CreatingA C++ Program, Input/ Output, Relational Operators, Logical Operators and Logical Expressions.

Module-III

If And If-Else Statement, Switch and Break Statements. for, While and Do-While Loops and Continue Statement, Nested Control Statement, Value Returning Functions, Value Versus Reference Parameters, Local and Global Variables, One Dimensional Array, Two Dimensional Array, Pointer Data and Pointer Variables.

Text Book:

1. D. S. Malik: C++ Programming Language, Edition-2009, Course Technology, CengageLearning,India Edition.

Chapters: 2(Pages:37-95), 3(Pages:96-129), 4(Pages:134-178), 5(Pages:181-236),6, 7(Pages:287-304), 9 (Pages: 357-390), 14(Pages:594-600).

Reference Books:

1. E. Balaguruswami: Object Oriented Programming with C++, Fifth Edition, Tata McgrawHillEducation Pvt. Ltd.
2. R. JohnsonbaughAnd M. Kalin-Applications Programming In Ansi C, Pearson Education.
3. S. B. LippmanAnd J. Lajoie, C++ Primer, 3rd Ed., Addison Wesley, 2000.
4. BjarneStroustrup , The C++ Programming Language, 3rd Ed., AddisonWelsley.

List of Practical (Using any software)
Practical/ Lab work to be performed on a Computer.

1. Calculate the Sum of the series:- $\frac{1}{1}+\frac{1}{2}+\frac{1}{3}\ldots+\frac{1}{N}$ For Any Positive Integer N :
2. Write a user Defined Function To find The Absolute Value Of An Integer And Use It To Evaluate The Function (-1)n/|n|, for n=-2,-1,0,1,2.
3. Calculate The Factorial Of Any Natural Number.
4. Read floating Numbers And Compute Two Averages: The Average Of Negative Numbers And The Average Of Positive Number
5. Write A Program That Prompts The User To Input A Positive Integer. It Should Then Output A Message
   Indicating Whether The Number Is A Prime Number.
6. Write A Program that prompts the user to input the value of A;B and C involved in the equation $ax^2+bx+c=0$ and outputs the type of the roots of the equation. Also the program should outputs all the roots of the equation.

7. Write a program that generates random integer between 0 and 99: given that first two Fibonacci numbers are 0 and 1; generate all Fibonacci numbers less than or equal to generated number.
8. Write a program that does the following:
    A. Prompts the user to input + Ve Decimal numbers
    B. Prints the +Ve Decimal Numbers.
    C. Converts each decimal number to the nearest integer.
    D. Adds these +Ve integers.
    E. Prints the sum and average of them.
9. Write a program that uses while loops to perform the following steps:
    A. Prompt the user to input two integers: first number and second number (first numshoul be less than second num).
    B. Output all odd and even number between first num and second num.
    C. Output the sum of all even numbers between first num and second num.
    D. Output the sum of the square of the odd numbers firs T num and second num.
    E. Output all uppercase letters corresponding to the numbers between first num and second num if any.
10. Write a program that prompts the user to input +Ve decimal numbers. The program should then add the +Ve decimal numbers, convert the sum to the nearest integer, and print the result.
11. Write a program that prompts the user to enter the lengths of three sides of a triangle and then outputs a message indicating whether the triangle is a right triangleor a scalene triangle.
12. Multiplication/addition of two matrices using two dimension arrays.

Discipline Specific Elective – 2

(Any one of the following)

BSMA3504 Integral Transforms

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3504	Integral Transforms	Theory	6	5-1-0

Module-I

Fourier series, Periodic Function, Fourier Expansion of Functions of any Period, Even and Odd Functions, Half Range Expansions, Complex form of Fourier series
Fourier Integrals, Different forms of Fourier Integral Theorem

Module-II

Introduction to Integral Transforms
Laplace Transform, Transforms of Derivatives and Integrals, Derivatives and Integrals of Transforms, Shifting Properties, Unit Step Function, Dirac's Delta Function, Evaluation of Integrals, Inverse Laplace Transform, Convolution, Solution to Differential Equation, Integral Equation.

Module-III

Fourier Transforms, Infinite Fourier Transforms, Linear property, Change of scale, shifting property, Modulation Theorem, Convolution theorem, Parseval's identity.

