B.A / B.Sc. MATHEMATICS (HONS.)

Course Structure Under

CHOICE BASED CREDIT SYSTEM

FOR

SESSION 2016-2019

BERHAMPUR UNIVERSITY

CORE COURSES

B.A/B.SC. (HONOURS.) –MATHEMATICS

SEMESTER-I

C-1.1: CALCULUS-I

Part-I(Marks:75)

(Theory:60 Marks+Mid-Sem:15 Marks)

Unit-I	:	Hyperbolic functions, Higher Order Derivatives, Leibniz rule and its applications to problems of the type $e^{ax+b}Sinx$; $e^{ax+b}Cosx$; $(ax+b)^nSinx$; $(ax+b)^nCosx$; Concavity and inflection points, Curve tracing in Cartesian coordinates, Tracing in polar coordinates of standard curves, L Hospitals Rule, Curvature and Asymptotes.
Unit-II	:	Reduction formulae, derivations and illustrations of reduction formulae of type $\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \sec^n x dx, \int (\log x)^n dx, \int \sin^n x \cos^n x dx$ Volumes by slicing, disks and washers methods, Volumes by cylindrical shells, Parametric equations, Parameterizing a curve, arc length, arclength of parametric curves, area of surface of revolution.
Unit-III	:	Techniques of sketching conics, refletion properties of conics, rotation of axes and second degree equations, Classiffcation into conics using the discriminant, polar equations of conics. Sphere, Cone, Cylinder, Central conicoids.
Unit-IV	:	Triple product, 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.

Part-II(Practical, Marks:25)

List of Practicals (Using Any Software)

Practical/Lab Work To Be Performed On A Computer.

Record =5 Marks ; Viva-Voce=5 Marks ; Experiment=15 Marks

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. Strophoid, 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.
7. Matrix Operation (Addition, Multiplication, Inverse, Transpose).

Books Recommended:-

1. Mathematics For Degree Students By P.K . Mittal ,S.Chand&Co.(For B.Sc. 1st year).
2. Advanced Analytical Geometry & Vector Analysis By B.K karbooks & Allied (P) Ltd. Kolkatta (Chapter—2,4(4.5,4.7)
3. Topics In calculus By R.K Panda &P.K Satapathy,S.G Publication ,Puri(Chapter-1,2,5)
4. Analytical solid geometry by Shantinaryana & P.K. Mittal ,S. Chand & co.
5. Text book of calculus,part-II by Shantinaryana & P.K. Mittal ,S. Chand & co. , chapters: 6,7,10(art 33-36)
6. Text book of calculus,part-III by Shantinaryana & P.K. Mittal ,S. Chand & co. Chapters: 1(art 1,2), 3(art 7,8), 6(15 restricted) .

Books For Reference:-

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. Analytical Geometry Of Quadratic Surfaces, B.P. Acharya And D.C. Sahu, Kalyani Publishers, New Delhi, Ludhiana.
4. G.B. Thomas And R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005:
5. R. Courant And F. John, Introduction To Calculus And Analysis (Volumes I &Ii), Springer-Verlag,New York, Inc., 1989

C-1.2: Algebra-I

Total Marks:100

Theory:80 Marks+Mid-Sem:20 Marks

5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-I	:	Polar representation of Complex Numbers, n-th roots of Unity, De Moivres theorem for rational indices and its applications.
Unit-II	:	Equivalence relations, functions, composition of functions, invertible functions, one to one correspon-dence and cardinality of a set, well-ordering property of positive integers, division algorithm, divisibility and euclidean algorithm, congruence relation between integers, principles of mathematical induction,statement of fundamental theorem of arithmetic.
Unit-III	:	Vector Spaces, Subspaces, Algebra of Subspaces, Quotient Spaces, Linear Combination of Vectors, Linear Span, Linear Independence, Basis and Dimension, Dimension of Subspaces.
Unit-IV	:	Linear Transformations, Null Space, Range, Rank and Nullity of a Linear

		Transformation, Matrix Representation of a Linear Transformation, Algebra of Linear Transformations. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Books Recommended:-

1. Complex Analysis ,S.Armugan ,A.ThangapandiIssac,A.Somasundaram,SCITECH Publication (India)Pvt. Ltd.Chennai .
2. Discrete Mathematics, R. K Bhist&H.SDhami Oxford University Press Kolkota
3. An introduction to linear algebra by V.Krishna Murthy ,V.P Mainra ,J.L Arora, Affilitated east -west Press Pvt Ltd.(Chapters-3, 4(4.1- 4.7)

