SYLLABUS FOR B.SC. (General)

IN

MATHEMATICS

Under Choice Based Credit System (CBCS)

Effective from 2017-2018

The University of Burdwan
Burdwan-713104
West Bengal

Details of Courses of B.A. (General) under CBCS

Course		Credit		Marks
1.	**Core Course** (8 papers) 4 core papers each in 2 disciplines of choice	**Theory + Practical** 8×(4+2)=48	**Theory +Tutorial** 8×(5+1)=48	8×75=600
2.	**Language course** (4 Papers)		**Theory +Tutorial** 4×(5+1)=24	4×75=300
3.	**Elective Course** A. **DSE** (4 Papers)	4×(4+2)=24	4×(5+1)=24	4×75=300
	B. **GE** (2 Papers)	2×(4+2)=12	2×(5+1)=12	2×75=150
4.	**Ability Enhancement Course**			
	A. AECC (2 Papers) **AECC1 (ENVS)** **AECC2 (English/MIL)**	4×1=4 2×1=2	4×1=4 2×1=2	100 50
	B. SEC (4 Papers)	4×2=8	4×2=8	4×50=200
	Total Credit :	**122**	**122**	**1700**

Details of Courses of B.Sc. (General) under CBCS

Course		Credit		Marks
1.	**Core Course** (12 papers) 4 core papers each in 3 disciplines of choice	**Theory + Practical** 12×(4+2)=72	**Theory +Tutorial** 12×(5+1)=72	12×75=900
2.	**Elective Course** **DSE** (6 Papers)	6×(4+2)=36	6×(5+1)=36	6×75=450
3.	**Ability Enhancement Course**			
	A. AECC (2 Papers) AECC1 (ENVS) AECC2 (English/MIL)	4×1=4 2×1=2	4×1=4 2×1=2	100 50
	B. SEC (4 Papers)	4×2=8	4×2=8	4×50=200
	Total Credit :	**122**	**122**	**1700**

B.A. Mathematics General Course Structure

Semester	Core Course (CC)(8)	Language Course (4)	Elective Course		Ability Enhancement Course	
			DSE(4)	GE(2)	AECC (2)	SEC (4)
I	**CC1A (Mathematics)** CC2A(Other discipline)	L_1-1			AECC1	
II	**CC1B (Mathematics)** CC2B(Other discipline)	L_2-1			AECC2	
III	**CC1C (Mathematics)** CC2C(Other discipline)	L_1-2				**SEC1 (Mathematics)** Or SEC1 (Other discipline)
IV	CC1D (Mathematics) CC2D(Other discipline)	L_2-2				**SEC2 (Mathematics)** Or SEC2 (Other discipline)
V			**DSE1A (Mathematics)** DSE2A(Other discipline)	GE-1 (Other discipline)		**SEC3 (Mathematics)** Or SEC3 (Other discipline)
VI			**DSE1B (Mathematics)** DSE2B(Other discipline)	GE-2 (Other discipline)		**SEC4 (Mathematics)** Or SEC4 (Other discipline)

B.Sc. Mathematics General Course Structure

Semester	Core Course (CC)(12)	Discipline Specific Elective (DSE)(6)	Ability Enhancement Course	
			AECC (2)	SEC (4)
I	**CC1A (Mathematics)** CC2A(Other discipline) CC3A(Other discipline)		AECC1	
II	**CC1B (Mathematics)** CC2B(Other discipline) CC3B(Other discipline)		AECC2	
III	**CC1C (Mathematics)** CC2C(Other discipline) CC3C(Other discipline)			**SEC1 (Mathematics)** Or SEC1 (Other discipline)
IV	**CC1D (Mathematics)** CC2D(Other discipline) CC3D(Other discipline)			**SEC2 (Mathematics)** Or SEC2 (Other discipline)
V		**DSE1A(Mathematics)** DSE2A(Other discipline) DSE3A(Other discipline)		**SEC3 (Mathematics)** Or SEC3 (Other discipline)
VI		**DSE1B(Mathematics)** DSE2B(Other discipline) DSE3B(Other discipline)		**SEC4 (Mathematics)** Or SEC4 (Other discipline)

Core Courses of Mathematics :