Module IV

Finite Fourier Sine & Cosine transforms and its applications

Books Prescribed

1. M.D. Raisinghania, H.C.Saxena and H.K.Dass: Integral transforms, S.Chand& Company LTD. Chapters: 1, 2, 3,4,5(5.1, 5.2 ,5.16, 5.18), 6(6.1 to 6.3,6.6 to 6.9, 6.11 to 6.14), 7(7.1 to 7.9)

BSMA3505 Mathematical Modelling

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3505	Mathematical Modeling	Theory	6	5-1-0

Module – I

Simple Situations Requiring Mathematical Modeling. The Technique of Mathematical Modeling, Mathematical Modeling through Differential Equations, Linear Growth and Decay Models, Non-Linear Growth and Decay Models, Compartment Models, Mathematical Modeling of Geometrical Problems Through Ordinary Differential Equations of first Order.

Module – II

Mathematical Modeling In Population Dynamics, Mathematical Modeling of Epidemics Through Systems of Ordinary Differential Equations of first Order, Compartment Models through Systems of Ordinary Differential Equations, Mathematical Modeling In Economics Through Systems of Ordinary Differential Equations of first Order.

Module – III

Mathematical Models In Medicine, Arms Race, Battles And International Trade In Terms of Systems of Ordinary Differential Equations. Mathematical Modeling of Planetary Motions, Mathematical Modeling of Circular Motion and Motion of Satellites. Mathematical Modeling through linear differential equations of second order.

Module-IV

Situation Giving Rise to Partial Differential Equations Models, Mass Balance Equations: First Method of Getting PDE Models, Momentum Balance Equations. The Second Method of Obtaining Partial Differential Models, Variational Principles. Third Function, Fourth Method of Obtaining Partial Differential Equation Models, Models for Tracing of a Highway. Situation That can be Modeled through Graphs, Mathematical Models in terms of directed Graphs, Optimization Principles and Techniques, Mathematical Modeling through Calculus of Variations.

Text Book:

1. J.N. Kapur-Mathematical Modeling

Chapters: 1(1.1 And 1.2), 2(2.1 To 2.4, 2.6), 3(3.1 To 3.6),4(4.1 To 4.3), 6(6.1 To 6.6), 7(7.1 To 7.2), 9(9.1 And 9.2).

Semester – VI
Core Courses

BSMA3601Linear Programming

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3601	Linear Programming	Theory	6	5-1-0

Module-I

Introduction to linear programming problems (LPP), Mathematical formulation of the LPP with illustrations, Graphical method, general Linear programming problems, canonical and standard form of LPP. Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two – phase method, big-M method and their comparisons.

Module-II

Duality in LPP: Introduction, General Primal-Dual Pair, Formulation of the Dual Problem, Primal Dual relationship duality theorems, complementary slackness theorem, duality and simplex method, Economic interpretation of the duality.

Module-III

Transportation Problem(TP): LP formulation of TP, Existence of solution and duality in TP. Solution of transportation problems, North-West corner method, Least-cost method and Vogel approximation method for determination of strategy basic solution, algorithm of solving transportation problem, assignment problem and its mathematical formulation. Solution methods of assignment problem, special cases in assignment problems.

Module-IV

Games and strategie4s: Introduction, Formulation of two person zero sum games, solving two person zero sum games, maximin-minimax principle, Games without saddle points, games with mixed strategies, Graphical solution procedure to (2xn) and (mx2) games.

Text Book:

1. KantiSwarup, P.K. Gupta and Man Mohan-Operations Research, S. Chand and Co. Pvt. Ltd. (chapters: 2, 3, 4, 5(5.1-5.8), 10(10.1-10.10), 11(11.1-11.4), 17(17.1-17.6)

Reference Books:

Mathematical Programing by N. S. Kambo.
Chapters : 6 (6.4 to 6.6), 7 (7.1 and 7.4), 8.16.

BSMA3602 Discrete Mathematics

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3602	Discrete Mathematics	Theory	6	5-1-0

Module-I

Logic, Proportional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Relations and their Properties, n-Ary Relations and their Applications, Boolean Functions and their Representation. The Basic Counting, the Pigeon-Hole Principle, Generalized Permutations and Combinations.

Module-II

Recurrence Relations, Counting Using Recurrence Relations, Solving Linear Homogeneous Recurrence Relations with Constant Coefficients, Generating Functions, Solving Recurrence Relations using Generating Functions.

Module-III

Partially Ordered Sets, Hasse Diagram of Partially Ordered sets, maps between ordered sets, Duality Principle, Lattices as Ordered Sets, Lattices as Algebraic Structures, Sub lattices, Boolean Algebra and Its Properties.

