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					Credits
						Theory		Lab/Seminar/ Viva Voce/ Dissertation		Total	
			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. (Hons.) Mathematics

Code	**Title**	**Teaching**			**Evaluation**					**Credits**
					Theory		**Lab/Seminar/ Viva Voce/ Dissertation**		**Total**	
		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										
BSSE 1301	LaTeX and HTML	1	-	2	40	60	50	-	150	2
BSSE 1311	Web Technologies	1	-	2	40	60	50	-	150	2
Skill Enhancement Course – II										
BSSE 1411	Linux / Unix Programming	1	-	2	40	60	50	-	150	2
BSSE 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 $e^{ax+b}Sinx$, $e^{ax+b}Cosx$, $(ax+b)^nSinx$, $(ax+b)^nCosx$ ([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 $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x dx$ ([3] Chapter1). 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 n^{th} 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.

Semester	Third		
Course Name	**Theory of Real Functions**		
Category: Core	Code: **BSM 1301**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Limits of functions, limit theorems ([1]: Chapter 4). Continuous functions, algebra of continuous functions, continuous functions on interval, Boundedness theorem, Maximum-minimum theorem, location of roots theorem, Bolzano intermediate value theorem, preservation of intervals theorem, uniform continuity, non-uniform continuity criteria, uniform continuity theorem. ([1]: Chapter 5).

Module II: Differentiability of a function at a point and in an interval, The Chain Rule, Caratheodory's theorem, algebra of differentiable functions, Interior extremum theorem, Rolle's theorem, First mean value theorem. ([1]: Chapter 6).

Module III: Intermediate value property for derivatives, Darboux's theorem, Cauchy's mean value theorem, Application of mean value theorem to inequalities and approximation of polynomials. ([1]: Chapter 6).

Module IV: Taylor's theorem with Lagrange's and Cauchy's form of remainders, application of Taylor's theorem to convex functions, Relative extrema, Binomial series theorem, Taylor series, Maclaurin series, Expansions of exponential, Logarithmic and Trigonometric functions, $\log\ (1+x)$, $\frac{1}{ax+b}$ and $(1+x)^n$. ([1]: Chapter 6).

REFERENCES:

Text Book:

[1]. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis* (4th Edition), John Wileyand Sons (Asia) Pvt. Ltd., Singapore, 2010.

Reference Books:

[2]. K. A. Ross, *Elementary Analysis, The Theory of Calculus*, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.
[3]. A. Mattuck, *Introduction to Analysis*, Prentice Hall, 1999.
[4]. S. R. Ghorpade and B.V. Limaye, *A Course in Calculus and Real Analysis*, Springer, 2006.

Semester	Third		
Course Name	**Group Theory I**		
Category: Core	Code: **BSM 1302**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40Marks

SYLLABUS

Module I: Definition and examples of groups, finite and infinite groups,elementary properties of groups, order of an element of a group,permutations, properties of permutations,cycle notation for permutations, even and odd permutations. ([1]: Chapter 1& 2). Alternating group.([1]: Chapter 3).

Module II: Subgroups and examples of subgroups, cyclic groups, properties of cyclic groups, classification of subgroups of cyclic groups.([1]: Chapter 2).

Module III: Cosets, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem([1]: Chapter 2).Normal subgroups, factor groups, centralizer, normalizer, center of a group, Cauchy's theorem for finite Abelian groups. ([1]: Chapter 3).

Module IV: Group homomorphism, properties of homomorphism, Cayley's theorem, properties of isomorphism, First, Second and Third isomorphism theorems,Fundamental theorem of group homomorphism.([1]: Chapter 3).

REFERENCES:

Text Book:

[1]. Vijay K. Khanna and S. K. Bhambri, *A Course in Abstract Algebra*, 2nd Revised Ed., Vikas Publishing House Pvt. Ltd., 2005.

Reference Books:

[2]. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002**.**
[3]. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
[4]. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, New Delhi, 1999.
[5]. Joseph J. Rotman, *An Introduction to the Theory of Groups*, 4th Ed., Springer Verlag, 1995.
[6]. I.N. Herstein, *Topics in Algebra*, Wiley Eastern Limited, India, 1975.