Books Reference:-

1. L.V. Ahlfors, Complex Analysis, Mcgraw-Hill(International Student Edn.)
2. TituAndreescu And DorinAndrica, Complex Numbers From A To Z, Birkhauser, 2006: Chapter:2
3. Edgar G. Goodaire And Michael M. Parmenter, Discrete Mathematics With Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005: Chapters:2(2.4), 3,4(4.1-4.1.6,4.2-4.2.11, 4.4(4.1-4.4.8),4.3-4.3.9, 5(5.1-5.1.4)
4. David C. Lay, Linear Algebra And Its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007: Chapters:1(1.1-1.9), 2(2.1-2.3, 2.8, 2.9), 5(5.1,5.2)

SEMESTER-II

C-2.1: Real Analysis (Analysis-I)
Total Marks:100
Theory:80 Marks+Mid-Sem:20 Marks
5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-I	:	Field Structure and Order Structure, Bounded and unbounded sets, supremum, infimum, completeness property of R, Archimedean Property of Real numbers, Dedekind's form of completeness property.
Unit-II	:	Neighbourhood of a point open sets, closed sets and countable sets, limit point of a set, closed sets, closure of a set, countable and uncountable sets, Blozanoweirstrass theorem for sets.
Unit-III	:	Real Sequence: Sequence, Limit Points of a sequence Limit inferior and superior, convergent sequences, Non-convergent sequences (definition), Algebra of sequences Cauchy's general Principle of convergence. Some important theorems of Sequences: Sandwich theorem, Cauchy's first theorem on limits Cesaro's theorem, Monotonic Sequences, Subsequences.
Unit-IV	:	Infinite Series: Positive term series, comparison Tests for positive Term

		Series, Cauchy's root test, D' Alemberts Ratio Test, Raabe's Test, Logarithmic Test Integral Test, Gauss's Test, Series with arbitrary terms, Rearrangement of terms.

Book Recommended:-

1. Mathematical Analysis, S.C Malik &S.Arora .New Age Int.Pub .New Delhi, Chapter-1(1.2 to 1.4), 2,3,4.)

Books For References:-

1. R.G. Bartle And D. R. Sherbert, Introduction To Real Analysis, 3rd Ed., John Wiley And Sons(Asia) Pvt. Ltd., Singapore, 2002:
2. Gerald G. Bilodeau , Paul R. Thie, G.E. Keough, An Introduction To Analysis, 2nd Ed., Jones & Bartlett, 2010:
3. Brian S. Thomson, Andrew. M. Bruckner And Judith B. Bruckner, Elementary Real Analysis,Prentice Hall, 2001:
4. S.K. Berberian, A First Course In Real Analysis, Springer Verlag, New York, 1994:
5. D. SmasundaramAnd B. Choudhury-A First Course In Mathematical Analysis, Narosa Publishing House.
6. S.L. Gupta AndNisha Rani-Real Analysis, Vikas Publishing House Pvt. Ltd., New Delhi.
7. G. Das And S. Pattanayak, Fundamentals Of Mathematics Analysis, Tmh Pub-LishingCo. ,Chapters: 2(2.1 To 2.4, 2.5 To 2.7), 3(3.1-3.5), 4(4.1 To 4.7, 4.10,4.11,4.12, 4.13).

C-2.2: Differential Equations
(Total Marks:100)
Part-I(Marks:75)
Theory:60 Marks+Mid-Sem:15 Marks
04 Lectures(Per Week Per Student)

Unit-I	:	Differential equations and mathematical models. First order and first degree ordinary differential equations (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).
Unit-II	:	Second order linear equations(Both homogeneous and Non-homogeneous) with constant coeffcients, Second order equations with variable coeffcients, Variation of Parameters, Method of Undetermined Coeffcients, Equations Reducible To Linear Equations with Constant Coeffcients, Euler's Equation. Applications of second Order Differential Equations.
Unit-III	:	Power series solutions of second order differential equations.

Unit-IV	:	Laplace transforms and its applications to solutions of differential equations.

Part-II(Practical: Marks:25)
List of Practicals (Using Any Software)
Practical/Lab Work To Be Performed On A Computer
Record =5 Marks ; Viva-Voce=5 Marks ; Experiment=15 Marks

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.

Book Recommended:-

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 To4.7), 5, 7(7.1-7.4), 9(9.1, 9.2, 9.3,9.4, 9.5, 9.10, 9.11, 9.13).

Books For References:-

1. Martin Braun, Differential Equations And Their Applications, Springer International.
2. M.D. Raisinghania-Advanced Differential Equations, S. Chand & Company Ltd.,NewDelhi.
3. G. Dennis Zill-A First Course In Differential Equations With Modelling Applications, Cengage Learning India Pvt. Ltd.
4. S.L. Ross, Differential Equations, John Wiley & Sons, India, 2004.