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
I	CC	BMG1CC1A	Differential Calculus	5:1:0	6	75	6
II	CC	BMG2CC1B	Differential Equations	5:1:0	6	75	6
III	CC	BMG3CC1C	Real Analysis	5:1:0	6	75	6
IV	CC	BMG4CC1D	Algebra	5:1:0	6	75	6

Discipline Specific Electives (DSE)

Choices for BMG5DSE1A (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
V	DSE	**BMG5DSE1A1**	Matrices	5:1:0	6	75	6
	DSE	**BMG5DSE1A2**	Mechanics	5:1:0	6	75	6
	DSE	**BMG5DSE1A3**	Linear Algebra	5:1:0	6	75	6

Choices for DSE1B (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
VI	DSE	**BMG6DSE1B1**	Numerical Methods	5:1:0	6	75	6
	DSE	**BMG6DSE1B2**	Complex Analysis	5:1:0	6	75	6
	DSE	**BMG6DSE1B3**	Linear Programming	5:1:0	6	75	6

Skill Enhancement Courses (SEC)

Choices for SEC 1 (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
III	SEC	BMG3SEC11	Logic and Sets	2:0:0	2	50	2
	SEC	BMG3SEC12	Analytical Geometry	2:0:0	2	50	2
	SEC	BMG3SEC13	Integral Calculus	2:0:0	2	50	2

Choices for SEC 2 (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
IV	SEC	BMG4SEC21	Vector Calculus	2:0:0	2	50	2
	SEC	BMG4SEC22	Theory of Equations	2:0:0	2	50	2
	SEC	BMG4SEC23	Number Theory	2:0:0	2	50	2

Choices for SEC 3 (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
V	SEC	BMG5SEC31	Probability and Statistics	2:0:0	2	50	2
	SEC	BMG5SEC32	Mathematical Finance	2:0:0	2	50	2
	SEC	BMG5SEC33	Mathematical Modeling	2:0:0	2	50	2

Choices for SEC 4 (Choose any one)

Semester	Course Type	Course Code	Name of the Course	Credit Pattern (L:T:P)	Total class hrs./week	Marks	Credit
VI	SEC	BMG6SEC41	Boolean Algebra	2:0:0	2	50	2
	SEC	BMG6SEC42	Transportation and Game Theory	2:0:0	2	50	2
	SEC	BMG6SEC43	Graph Theory	2:0:0	2	50	2

Course : BMG1CC1A

Differential Calculus (Marks : 75)

Total lecture hours: 60

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions,Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem onhomogeneous functions. 20L

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves.Parametricrepresentation of curves and tracing of parametric curves, Polar coordinates and tracing of curvesin polar coordinates. 15L

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's formsof remainder, Taylor's series, Maclaurin's series of sin x, cos x, e^x, log(l+x), $(l+x)^n$, Maxima andMinima, Indeterminate forms. 25L

Books Recommended:

1. H. Anton, I. Birens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.

Course :BMG2CC1B

Differential Equations (Marks : 75)

Total lecture hours: 60

First order exact differential equations. Integrating factors, rules to find an integrating factor.First order higher degree equations solvable for x, y, p. Methods for solving higher-orderdifferential equations. Basic theory of linear differential equations, Wronskian, and its properties.
Solving a differential equation by reducing its order. 20L

Linear homogenous equations with constant coefficients, Linear non-homogenous equations,The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differentialequations, Total differential equations. 16L

Order and degree of partial differential equations, Concept of linear and non-linear partialdifferential equations, Formation of first order partial differential equations, Linear partialdifferential equation of first order, Lagrange's method, Charpit's method. 15L

Classification of second order partial differential equations into elliptic, parabolic and hyperbolicthrough illustrations only. 9L

Books Recommended:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition,1967.