Semester	Third		
Course Name	**PDE and System of ODE**		
Category: Core	Code: **BSM 1303**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Partial Differential Equations: Basic concepts and definitions, classification of first order partial differential equations, derivation of PDE ([1]: Chapter 1, Part II), Lagrange's method for obtaining general solution of Quasi Linear Equations. ([1]: Chapter 2, Part II).

Module II: Homogeneous and non-homogeneous PDE with constant coefficients, solutions under given geometrical conditions ([1]: Chapter 4 & 5, Part II). Equations reducible to equation with constant coefficients ([1]: Chapter 6, Part II). PDE of order two with variable coefficients. ([1]: Chapter 7, Part II).

Module III: Canonical Forms of first-order Linear PDE, classification of second order linear equations as hyperbolic, parabolic or elliptic, Reduction of second order Linear Equations to canonical forms ([1]: Chapter 8, Part II). Method of separation of variables for solving first order PDEs, derivation of heat equation, wave equation and Laplace equation.([1]: Chapter 1, Part III).

Module IV: Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients, basic theory of linear systems in normal form, homogeneous linear systems with constant coefficients.([2]: Chapter 10).

REFERENCES:

Text Books:

[1]. M. D. Raisinghania,*Advanced Differential Equations,* Thirteenth Revised Ed., S. Chand, 2010.

[2]. G. F. Simmons, *Differential Equation with Applications and Historical Notes*, 3rd Ed., CRC Press, 2017.

Reference Books:

[3]. TynMyint-U and LokenathDebnath, *Linear Partial Differential Equations for Scientists and Engineers*, 4th edition, Springer, Indian reprint, 2006.

[4]. S. L. Ross, *Differential equations*, 3rd Ed., John Wiley and Sons, India, 2004.

[5]. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, 22nd Revised Ed., S. Chand, 2010.

Semester	Fourth		
Course Name	**Numerical Methods**		
Category: Core	Code**: BSM 1401**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3Hrs	ESE: 60Marks	CIA: 40 Marks

SYLLABUS

Module I: Errors: absolute, relative, percentage, round off, truncation ([1]: Chapter 1). Zeroes of transcendental and polynomial equations using Bisection method, Newton-Raphson method, Secant method, Regula-Falsi method, Rate of convergence of the above methods. ([1]: Chapter 2).

Module II: Solution of system of linear algebraic equations by Gauss-Elimination method, Gauss-Jordan method, Gauss-Jacobi method, Gauss-Seidel method, Convergence analysis of the above methods. ([1]: Chapter 3).

Module III: Interpolation: finite difference operators, Newton's-Gregory forward and backward interpolation method, Lagrange's and Newton's divided difference interpolation for unequal intervals, error bounds.([1]: Chapter 4).

Module IV: Numerical Integration: Trapezoidal rule, Simpson's $1/3^{rd}$and $3/8^{th}$rule, Composite Trapezoidal rule, Composite Simpson's rule ([1]: Chapter 5). Boole's rule, Midpoint rule, solution of ordinary differential equations by Euler's method, and Runge-Kutta methods of orders two and four. ([1]: Chapter 6).

REFERENCES:

Text Book:

[1]. M. K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 6th Ed., New age International Publisher, India, 2007.

Reference Books:

[2]. Brian Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.

[3]. C. F. Gerald and P.O. Wheatley,*Applied Numerical Analysis*, Pearson Education, India, 2008.

[4]. Uri M. Ascher and Chen Greif, *A First Course in Numerical Methods*, 7th Ed., PHI Learning Private Limited, 2013.

[5]. John H. Mathews and Kurtis D. Fink, *Numerical Methods using Matlab*, 4th Ed., PHI Learning Private Limited, 2012.

Semester	Fourth		
Course Name	**Riemann Integration and Series of Functions**		
Category: Core	Code: **BSM 1402**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Riemann integration, inequalities of upper and lower sums, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, Riemann integrability of monotonic and continuous functions, properties of the Riemann integral. ([1]: Chapter 9).