SEMESTER-III

C-3.1: Theory Of Real Functions (Analysis-II)
Total Marks:100
Theory:80 Marks+Mid-Sem:20 Marks
5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-I	:	Limits of functions ($\in and\ \delta$ approach), sequential criterion for limits, divergence criteria. Limit theorems,one sided limits. Infnite limits and limits at infnity. Continuous functions.
Unit-II	:	Algebra of continuous functions and theorems related to discontinuity and kinds of discontinuity. Continuous functions. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem. Differentiability of a function at a point and in an interval, Caratheodorys

		theorem, algebra of differentiable functions.
Unit-III	:	Relative extrema, interior extremum theorem. Rolles theorem, mean value theorem, intermediate value property of derivatives, Darbouxs theorem. Applications of mean value theorem. Taylors theorem to inequalities.
Unit-IV	:	Cauchys Mean Value Theorem. Taylors Theorem with Lagranges Form of Remainder, Taylors Theorem with Cauchys Form of Remainder, Application of Taylors Theorem to Convex Functions, Relative Extrema. Taylors Series andmaclaurins Series Expansions of Exponential and Trigonometric Functions, $\ln(1 + x), 1/(ax + b)$ & $(1 + x)^n$

Book Recommended:-

1. Mathematical Analysis (4^{TH} Edn.)S.C Malik &S.Arora .New Age Int.Pub .New Delhi Chapter-5,6,7,8.
2. Mathematics for Degree Students By P.K Mital ,Dr U.S Rana,S.Chand& Co

Books For References:-

1. G. Das And S. Pattanayak, Fundamentals Of Mathematics Analysis, Tmh Pub-Lishing Co.,Chapters:6(6.1-6.8), 7(7.1-7.7), 9(9.7) only
2. R. Bartle And D.R. Sherbert, Introduction To Real Analysis, John Wiley And Sons, 2003.
3. K.A. Ross, Elementary Analysis: The Theory Of Calculus, Springer, 2004.
4. A. Mattuck, Introduction To Analysis, Prentice Hall, 1999.
5. S.R. GhorpadeAnd B.V. Limaye, A Course In Calculus And Real Analysis, Springer, 2006.

C-3.2: Group Theory(Algebra-II)

Total Marks:100

Theory:80 Marks+Mid-Sem:20 Marks

5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-I	:	Symmetries of a square, dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.
Unit-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, including fermat's little theorem. An application of cosets to permutation groups.
Unit-III	:	External direct product of a finite number of groups, normal subgroups,

		factor groups, cauchys theorem for finite abelian groups.
Unit-IV	:	Group Homomorphisms, Properties of Homomorphisms, Isomorphisms: Definition and examples Cayleys Theorem, Properties of isomorphisms, first, second and third Isomorphism theorems

Book Recommended:-

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

Books For References:-

1. A Course In Abstract Algebra By V.K Khana& S.K Bhamri ,Vikash Pub. House New Delhi.
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 J. Rotman, An Introduction To The Theory Of Groups, 4th Ed., Springer Verlag, 1995.
5. I.N. Herstein, Topics In Algebra, Wiley Eastern Limited, India, 1975.

C-3.3:Partial Differential Equations And Systems Of Ordinary Differential Equations

(Total Marks:100)

Part-I(Marks:75)

Theory:60 Marks+Mid-Sem:15 Marks

04 Lectures(Per Week Per Student)

Unit-I	:	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 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.
Unit-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.
Unit-III	:	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.
Unit-IV	:	Laplace equation, solution of laplace equation by separation of variables, one dimensional wave equa-tion, solution of the wave equation(method of separation of variables), diffusion equation, solution of one-dimensional diffusion equation, method of separation of variables.

Part-II(Practical: Marks:25)
List of Practicals (Using Any Software)
Practical/Lab work to Be Performed on a Computer.
Record =5 Marks ; Viva-Voce=5 Marks ; Experiment=15 Marks

1. To find the general solution of the non-homogeneous system of the form:

$$\frac{dx}{dt} = a_1x + b_1y + f_1(t), \frac{dy}{dt} = a_2x + b_2y + f_2(t)$$

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 conditions:

(a) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), x \in \mathbb{R}, t > 0$. (b) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), u_x(0,t) = 0, x \in (0,\infty), t > 0$. (c) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), u(0,t) = 0, x \in (0,\infty), t > 0$. (d) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), u(0,t) = 0, u(1,t) = 0, 0 < x < l, t > 0$.

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

(a) $u(x,0) = \phi(x), u(0,t) = a, u(l,t) = b, 0 < x < l, t > 0$.
(b) $u(x,0) = \phi(x), x \in \mathbb{R}, 0 < t < T$.
(c) $u(x,0) = \phi(x), u(0,t) = a, x \in (0,\infty), t \geq 0$.