Course :BMG3CC1C

Real Analysis (Marks : 75)

Total lecture hours: 60

Finite and infinite sets, examples of countable and uncountable sets.Real line, bounded sets,suprema and infima, completeness property of R, Archimedean property of R, intervals.Conceptof cluster points and statement of Bolzano-Weierstrass theorem. 15L

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy'stheorem on limits, order preservation and squeeze theorem, monotone sequences and theirconvergence (monotone convergence theorem without proof). 15L

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series,comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test(Tests of Convergence without proof). Definition and examples of absolute and conditionalconvergence. 15L

Sequences and series of functions, Pointwise and uniform convergence.M_n-test, M-test,Statements of the results about uniform convergence and integrability and differentiability offunctions, Power series and radius of convergence. 15L

Books Recommended :

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P.Ltd., 2000.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series*- Undergraduate Texts inMathematics, Springer Verlag, 2003.

Course :BMG4CC1D

Algebra (Marks : 75)

Total lecture hours: 60

Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n ofintegers under addition modulo n and the group U(n) of units under multiplication modulo n.Cyclic groups from number systems, complex roots of unity, circle group, the general lineargroup $GL_n(n,R)$, groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle,(iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions. 20L

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and thecommutator subgroup of group, examples of subgroups including the center of a group.Cosets,Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition,examples, and characterizations, Quotient groups. 20L

Definition and examples of rings, examples of commutative and non-commutative rings: ringsfrom number systems, Z_n the ring of integers modulo n, ring of real quaternions, rings ofmatrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integraldomains and fields, examples of fields: Z_p, Q, R, and C. Field of rational functions. 20L

Books Recommended:

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002**.**
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.

Course :BMG5DSE1A1
Matrices (Marks : 75)

Total lecture hours: 60

R, R_2, R_3 as vector spaces over R. Standard basis for each of them. Concept of LinearIndependence and examples of different bases.Subspaces of R_2, R_3. 10L

Translation, Dilation, Rotation, Reflection in a point, line and plane.Matrix form of basicgeometric transformations. Interpretation of eigen values and eigen vectors for suchtransformations and eigen spaces as invariant subspaces.15L

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations.Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equationswith number of equations and unknowns upto four. 15L

Matrices in diagonal form.Reduction to diagonal form upto matrices of order 3.Computation ofmatrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linearequations using matrices.Illustrative examples of above concepts from Geometry, Physics,Chemistry, Combinatorics and Statistics. 20L

Books Recommended :

1. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd.,New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

Course :BMG5DSE1A2
Mechanics (Marks : 75)

Total lecture hours: 60

Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body, Laws offriction, Problems of equilibrium under forces including friction, Centre of gravity, Work andpotential energy. Velocity and acceleration of a particle along a curve: radial and transversecomponents (plane curve), tangential and normal components (space curve), Newton's Laws ofmotion, Simple harmonic motion, Simple Pendulum, Projectile Motion. 60L

Books Recommended :

1. A.S. Ramsay, *Statics*, CBS Publishers and Distributors (Indian Reprint), 1998.
2. A.P. Roberts, *Statics and Dynamics with Background in Mathematics*, Cambridge UniversityPress, 2003.

Course :BMG5DSE1A3
Linear Algebra (Marks : 75)

Total lecture hours: 60

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors,linear span, linear independence, basis and dimension, dimension of subspaces. 20L

Linear transformations, null space, range, rank and nullity of a linear transformation, matrixrepresentation of a linear transformation, algebra of linear transformations.Dual Space, DualBasis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinatematrix. 40L

Books Recommended :

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra,* 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, *Linear Algebra and its Applications,* 3rd Ed., Pearson Education Asia, IndianReprint, 2007.
3. S. Lang, *Introduction to Linear Algebra,* 2nd Ed., Springer, 2005.
4. Gilbert Strang, *Linear Algebra and its Applications,* Thomson, 2007.

Course :BMG6DSE1B1
Numerical Methods (Marks : 75)

Total lecture hours: 60

Algorithms, Convergence, Bisection method, False position method, Fixed point iterationmethod, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel andSOR iterative methods. 25L

Lagrange and Newton interpolation: linear and higher order, finite difference operators.Numerical differentiation: forward difference, backward difference and central Difference.Integration: trapezoidal rule, Simpson's rule, Euler's method for solving ordinary differential equations.. 35L

Books Recommended :

1. B. Bradie, *A Friendly Introduction to Numerical Analysis,* Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and EngineeringComputation,* 5th Ed., New age International Publisher, India, 2007.