Module II: Definition and integrability of piecewise continuous and monotonic functions, Intermediate value theorem for integrals, Fundamental theorems of calculus, Improper integrals. Convergence of Beta and Gamma functions. ([1]: Chapter 9).

Module III: Pointwise and uniform convergence of sequence of functions,theorems on continuity,derivability and integrability of the limit function of a sequence of functions. Series of functions, theorems on the continuity and derivability of the sum function of a series of functions, Cauchycriterion for uniform convergence and Weierstrass M-Test.([1]: Chapter 12).

Module IV: Limit superior and limit inferior, power series, radius of convergence, Cauchy-Hadamard theorem, differentiation and integration of power series, Abel's theorem, Weierstrass approximation theorem (statement only). ([1]: Chapter 13).

REFERENCES:

Text Books:

[1]. S. C. Malik and S. Arora, *Mathematical Analysis*, 2nd Ed., Wiley Eastern Ltd., 1991.

Reference Book:

[2]. K. A. Ross, Elementary Analysis, *The Theory of Calculus*, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

[3]. R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, (4th Edition), John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2010.

[4]. Charles G. Denlinger, *Elements of Real Analysis*, Jones and Bartlett (Student Edition), 2011.

[5]. Shanti Narayan, *Elements of Real Analysis*, (6th Edition) S. Chand Publication, 2006.

Semester	Fourth		
Course Name	**Ring Theory and Linear Algebra I**		
Category: Core	Code: **BSM 1403**	Credits:6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring,ideal, ideal generated by a subset of a ring, operations on ideals, prime and maximal ideals.([1]: Chapter 6& 7).

Module II: Quotient rings,ring homomorphism, properties of ring homomorphism, Isomorphism theorems I, II and III, field of quotients.([1]: Chapter 7).

Module III: Vector spaces and their elementary properties, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.([1]: Chapter 9).

Module IV: Linear transformations, algebra of linear transformations,null space, range, rank and nullity of a linear transformation,invertible linear transformation, matrix representation of a linear transformation,dual spaces,Inner product space. ([1]: Chapter 9& 10).

REFERENCES:

Text Book:

[1]. Vijay K. Khanna and S. K. Bhambri, *A Course in Abstract Algebra*, 2nd Revised Ed., Vikas Publishing House Pvt. Ltd., 2005.

Reference Books:

[2]. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, New Delhi, 1999.
[3]. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
[4]. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
[5]. Kenneth Hoffman, Ray Alden Kunze, *Linear Algebra*, 2nd Ed., Prentice-Hall of India Pvt.Ltd., 1971.

Semester	Fifth		
Course Name	**Multivariate Calculus**		
Category: Core	Code: **BSM 1501**	Credits:6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Functions of several variables, limit and continuity of functions of two variables partial differentiation, total differentiability and differentiability, sufficient condition fordifferentiability, chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes. ([1]: Chapter 11).

Module II: Extrema of functions of two variables, method of Lagrange's multipliers, constrained optimization problems, definition of vector field, divergence and curl.([1]: Chapter 11).

Module III: Double integration over rectangular region, double integration over non-rectangular region, double integrals in polar co-ordinates, change of order of integration, **t**riple integrals, triple integral over a parallelepiped and solid regions, volume by triple integrals, cylindrical and spherical co-ordinates, change of variables in double integrals and triple integrals. ([1]: Chapter 12).

Module IV: Line integrals, applications of line integrals: Mass and Work, Fundamental theorem for line integrals, conservative vector fields, independence of path, surface integrals, integrals over parametrically defined surfaces, Green's theorem,Gauss Divergence theorem. ([1]: Chapter 13).

REFERENCES:

Text Book:

[1]. M. J. Strauss, G. L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), New Delhi, 2007.

Reference Books:

[2]. S. C. Malik and S. Arora, *Mathematical Analysis*, 2nd Ed., Wiley Eastern Ltd., 1991.