Book recommended:-

1. J.Sinha Roy and S. Padhy, A course on ordinary and Partial Differential Equations, Kalyani Publishers, 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).

Books for references:-

1. Tynmyint-u and Lokenath Debnath, linear partial deferential equations for scientists and engineers, 4th edition, Springer, Indian Reprint, 2006.
2. S.L. Ross, Differential Equations, 3rd ed., John Wiley and Sons, India, 2004.

SEMESTER-IV

C-4.1: Numerical Methods
(Total Marks:100)
Part-I(Marks:75)
Theory:60 Marks+Mid-Sem:15 Marks
04 Lectures(Per Week Per Student)

Unit-I	:	Algorithms, convergence, errors: relative, absolute, round off, truncation. Transcendental and polynomial equations: bisection method, newtons method, secant method. Rate of convergence of these methods.
Unit-II	:	System of linear algebraic equations: gaussian elimination and gauss jordan methods. Gauss Jacobimethod, gauss seidel method and their convergence analysis.
Unit-III	:	Interpolation: Lagrange and Newtons Methods. Error Bounds. Finite Difference Operators. Gregory Forward And Backward Difference Interpolation.
Unit-IV	:	Numerical Integration: Trapezoidal Rule, Simpsons Rule, Simpsons 3/8th Rule, Booles Rule. Midpoint Rule, Composite Trapezoidal Rule, Composite Simpsons Rule. Ordinary Differential Equations: Eulers Method. Runge-Kutta Methods Of Orders Two, Three and Four.

Part-II(Practical: Marks:25)
List of Practicals (Using Any Software)
Practical/Lab Work To Be Performed On A Computer.
Record =5 Marks ; Viva-Voce=5 Marks ; Experiment=15 Marks

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. RegulaiFalsi 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.

Book Recommended:-

B.P. Acharya And R.N. Das, A Course On Numerical Analysis, Kalyani Publishers, New Delhi,Ludhiana.

Chapters:

1. 2(2.1-2.4,2.6,2.8,2.9),3(3.1-3.4,3.6,3.11), 4(4.1, 4.2), 5(5.1, 5.2, 5.3), 6(6.1, 6.2, 6.3, 6.10, 6.11), 7(7.1-7.5 & 7.7).

2. Brian Bradie, A Friendly Introduction To Numerical Analysis, Pearson Education, India, 2007.

Books For References:-

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. C.F. Gerald And P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
3. Uri M. AscherAnd Chen Greif, A First Course In Numerical Methods, 7th Ed., Phi Learning Private Limited, 2013.
4. John H. Mathews And Kurtis D. Fink, Numerical Methods Using Matlab, 4th Ed., Phi Learning Private Limited, 2012.

Chapters: 1, 2(2.1 To 2.4, 2.6, 2.8, 2.9), 3(3.1 To 3.4, 3.6 To 3.8

C-4.2: Riemann Integration and Series of Functions (Analysis-III)

Total Marks:100

Theory:80 Marks+Mid-Sem:20 Marks

5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-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.I ntermediate Value Theorem for Integrals; Fundamental Theorems of Calculus.
Unit-II	:	Improper Integrals; Convergence of Beta And Gamma Functions.
Unit-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; cauchy criterion for uniform convergence and weierstrass m-test.
Unit-IV	:	Limit Superior and Limit Inferior. Power Series, Radius of Convergence, Cauchy Hadamard theorem,Differentiation and Integration of Power Series; Abels theorem; Weierstrass Approximation Theorem.

Book Recommended:-

1.S.CMallik&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.

Books For References:-

1. K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (Sie), Indian Reprint, 2004.
2. R.G. Bartle D.R. Sherbert, Introduction To Real Analysis, 3rd Ed., John Wiley And Sons (Asia) Pvt. Ltd., Singapore, 2002.
3. Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition), 2011.
4. Shanti Narayan And M.D. Raisinghania-Elements Of Real Analysis, S. Chand & Co. Pvt. Ltd.
5.G.Das&S.Pattanayak ,Fundamental Of Mathematics Anyalysis, TMH Publishing & Co-8,9

C-4.3: Ring Theory And Linear Algebra-I

Total Marks:100
Theory:80 Marks+Mid-Sem:20 Marks
5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-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, factor rings, operations on ideals, prime and maximal ideals.
Unit-II	:	Ring homomorphisms, properties of ring homomorphisms, isomorphism theorems i, ii and iii, field of quotients.
Unit-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.
Unit-IV	:	Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, character-izations of invertible matrices. Subspaces of rn, dimension of subspaces of Rn. Rank of a Matrix, Eigen Values, Eigen Vectors and Characteristic Equation of a Matrix.