Course :BMG6DSE1B2
Complex Analysis (Marks : 75)

Total lecture hours: 60

Limits, Limits involving the point at infinity, continuity.Properties of complex numbers, regionsin the complex plane, functions of complex variable, mappings.Derivatives, differentiationformulas, Cauchy-Riemann equations, sufficient conditions for differentiability. 20L

Analytic functions, examples of analytic functions, exponential function, Logarithmic function,trigonometric function, derivatives of functions, definite integrals of functions.

Contours,Contour integrals and its examples, upper bounds for moduli of contour integrals.Cauchy-Goursat theorem, Cauchy integral formula. 20L

Liouville's theorem and the fundamental theorem of algebra.Convergence of sequences andseries, Taylor series and its examples. 12L

Laurent series and its examples, absolute and uniform convergence of power series. 8L

Books Recommended :

1.James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications,* 8th Ed.,McGraw – Hill International Edition, 2009.
2.Joseph Bak and Donald J. Newman, *Complex analysis,* 2nd Ed., Undergraduate Texts inMathematics, Springer-Verlag New York, Inc., New York, 1997.

Course :BMG6DSE1B3
Linear Programming (Marks : 75)

Total lecture hours: 60

Linear Programming Problems, Graphical Approach for solving some Linear Programs.ConvexSets, Supporting and Separating Hyperplanes.Theory of simplex method, optimality andunboundedness, the simplex algorithm, simplex method in tableau format, introduction toartificial variables, two-phase method, Big-M method and their comparison. 40L

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation ofthe dual. 20L

Books Recommended :

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear programming and NetworkFlows,* 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research,* 8th Ed., Tata McGrawHill, Singapore, 2004.
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

Course : BMG3SEC11
Logic and Sets (Marks :50)

Total lecture hours: 40

Introduction, propositions, truth table, negation, conjunction and disjunction.Implications,biconditional propositions, converse, contra positive and inverse propositions and precedence oflogical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers:Introduction, Quantifiers, Binding variables and Negations. 16L

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite andinfinite sets.Finite sets and counting principle. Empty set, properties of empty set. Standard setoperations. Classes of sets. Power set of a set. 12L

Difference and Symmetric difference of two sets. Set identities, Generalized union andintersections. Relation: Product set, Composition of relations, Types of relations, Partitions,Equivalence Relations with example of congruence modulo relation. 12L

Book Recommended :

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education,1998.
2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.
3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.

Course : BMG3SEC12
Analytical Geometry (Marks : 50)

Total lecture hours: 40

Techniques for sketching parabola, ellipse and hyperbola.Reflection properties of parabola,ellipse and hyperbola.Classification of quadratic equations representing lines, parabola, ellipseand hyperbola.spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaceslike cone, ellipsoid. 40L

Books Recommended :

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.
4. R. J.T. Bell, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillanIndia Ltd., 1994.

Course : BMG3SEC13
Integral Calculus (Marks :50)

Total lecture hours: 40

Integration by Partial fractions, integration of rational and irrational functions. Properties ofdefinite integrals. Reduction formulae for integrals of rational, trigonometric, exponential andlogarithmic functions and of their combinations. 25L

Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. Doubleand Triple integrals. 15L

Books Recommended :

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

Course :BMG4SEC21
Vector Calculus (Marks :50)

Total lecture hours: 40

Differentiation and partial differentiation of a vector function. Derivative of sum, dot productand cross product of two vectors.
Gradient, divergence and curl. 40L

Books Recommended :

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

Course :BMG4SEC22
Theory of Equations (Marks :50)

Total lecture hours: 40

General properties of polynomials, Graphical representation of a polynomials, maximum andminimum values of a polynomials, General properties of equations, Descarte's rule of signspositive and negative rule, Relation between the roots and the coefficients of equations. 20L

Symmetric functions, Applications 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. 20L

Books Recommended :

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2. C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

Course :BMG4SEC23
Number Theory (Marks :50)

Total lecture hours: 40

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem ofarithmetic, prime counting function, statement of prime number theorem, Goldbach conjecture,binary and decimal representation of integers, linear congruences, complete set of residues. 20L

Number theoretic functions, sum and number of divisors, totally multiplicative functions,definition and properties of the Dirichlet product, the Möbius inversion formula, the greatestinteger function, Euler's phi-function. 20L

Books Recommended:

1. David M. Burton, *Elementary Number Theory* 6th Ed., Tata McGraw-Hill Edition, Indianreprint, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra withMaple*, CRC Press, Boca Raton, 2000.
3. Neville Robinns, *Beginning Number Theory*, 2nd Ed., Narosa Publishing House Pvt. Limited,Delhi, 2007.