[3]. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE), Indian reprint, 2005.

[4]. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

[5]. Shanti Narayan, *Elements of Real Analysis*, (6th Edition) S. Chand Publication, 2006.

Semester	Fifth		
Course Name	**Group Theory II**		
Category: Core	Code: **BSM 1502**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Automorphism, Inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups. ([1]: Chapter 6). Characteristic subgroups, commutator subgroup and its properties.([1]: Chapter 8).

Module II: Properties of external direct products, the group of units modulo n as an external direct product ([1]: Chapter 8). Internal direct products ([1]: Chapter 9).Fundamental theorem of finite Abelian groups. ([1]: Chapter 11).

Module III: Group actions, stabilizers and kernels, permutation representation associated with a given group action, applications of group actions, groups acting on themselves by conjugation. ([1]: Chapter 29).

Module IV: Class equation and consequences, conjugacy in Sn, *p*-groups, Sylow's I and II theorems only and its consequences, Cauchy's theorem ([1]: Chapter 24). Simplicity of A_n for $n \geq 5$, non-simplicity tests, Generalized Cayley's theorem (without proof), Index theorem. ([1]: Chapter 25).

REFERENCES:

Text Book:

[1]. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa Publishing House, 1999.

Reference Books:

[2]. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.

[3]. David S. Dummit and Richard M. Foote, *Abstract Algebra*, 3rd Ed., John Wiley and Sons(Asia) Pvt. Ltd., Singapore, 2004.

[4]. J. R. Durbin, Modern *Algebra*, John Wiley & Sons, New York Inc., 2000.

[5]. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.

Semester	Sixth		
Course Name	**Metric Spaces** and **Complex Analysis**		
Category: Core	Code: **BSM 1601**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Metric spaces: definition and examples, sequences in metric spaces, Cauchy sequences, complete metric spaces, open and closed balls, neighborhood, open set, interior of a set, limit point of a set, closed set, diameter of a set. ([1]: Chapter 1 & 2).

Module II: Representation of Complex numbers, functions of complex variable, limits, continuity, differentiability, Analytic functions, Cauchy-Riemann equations, sufficient conditions for differentiability, Analyticity of elementary functions,Harmonic functions. ([2]: Chapter 2 & 3).

Module III: Line integral, Contours, contour integrals and its examples, Cauchy theorem(without proof), Cauchy-Goursat theorem, Cauchy integral formula, Liouville'stheoremand the fundamental theorem of algebra. ([2]: Chapter 4).

Module IV: Power series, Taylor's and Laurent's series, singularities, residues, residues at infinity, Cauchy residue theorem, Evaluation of integral of the type $\int_0^{2\pi} f(\cos\theta,\sin\theta)\,d\theta$ and $\int_{-\infty}^{\infty} f(z)\,dz$. ([2]: Chapter 5&6).

REFERENCES:

Text Books:

[1]. Q. H. Ansari, *Metric Spaces*, Narosa Publication, New Delhi, 2010.

[2]. J. W. Brown and Ruel V. Churchill, *Complex Variables and Applications*, 8th Edition, McGraw – Hill International Edition, 2009.

Reference Books:

[3]. G. F. Simmons, *Introduction to Topology and Modern Analysis*, McGraw-Hill, 2004.

[4]. S. Kumaresan, *Topology of Metric Spaces*, 2nd Ed., Narosa Publishing House, 2011.

[5]. E. C. Titchmarsh, *The Theory of Functions*, 2nd Ed. Oxford University Press, 1939.

[6]. S. Ponnusamy, *Foundation of Complex Analysis*, Narosa Publication, 2003.

Semester	Sixth		
Course Name	**Ring Theory and Linear Algebra II**		
Category: Core	Code: **BSM 1602**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains,factorization of polynomials([1]: Chapter 16).Reducibility tests, irreducibility tests, Eisenstein criterion, unique factorization in Z[x]. ([1]: Chapter 17). Divisibility in integral domains, irreducibles, primes, unique factorization domains, Euclidean domains. ([1]: Chapter 18).