Book Recommended:-

1. Joseph A. Gallian, Contemporary Abstract Algebra(4th Edn.), Narosa Publishing House, New Delhi. Chapters:12, 13, 14, 15.
2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall Of India Pvt. Ltd., New Delhi, 2004. Chapters: 1 (1.2-1.6), 2(2.1-2.5).
3.A Course In Abstract Algebra V.K Khana,&S.K Bhamri ,Vikash Pub. New Delhi.

Books For References:-

1. John B. Fraleigh, A First Course In Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. S. Lang, Introduction To Linear Algebra, 2nd Ed., Springer, 2005.
4. Gilbert Strang, Linear Algebra And Its Applications, Cengage Learning India Pvt. Ltd.
5. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall Of India,1999.
6. Kenneth Hofman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall Of India Pvt. Ltd.,1971.
7. I.N. Herstein-Topics In Algebra, Wiley Eastern Pvt. Ltd.

SEMESTER-V

C-5.1: Multivariate Calculus (Calculus-II)

Total Marks:100

Theory:80 Marks+Mid-Sem:20 Marks

5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-I	:	Functions of Several Variables, Limit and Continuity of Functions of Two Variables, Partial Differentiation, Approximation and Differentiability, Chain rule for one and two independent parameters
Unit-II	:	Directional derivatives and gradient, maximal property of the gradient, normal property of the gradient, tangent planes and the normal lines, extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems, a geometrical interpretation.
Unit-III	:	Double integration over rectangular region and over non-rectangular region, double integrals in polar co-ordinates, 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.
Unit-IV	:	Definition of vector field, divergence and curl, line integrals, applications of line integrals. Mas and work, Fundamental theorem and path independence of line integrals. Green's theorem, Area as a line integral, Alternative forms of green's theorem, Normal derivatives, surface integrals, Integrals over parametrically defined surfaces, stokes theorem the divergence theorem.

Books Recommended:-

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. Mathematical Analysis By S.C Malik &S.Arora (Chapter-15,17,18).
3. Topics In CalculuS By R.K Panda & P.K Satapathy ,S.G Publication ,Puri

Books For Reference:-

1. G.B. Thomas And R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.
2. E. Marsden, A.J. TrombaAnd A. Weinstein, Basic Multivariable Calculus, Springer (Sie), IndianReprint, 2005.
3. Santosh K. Sengar-Advanced Calculus, Cengage Learning India Pvt. Ltd.

C-5.2: Probability And Statistics

Total Marks:100

Theory:80 Marks+Mid-Sem:20 Marks

5 Lectures, 1 Tutorial (Per Week Per Student)

Unit-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.
Unit-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.
Unit-III	:	Some probability distributions(Continuous case), uniform, Gamma, Exponential, Beta Distributions, Normal distributions, Normal approximation to the Binomial distributions Bivariate normal distribution.
Unit-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, linea regression of two variables. Limit theorems, Markov's inequality, chebyshevs inequality.

Books Recommended:-

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).

Books For References:-

1. Alexander M. Mood, Franklin A. Graybill And Duane C. Boes, Introduction to the Theory of Statistics, 3rd Ed., Tata Mcgraw- Hill, Reprint 2007.
2. S.C. Gupta And V.K. Kapoor-Fundamentals of Mathematical Statistics, S. Chand and Company Pvt. Ltd., New Delhi.
3. S. Ross-A First Course In Probability, Pearson Education.
4. Robert V. Hogg, Joseph W. Mckean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007. Chapters: 1(1.1, 1.3. 1.5-1.9), 2(2.1, 2.3-2.5).

SEMESTER-VI

C-6.1: Metric Spaces and Complex Analysis (Analysis-Iv)

Total Marks: 100

Theory: 80 Marks+Mid-Sem: 20 Marks

5 Lectures, 1 Tutorial (Per Week per Student)

Unit-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, separable metric spaces, sequences in metric space, convergent sequences, cauchy sequences, complete metric space, distance between sets and diameter of a set, subspaces, cantor's theorem. Continuous functions, definition and characterizations, sequential criterion and other characterizations of continuity, uniform continuity, homeomorphism, connectedness, connected subsets of separated sets, disconnected sets, contraction mappings, Banach fixed point theorem.
Unit-II	:	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.
Unit-III	:	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.
Unit-IV	:	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.

Books Recommended:-

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. Mathematics For Degree Students By P.K . Mittal ,S.Chand& Co .
3.Complex Analysis ,S.Armugan ,A.ThangapandiIssac,A.Somasundaram,SCITECH Publication (India)Pvt. Ltd.Chennai .(Chapter-2,6,7).

Books For References:-

1. Mathematical Analysis by S.C Malik &S.Arora (Chapter-19).
2. 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).
3. S. Ponnusamy-Foundations Of Complex Analysis, Alpha Science International Ltd.
4. J.B. Conway-Functions Of One Complex Variable, Springer.
5. N. Das- Complex Function Theory, Allied Publishers Pvt. Ltd., Mumbai.