Module-IV

Graphs: Basic Concepts and Graph Terminology, Representing Graphs and Graph Isomorphism. Distance in a Graph, Cut-Vertices and Cut-Edges, Connectivity, Euler and Hamiltonian Path

Text Book:

1. Kenneth H. Rosen, Discrete Mathematics and Applications, Tata Mcgraw Hill Publications, Chapters: 1(1.1 To 1.5), 4(4.1, 4.2, 4.5), 5(5.1, 5.2, 5.5), 6(6.1, 6.2, 6.4, 6.5, 6.6), 7(7.1, 7.2), 8, 10(10.1,10.2).

Reference Books:

1. Discrete Mathematics with Graph Theory by Edgar G. Goodaire and Michael M.Parmenter

Discipline Specific Elective – 3

(Any one of the following)

BSMA3603 Hydrodynamics

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3603	Hydrodynamics	Theory	6	5-1-0

Module-I

Eulerian and Lagrangian method, equation of continuity in different co-ordinates system, boundarysurface, Helmholtz's vorticity equation of motion, Bernoulli's equation, Cauchy's Integrals.

Module-II

Two dimensional motion, source, sink and doublet, Images, Theorem of Blasius, Vortex motion, Kerman Vortex sheet.

Module- III:

Motion of circular and elliptic cylinder, motion of a sphere in sample cases.

Module- IV:

Laws of Newtonian Attraction, Attraction and potential of a rod, circular disc, spherical shell and solid sphere. Gauss's and Poisson's Equation of matter and Equipotential Surfaces.

Text Books:

1. A treatise on hydromechanics, part 1,William Henry Besant Deighton, Bell, 1891
2. Hydrodynamics, Shanti Swarup, Krishna Prakashan Media (P) Ltd.
3. An elementary treatise on hydromechanics: with numerous examples:5th ed., Edward Albert Bowser, D. Van Nostrand, 1899
4. Hydromechanics: Besant & Ramsay
5. Newtonian Attraction: A S Ramsay
6. Statics: S L Loney

BSMA3604 Graph Theory

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3604	Graph Theory	Theory	6	5-1-0

Module-I

Introduction to Graphs: Definition of a graph, finite and infinite graphs, incidence of vertices and edges, types of graphs, subgraphs, walks, trails, paths, cycles, connectivity, components of a graph, Eulerian and Hamiltonian graphs, travelling salesman problem, vertex and edge connectivity, matrix representation of graphs, incidence and adjacency matrices of graphs

Module-II

Trees and Fundamental Circuits: Definition and properties of trees, rooted and binary trees, counting trees, spanning trees, weighted graphs, minimum spanning tree, fundamental circuit, cut set, separability, network flows Vector Spaces Associated with Graphs: Galois fields, vector spaces associated with graphs, orthogonal vectors and spaces

Module-III

Planar graphs and Graph Coloring: Planar graphs, Kuratowski's graphs, detection of planarity, Euler's formula for planar graphs, geometric and combinatorial duals of a planar graphs, coloring of graphs, chromatic numbers, chromatic polynomial, chromatic partitioning, Four color theorem.

Directed Graphs: Types of digraphs, digraphs and binary relations directed paths andconnectedness, Euler digraphs, de Brujin sequences, tournaments

Module-IV

Ramsey Theory: Introduction to Ramsey theory, Ramsey numbers, Ramsey theorem

Enumerations: Types of enumerations, Polya theory of enumeration and its applications

Text Books:

1. Deo, N., “Graph Theory with Applications to Engineering and Computer Science”, Prentice Hall India 2004

Reference Books

1. West, D. B., "Introduction to Graph Theory ", Prentice Hall India (2nd Edition 2009
2. Clark, J. and Holton, J. A.,"A First Look at Graph Theory", World Scientific 1991
3. Aldous, J. M., Wilson, R. J. and Best S., “Graphs and Applications: An Introductory Approach”, Springer2003
4. Deistel, R., “Graph Theory”, Springer (4th Edition) 2010
5. Chartrand, G. and Zhang, P., "Introduction to Graph Theory", Tata McGraw Hill 2007
6Bondy, J. A. and Murty, U. S. R., “Graph Theory”, Springer 2011

Discipline Specific Elective – 4

BSMA3605 PROJECT WORK

Code	Course Title	Course Type	Credits	L-T-P (hrs.)
BSMA3605	Project Work	Project	6	0-0-6