Module II: Linear functionals, dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. ([2]: Chapter 3).

Module III: Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator ([2]: Chapter 6). Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements. ([2]: Chapter 8).

Module IV: Bessel's inequality, the adjoint of a linear operator, Minimal solutions to systems of linear equations, Normal and self-adjoint operators. ([2]: Chapter 8 & 9).

REFERENCES:

Text Books:

[1]. Joseph A. Gallian, *Contemporary Abstract Algebra*, 4th Ed., NarosaPublishing House, 1999.
[2]. Kenneth Hoffman, *Ray Alden Kunze*, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971.

Reference Books:

[3]. S. Lang, *Introduction to Linear Algebra*, 2nd Ed., Springer, 2005.
[4]. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
[5]. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.
[6]. S. Kumaresan, *Linear Algebra- A Geometric Approach*, Prentice Hall of India, 1999.
[7]. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.

DSE I

Semester	Fifth		
Course Name	**Differential Geometry**		
Category: DSE I	Code: **BSM 1551**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formulae, Osculating circles and spheres, existence of space curves, Evolutes and involutes of curves. ([1]: Chapter 1).

Module II: Theory of Surfaces: parametric curves on surfaces, direction coefficients, First and second Fundamental forms, Principal and Gaussian curvatures, Lines of curvature, Euler's theorem, Rodrigue's formula, Conjugate and Asymptotic lines. ([1]: Chapter 4).

Module III: Geodesics: canonical geodesic equations, nature of geodesics on a surface of revolution, Clairaut's theorem, normal property of geodesics, Torsion of a geodesic, Geodesic, curvature, Gauss-Bonnet theorem.([1]: Chapter 6).

Module IV: Tensors: summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3-index Christoffel symbols, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence.([2]: Chapter 1).

REFERENCES:

Text Book:

[1]. C.E. Weatherburn, *Differential Geometry of Three Dimensions*, Cambridge University Press 2003.

[2]. U.C. De, Absos Ali Shaikh and JoydeepSengupta, *Tensor Calculus*, 2nd Ed. Alpha Science International Ltd., Horrow, UK, 2014.

Reference Books:

[3]. T.J. Willmore, *An Introduction to Differential Geometry*, Dover Publications, 2012.

[4]. B. O'Neill, *Elementary Differential Geometry*, 2nd Ed., Academic Press, 2006.

[5]. D.J. Struik, *Lectures on Classical Differential Geometry*, Dover Publications, 1988.

Semester	Fifth		
Course Name	**Number Theory**		
Category: DSE I	Code: **BSM 1552**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Divisibity Theorem in Integers, Primes and their Distributions, Fundamental Theorem of Arithmetic, Greatest Common Divisor, Euclidean Algorithms, Modular Arithmetic, Linear Diophantine Equation. ([1]: Chapter 2).Prime Counting Function, Statement of Prime Number theorem, Gold Bach Conjecture.([1]: Chapter 3).

Module II: Introduction to Congruence, Linear Congruence. Chinese Remainder Theorem.([1]: Chapter 4).Polynomial Congruence, System of Linear Congruence, complete set of Residues, Chinese Remainder Theorem, Fermat's Little Theorem, Wilsons Theorem.([1]: Chapter 5).

Module III: Number Theoretic Functions, Sum and Number of Divisors, Totally Multiplicative Functions, Definition and Properties of the Dirichlet Product, the Mobius Inversion Formula, the Greatest Integer Function. ([1]: Chapter 6).Euler's Phi function, Euler's Theorem, Reduced Set of Residues, Some Properties of Eulers Phi-Function.([1]: Chapter 7).

Module IV: Order of an Integer Modulo N, Primitive Roots for Primes, Composite Numbers Having Primitive Roots. ([1]: Chapter 8).Euler's Criterion, The Legendre Symbol and its Properties, Quadratic Reciprocity, Quadratic Congruence with Composite Moduli.([1]: Chapter 6).