C-6.2: Linear Programming

Total Marks: 100

Theory: 80 Marks+Mid-Sem: 20 Marks

5 Lectures, 1 Tutorial (Per Week per Student)

Unit-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.
Unit-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.

Unit-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.
Unit-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.

Books Recommended:-

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)

Books For Reference:-

1. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
2. N.V.R. Naidu, G. Rajendra and T. Krishna Rao-Operations Research, I.K. International Publishing House Pvt. Ltd., New Delhi, Bangalore.
3. P.K. Gupta and D.S. Hira-Operations Research, S. Chand And Company Pvt. Ltd., New Delhi.
4. R. Veerachamy and V. Ravi Kumar-Operations Research- I.K. International Publishing House Pvt. Ltd., New Delhi, Bangalore.
5. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows,2nd Ed., John Wiley and Sons, India, 2004. Chapters:3(3.2-3.3, 3.5-3.8), 4(4.1-4.4), 6(6.1-6.3).
6. F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Ed., Tata Mcgraw Hill, Singapore, 2009. Chapter: 14
7. Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prenticehall India, 2006. Chapter:5(5.1, 5.3, 5.4).
8. G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002

Discipline Specific Electives(DSE)

SEMESTER-V

DSE-1

Programming In C++ (Compulsory)

Part-I(Marks:75)

(Theory:60 Marks+Mid-Sem:15 Marks)

Unit-I	:	Introduction To Structured Programming: Data Types- Simple Data Types, Oating Data Types, Character Data Types, String Data Types.
Unit-II	:	Arithmetic Operators and Operators Precedence, Variables and Constant Declarations, Expressions, Input Using The Extraction Operator >>and Cin, Output Using The Insertion Operator << and Cout.
Unit-III	:	Preprocessor Directives, Increment(++) And Decrement({) Operations, CreatingA C++ Program, Input/ Output, Relational Operators, Logical Operators and Logical Expressions.
Unit-IV	:	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.

Book Recommended:-

1. D. S. Malik: C++ Programming Language, Edition-2009, Course Technology, Cengage Learning,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).

Books For References:-

1. E. Balaguruswami: Object Oriented Programming with C++, _Fth Edition, Tata Mcgraw HillEducation 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.

Part-II(Practical, Marks:25)
List OfPracticals (Using Any Software)
Practical/Lab Work To Be Performed On A Computer.
Record =5 Marks; Viva-Voce=5 Marks ; Experiment=15 Marks

1. Calculate the Sum of the series :- $\frac{1}{1}+\frac{1}{2}+\frac{1}{3}..+\frac{1}{N}$ 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=Jnj; For N = □2;□1; 0; 1; 2:
3. Calculate the Factorial of any Natural Number.
4. Read Oating Numbers and Compute two Averages: The Average of Negative Numbers and the Average of Positive Numbers.
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 Whileloops to perform the following steps:
   A. Prompt the user to input Two Integers : First Num and Second Num (first Num Shoul be Less than Second Num).
   B. Output all Odd and Even Numbers 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 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. Write A Value Returning Function Smaller To Determine The Smallest Number From A Set Of Numbers.

Use This Function To Determine The Smallest Number From A Set Of 10 Numbers.

13. Write A Function That Takes As A Parameter An Integer (As A Long Value) And Returns The Number Of Odd, Even, And Zero Digits. Also Write A Program To Test Your Function.
14. Enter 100 Integers Into An Array And Short Them In An Ascending/ Descending Order And Print The Largest/ Smallest Integers.
15. Enter 10 Integers Into An Array And Then Search For A Particular Integer In The Array.
16. Multiplication/ Addition of Two Matrices Using Two Dimensional Arrays.
17. Using Arrays, Read The Vectors of The Following Type: A = (12345678);B= (02340156) And Compute The Product And Addition Of These Vectors.
18. Read From A Text file And Write To A Text file.
19. Write A Function, Reverse Digit, That Takes An Integer As A Parameter And Returns The Number With Its Digits Reversed. For Example, The Value of Function Reverse Digit12345 Is 54321 and the Value of Reverse Digit □532 is □235:

DSE-II
Total Marks: 100
Theory: 80 Marks+Mid-Sem:20 Marks
5 Lectures, 1 Tutorial (Per Week per Student.
(Any One of the Following)
1-Discrete Mathematics

Unit-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.
Unit-II	:	Recurrence Relations, Counting Using Recurrence Relations, Solving Linear Homogeneous Recurrence Relations with Constant Coefficients, Generating Functions, Solving Recurrence Relations using Generating Functions.
Unit-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.
Unit-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