Course :BMG5SEC31
Probability and Statistics (Marks :50)

Total lecture hours: 40

Sample space, probability axioms, real random variables (discrete and continuous), cumulativedistribution function, probability mass/density functions, mathematical expectation, moments,moment generating function, characteristic function, discrete distributions: uniform, binomial,Poisson, continuous distributions: uniform, normal, exponential. 20L

Joint cumulative distribution function and its properties, joint probability density functions,marginal and conditional distributions, expectation of function of two random variables,conditional expectations, independent random variables. 20L

Books Recommended:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to MathematicalStatistics*, Pearson Education, Asia, 2007.

2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application,*7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Model,* 9th Ed., Academic Press, Indian Reprint,2007.

Course :BMG5SEC32
Mathematical Finance (Marks :50)

Total lecture hours: 40

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound,discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds,bond prices and yields. Floating-rate bonds, immunization. 22L

Asset return, short selling, portfolio return, (brief introduction to expectation, variance,covariance and correlation), random returns, portfolio mean return and variance, diversification,portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2constraints). 18L

Books Recommended:

1. David G. Luenberger, *Investment Science,* Oxford University Press, Delhi, 1998.
2. John C. Hull, Options, *Futures and Other Derivatives,* 6th Ed., Prentice-Hall India, Indianreprint, 2006.
3. Sheldon Ross, *An Elementary Introduction to Mathematical Finance,* 2nd Ed., CambridgeUniversity Press, USA, 2003.

Course :BMG5SEC33
Mathematical Modeling (Marks :50)

Total lecture hours: 40

Applications of differential equations: the vibrations of a mass on a spring, mixture problem, freedamped motion, forced motion, resonance phenomena, electric circuit problem, mechanics ofsimultaneous differential equations. 22L
Applications to Traffic Flow.Vibrating string, vibrating membrane, conduction of heat in solids,gravitational potential, conservation laws. 18L

Books Recommended:

1. Shepley L. Ross, *Differential Equations,* 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations,* McGraw-Hill, International Edition,1967.

Course :BMG6SEC41
Boolean Algebra (Marks :50)

Total lecture hours: 40

Definition, examples and basic properties of ordered sets, maps between ordered sets, dualityprinciple, maximal and minimal elements, lattices as ordered sets, complete lattices, lattices asalgebraic structures, sublattices, products and homomorphisms. 20L

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. 20L

Books Recommended:

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order,* Cambridge University Press,Cambridge, 1990.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra,* 2nd Ed., Undergraduate Texts inMathematics, Springer (SIE), Indian reprint, 2004.

Course :BMG6SEC42
Transportation and Game Theory (Marks :50)

Total lecture hours: 40

Transportation problem and its mathematical formulation, northwest-corner method, least costmethod and Vogel approximation method for determination of starting basic solution, algorithmfor solving transportation problem, assignment problem and its mathematical formulation,Hungarian method for solving assignment problem.25L

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure. 15L

Books Recommended:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and NetworkFlows,* 2nd Ed., John Wiley and Sons, India, 2004.
2. F. S. Hillier and G. J. Lieberman, *Introduction to Operations Research,* 9th Ed., Tata McGrawHill, Singapore, 2009.
3. Hamdy A. Taha, *Operations Research, An Introduction,* 8th Ed., Prentice-Hall India, 2006.

Course :BMG6SEC43
Graph Theory (Marks :50)

Total lecture hours: 40

Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partitegraphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles, theadjacency matrix, weighted graph, travelling salesman's problem, shortest path, Dijkstra'salgorithm, Floyd-Warshall algorithm. 40L

Books Recommended:

1. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory*2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts inMathematics, Springer (SIE), Indian reprint, 2004.