Text Book:

[1]. D. M. Burton: *Elementary Number Theory*, (6thEditiobn), McGraw Hill.

Reference Books:

[2]. K.H. Rosen: *Elementary Number Theory & its Applications*, Pearson Addition Wesley.

[3]. I. Niven and H.S. Zuckerman: *An Introduction to Theory of Numbers*, Wiley Eastern Pvt. Ltd.

[4]. Neville Robinns, Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.

Semester	Fifth		
Course Name	**Analytical Geometry**		
Category: DSE I	Code: **BSM 1553**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: General equation of second degree ([1]: Chapter 2), polar equation of a conic and its properties. ([1]: Chapter 4),system of conics, ([1]: Chapter 5), confocal conics. ([1]: Chapter 6).

Module II: Three dimensional system of co-ordinates ([1]: Chapter 1), projection and direction cosines ([1]: Chapter 1), Plane ([1]: Chapter 1), Straight line. ([1]: Chapter 1).

Module III: Sphere ([1]: Chapter 2), cone ([1]: Chapter 3) and cylinder. ([1]: Chapter 3).

Module IV: Central conicoids ([1]: Chapter 4),plane sections of general conicoids. ([1]: Chapter 6), generating lines of conicoids ([1]: Chapter 7), reduction of general equation of second degree. ([1]: Chapter 9).

REFERENCES:

Text Book:

[1]. R. Ballabh, *A Text Book of Co-Ordinate Geometry*, 12th Ed.Prakashan Kendra, Lucknow, 1987.

Reference Books:

[2]. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.

[3]. R. J. T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

DSE II

Semester	Fifth		
Course Name	**Mathematical Modeling**		
Category: DSE II	Code: BSM **1554**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Introduction to Mathematical modeling, its need, techniques and classifications. Linear growthand decay model and its uses in modeling dynamical and geometrical problems, mathematicalmodeling in population dynamics and Economics.([1]: Chapter 1, 2& 3).

Module II: Compartmental model, exponential decay model, Mathematical Modeling in Economics,Exponential growth of population.([1]: Chapter 2 &3).

Module III: Modeling through linear programming; graphical solution, simplex method.([1]: Chapter 10).

Module IV: Mathematical models on environmental pollution: air and water pollution.([1]: Chapter 6).

REFERENCES:

Text Book:

[1].J. N. Kapur,*Mathematical Modeling*, New Age International Publisher, 2005.

Reference Books:

[2].Frank R. Giordano, D. Maurice Weir and William P. Fox: *A First Course in MathematicalModeling*, Thomson Learning, London and New York, 2003.
[3].J. N. Kapur,*Mathematical Modeling in medicine and Biology*, New Age Publication.
[4].D. N. Burghes,*Mathematical Modeling in the Social Management and Life Science*, Ellie Herwood and John Wiley.

Semester	Fifth		
Course Name	**Boolean Algebra and Automata Theory**		
Category: DSE II	Code: **BSM1555**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, lattices as ordered sets, lattices as algebraic structures, sub lattices, products and homomorphism. ([1]: Chapter 7).

Module II: Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials, Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits. ([1]: Chapter 10).

Module III: Introduction: Alphabets, strings, and languages, Finite Automata and Regular Languages: deterministic and non-deterministic finite automata, regular expressions, regular languages and their relationship with finite automata, pumping lemma and closure properties of regular languages. ([2]: Chapter 3, 4 & 5).

Module IV: Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages. ([2]: Chapter 6 &7).

REFERENCES:

Text Books:

[1]. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, 7th Ed., McGraw-Hill, Indian Edition, 2012.

[2]. K. L. P. Mishra and N. Chandrasekaran, *Theory of Computer Science, Automata, Languages and Computation*, 3rd Ed. Printice Hall of India Pvt. Ltd., New Delhi, 2008.

Reference Books:

[3]. Peter Linz, *Formal Languages and Automata*, Narosa Publishing House, New Delhi.

[4]. B. A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge University Press, Cambridge, 1990.

[5]. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*, (2nd Ed.), Pearson Education (Singapore), Indian Reprint 2003.