Book Recommended:-

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).
2. Discrete Mathematics, R. K Bhist & H. S Dhami Oxford University Press Kolkota

Books For References:-

1. B A. Davey and H. A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.
2. Edgar G. GoodaireAnd Michael M. Parmenter, Discrete Mathematics with Graph Theory (2nd Edition), Pearson Education (Singapore) Pte. Ltd., Indian Reprint 2003.
3. Rudolf Lidl and GnterPilz, Applied Abstract Algebra (2nd Edition), Undergraduate Texts in Mathematics, Springer (Sie), Indian Reprint, 2004.
4. D.S. Malik-Discrete Mathematics: Theory & Applications, Cengage Learning India Pvt. Ltd.
5. Kevin Ferland-Discrete Mathematical Structures, Cengage Learning India Pvt. Ltd.

2. Mathematical Modelling

Unit-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.
Unit-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.
Unit-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.
Unit-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.

Books Recommended:-

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).

3-Number Theory

Unit-I	:	Divisibity Theorem in Integers, Primes and their Distributions, Fundamental Theorem of Arithmetic, Greatest Common Divisor, Euclidean Algorithms, Modular Arithmetic, Linear Diophantine Equation. Prime Counting Function, Statement of Prime Number theorem, Gold bach Conjecture.
Unit-II	:	Introduction to Congruence, Linear Congruence. Chinese Remainder Theorem, Polynomial Congruence, System of Linear Congruence, complete set of Residues, Chinese Remainder Theorem, Fermat's Little Theorem, Wilsons Theorem.
Unit-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,

		Euler's Phi function, Euler's Theorem, Reduced Set of Residues, Some Properties of Eulers Phi-Function.
Unit-IV	:	Order of an Integer Modulo N, Primitive Roots For Primes, Composite Numbers Having Primitive Roots, Euler's Criterion, The Legendre Symbol and its Properties, Quadratic Reciprocity, Quadratic Congruence with Composite Moduli.

Book Recommended:-

1. D.M. Burton-Elementary Number Theory, Mcgraw Hill, Chapters: 2(2.1 To 2.4), 3(3.1 To 3.3),4(4.1 To 4.4), 5(5.1 To 5.4), 6(6.1 To 6.3), 7(7.1 To 7.3), 8(8.1 To 8.2), 9(9.1 To 9.3).
2. Basic Number Theory by S.B Malik, Vikash Pub. House (P) New Delhi

Books For References:-

1. K.H. Rosen-Elementary Number Theory & its Applications, Pearson Addition Wesley.
2. I. NivenAnd H.S. Zuckerman-An Introduction to Theory of Numbers, Wiley Eastern Pvt. Ltd.
3. Tom M. Apostol-Introduction to Analytic Number Theory, Springer International Student Edn.
4. Neville Robinns, Beginning Number Theory (2nd Edition), Narosa Publishing House Pvt. Limited, Delhi, 2007.

SEMESTER-VI

DSE-III
Total Marks:100
Theory: 80 Marks+Mid-Sem: 20 Marks
5 Lectures, 1 Tutorial (Per Week per Student.
(Any One of the Following)
1-Differential Geometry

Unit-I	:	Theory of space curves: Space curves, planer curves, curvature, torsion and serret frenet formulae. Osculating circles, osculating circles and spheres. Existence of space curves.
Unit-II	:	Osculating circles, osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit-III	:	Developable: Developable associated with space curves and curve surfaces, minimal surfaces.
Unit-IV	:	Theory of Surfaces: Parametric Curves on Surfaces. Direction Coefficients. First and Second Fundamental Forms. Principal and Gaussian Curvatures. Lines of Curvature, Euler's Theorem. Rodrigues Formula, Conjugate and Asymptotic Lines.

Book Recommended:-

1. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge University Press 2003.Chapters:1(1-4, 7,8,10),2(13, 14, 16, 17), 3,4(29-31, 35, 37,38).
2. B.P. Acharya and R.N. Das-Fundamentals of Diferential Geometry, Kalyani Publishers, Ludhiana, New Delhi.
3. A Text Book of Vector Calculus by Shantinaryan , S.Chand&Co. New Delhi.

Books For References:-

1. T.J. Willmore, An Introduction to Differential Geometry, Dover Publications, 2012.
2. S. Lang, Fundamentals of Deferential Geometry, Springer, 1999.
3. B. O'neill, Elementary Deferential Geometry, 2nd Ed., Academic Press, 2006.
4. A.N. Pressley-Elementary Differential Geometry, Springer.