[6]. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Semester	Fifth		
Course Name	**Probability and Statistics**		
Category: DSE II	Code: **BSM 1556**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Probability and random variable: Addition and Multiplication theorem of probability, conditional probability, Baye's theorem, Moments and Moment generating function, Skewness and Kurtosis. ([1]: Chapter 3,4 & 6).

Module II: Discrete distribution: Binomial and Poisson distribution and their properties. Continuous Distribution:Distribution function, Probability density function, Normal distribution and its properties, Statement of Lindberg-Levy, Central Limit theorem.([1]: Chapter 7, 8).

Module III: Fitting of the curve by method of Least-Squares: Straight line, Parabola and Exponential curves. Correlation, Regression and their properties, Statistical quality control chart (Mean, Range, *p, np* and*c*charts). ([1]: Chapter 9, 10).

Module IV: Hypothesis Testing: Definition and formulation of hypothesis. Sampling: Various type of sampling. Small Sample Test: *t*, *F* and *Chi-square* tests. Large Sample Test: *Z test*.([1]: Chapter 12, 13 & 14).

REFERENCES:

Text Book:

[1]. S.C. Gupta and V.K. Kapur, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons Publishers, New Delhi. 2002.

[2]. J. N. Kapur and H. C. Saxena, *Mathematical Statistics*, 20th Ed., S. Chand Publishers, New Delhi, 2001.

Reference Books:

[3]. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.

[4]. Irwin Miller, Marylees Miller and John E. Freund, *Mathematical Statistics with Applications*, 7th Ed., Pearson Education, Asia, 2006.

[5]. S. Ross, *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint, 2007.

DSE III

Semester	Sixth		
Course Name	**Theory of Equations**		
Category: DSE III	Code: **BSM 1651**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: General properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, relation between the roots and the coefficients of equations. ([1]: Chapter 1, 2 & 3).

Module II: Symmetric functions, applications of symmetric function of the roots, transformation of equations, solutions of reciprocal and binomial equations, algebraic solutions of the cubic and biquadratic, properties of the derived functions. ([1]: Chapter 3, 4, 5, 6 & 7).

Module III: Symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations. ([1]: Chapter 8 & 9).

Module IV: Separation of the roots of equations, Strums theorem, applications of Strum's theorem, conditions for reality of the roots of an equation and biquadratic, solution of numerical equations. ([1]: Chapter 10 & 11).

REFERENCES:

Text Book:

[1]. W. S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.

Reference Books:

[2]. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.
[3]. H. W. Turnbull, *Theory of Equations,*Interscience Publication, 1947.

Semester	Sixth		
Course Name	**Linear Programming**		
Category: DSE III	Code: **BSM 1652**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Introduction to linear programming problem ([1]: Chapter 2), Theory of simplex method, optimality and unboundedness, simplex algorithm, introduction to artificial variables, two-phase method, Big-M method and their comparison. ([1]: Chapter 3).

Module II: Duality, formulation of the dual problem, primal-dual relationships, dual simplex method. ([1]: Chapter 4).

Module III: Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.([1]: Chapter 5).

Module IV: Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games. ([1]: Chapter 13).

REFERENCES:

Text Book:

[1]. Hamdy A. Taha, *Operation Research: An Introduction*, 8th Ed., Prentice-Hall India, 2007.

Reference Books:

[2]. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
[3]. G. Hadley, *Linear Programming*, Narosa Publishing House, New Delhi, 2002.
[4]. F.S. Hillierand G.J. Lieberman, *Introduction to Operations Research*, 9th Ed., Tata McGraw Hill, Singapore, 2009.

Semester	Sixth		
Course Name	**Industrial Mathematics**		
Category: DSE III	Code: **BSM 1653**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Medical Imaging and Inverse Problems: The content is based on Mathematics of X-ray and CT scan based on the knowledge of calculus, Elementary differential equations, Complex numbers and matrices.([1]: Chapter 1 & 4).

Module II: Introduction to Inverse problems: Illustration of Inverse problems in Pre-Calculus, Calculus, Matrices and differential equations, Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.([1]: Chapter 5 & 8).

Module III:X-ray: Introduction, X-ray behavior and Beers Law (The fundament question of imageconstruction), Lines in the place, Radon Transform: Definition and Examples, Linearity, Phantom (Shepp-Logan, Phantom–Mathematical phantoms), Back Projection, Definition, Properties and examples.([1]: Chapter 1, 2 & 3).

Module IV:CT scan: Revision of properties of Fourier and inverse Fourier transforms and applications of their properties in image reconstruction, Algorithms of CT scan machine, Algebraic reconstruction techniques abbreviated as ART with application to CT scan.([1]: Chapter 5, 9 & 10).

REFERENCES:

Text Book:

[1]. Timothy G. Feeman,*The Mathematics of Medical Imaging, A Beginners Guide*, Springer Under graduate Text in Mathematics and Technology, Springer, 2010.

Reference Books:

[2]. C.W. Groetsch,*Inverse Problems, Activities for Undergraduates*, The Mathematical Association of America, 1999.
[3]. Andreas Kirsch,*An Introduction to the Mathematical Theory of Inverse Problems*, 2nd Ed., Springer, 2011.

DSE IV

Semester	Sixth		
Course Name	**Graph Theory**		
Category: DSE IV	Code: **BSM 1654**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Examples and basic properties of graphs, finite and infinite graphs, incidence and degree, isolated and pendent vertices, Null graph, pseudo graph, complete graph, bipartite graph. ([1]: Chapter 1).

Module II: Isomorphism, subgraphs, walk, path and circuits, connected graph, disconnected graph and components. ([1]: Chapter 2).

Module III: Euler circuit, Euler graph, Chinese post man problem, Hamiltonian circuit, Hamiltonian graph, travelling salesman problem. ([1]: Chapter 2).

Module IV: Adjacency matrix, weighted graph, shortest path, Dijikstra's algorithm, Floyed-Warshall algorithm. ([1]: Chapter 7 & 11).

REFERENCES:

Text Book:

[1]. NarsinghDeo, *Graph Theory with Applications to Engineering and Computer Science,* Prentice Hall.

Reference Books:

[2]. B**.** A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge UniversityPress, Cambridge, 1990.

[3]. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*, 2nd Edition, Pearson Education (Singapore), Indian Reprint 2003.

[4]. Rudolf Lidl and Gunter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts inMathematics, Springer (SIE), Indian reprint, 2004.

Semester	Sixth		
Course Name	**Mechanics**		
Category: DSE IV	Code: **BSM 1655**	Credits: 6	
L-5 T-1 P-0	Theory Exam: 3 Hrs	ESE: 60 Marks	CIA: 40 Marks

SYLLABUS

Module I: Work: virtual work ([1]: Chapter 5 & 10). Stable and unstable equilibrium. ([1]: Chapter 9).

Module II: Forces in three dimensions, Poinsot's central axis, Wrenches, Null line and Null plane. ([1]: Chapter 10 & 11).

Module III: Rectilinear simple harmonic motion, motion under the Earth's attraction ([2]: Chapter 2). Component of velocity and acceleration in polar and intrinsic systems, Central forces, Apses and Apsidal distances. ([2]: Chapter 4 & 6).

Module IV: Kepler's laws of motion, planetary motion ([2]: Chapter 5). Constrained motion, Conservation of energy, Motion on a rough curve ([2]: Chapter 6). Motion in resisting medium, motion when the mass varies. ([2]: Chapter 7)

REFERENCES:

Text Books:

[1]. S. L. Loney, *An Elementary Treatise on Statics*, Kalyani Publishers, New Delhi.

[2]. S. L. Loney, *An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies*, H. M. Publications, Agra.

Reference Books:

[3]. R. S. Verma, *A Text Book on Statics*, Pothishala Pvt. Ltd., Allahabad.

[4]. J. L. Synge and B. A. Griffith - Principles of Mechanics, Tata McGraw-Hill, 1959.