2-Mechanics

Unit-I	:	Moment of a Force about a Point and an Axis, Couple and Couple Moment, Moment of a Couple about a Line, Resultant of a Force System, Distributed Force System, Free Body Diagram, Free Body Involving Interior Sections, General Equations of Equilibrium, Two Point Equivalent Loading, Problems Arising from Structures, Static Indeterminacy.
Unit-II	:	Laws of Coulomb Friction, Application to Simple and Complex Surface Contact Friction Problems, Trans Mission of Power Through Belts, Screw Jack, Wedge, first Moment of an area and The Centroid, other Centers, Theorem of Pappus-Guldinus, Second Moments and the Product of area of a Plane Area, Trans Fer Theorems, Relation Between Second Moments and Products of area, Polar Moment of area, Principal Axes.
Unit-III	:	Conservative Force field, Conservation For Mechanical Energy, Work Energy Equation, Kinetic Energy and Work Kinetic Energy Expression Based on Center of Mass. Moment of Momentum Equation For a Single Particle and a System of Particles.
Unit-IV	:	Translation And Rotation of Rigid Bodies. Chasles theorem, general relationship between time derivatives of a vector for different references, relationship between velocities of a particle for different references, acceleration of particle for different references.

Book Recommended:-

1. I.H. Shames and G. Krishna Mohan Rao, Engineering Mechanics: Statics and Dynamics, (4^{th}Ed.), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2009. Chapters:3, 4, 5,6(6.1-6.7), 7, 11, 12(12.5, 12.6), 13.

Books For References:-

1. R.C. Hibbeler and Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 11th Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi.
2. Grant R Fowles, Analytical Mechanics, Cengage Learning India Pvt. Ltd.

3-Ring Theory and Linear Algebra-II

Unit-I	:	Polynomial Rings Over Commutative Rings, Division Algorithm And Consequences, Principal Ideal Domains,Factorization Of Polynomials, Reducibility Tests, Irreducibility Tests, Eisenstein Criterion, Unique factorization in Z[X].
Unit-II	:	Divisibility In Integral Domains, Irreducibles, Primes, Unique Factorization Domains, Euclidean Domains.
Unit-III	:	dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, eigenspaces of a linear operator, diagonalizability, invariant subspaces and Cayley Hamilton theorem, the minimal polynomial for a linear operator.
Unit-IV	:	Inner product spaces and norms, gram-schmidt orthogonalisation process, orthogonal complements,bessels inequality. The adjoint of a linear operator, least squares approximation, minimal solutions tosystems of linear equations, normal and self-adjoint operators, orthogonal projections and spectraltheorem.

Books Recommended:-

1. Joseph A. Gallian, Contemporary Abstract Algebra (4th Ed.), Narosa Publishing House, 1999.Chapters: 16, 17, 18.
2. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra (4th Edition), PrenticeHallOf India Pvt. Ltd., New Delhi, 2004. Chapters: 2(2.6 Only), 5(5.1, 5.2, 5.4), 6(6.1, 6.4, 6.6),7(7.3 Only).

Books For References:-

(For Linear Algebra)

1. S Lang, Introduction To Linear Algebra (2nd Edition), Springer, 2005
2. Gilbert Strang, Linear Algebra And Its Applications, Thomson, 2007
3. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall Of India, 1999.

4. Kenneth Ho_Man, Ray Alden Kunze, Linear Algebra 2nd Ed., Prentice-Hall Of India Pvt.Limited, 1971.

(For Ring Theory)

1. John B.Fraleigh, A _Rst Course In Abstract Algebra, 7th Edition, Pearson Education India, 2003.
2. Herstein, Topics In Algebra (2nd Edition), John Wiley & Sons, 2006
3. M IchaelArtin, Algebra (2nd Edition), Pearson Prentice Hall, 2011
4. Robinson, Derek John Scott., An Introduction To Abstract Algebra, Hindustan Book Agency, 2010.

DSE-IV

Project Work(Compulsory)
Total Marks:100 (Project:75 Marks+Viva-Voce:25 Marks)
Record =5 Marks ; Viva-Voce=5 Marks ; Experiment=15 Marks

Generic Electives/Interdisciplinary
(04 Papers, 02 Papers Each From Two Allied Disciplines)
(Credit: 06 Each, Marks:100)
GE-I TO GE-IV
GE-I: Calculus And Ordinary Differential Equations

Unit-I	:	Curvature, asymptotes, tracing of curves (cartenary, cycloid, folium of descartes, astroid, limacon,cissoid& loops), rectification, quardrature, volume and surface area of solids of revolution.
Unit-II	:	Sphere, cones and cylinders, conicoid.
Unit-III	:	Explicit and implicit functions, limit and continuity of functions of several variables, partial derivatives, partial derivatives of higher orders, homogeneous functions, change of variables, mean value theorem,taylors theorem and maclaurins theorem for functions of two variables. maxima and minima of functions of two and three variables, implicit functions, lagranges multipliers. multiple integrals.
Unit-IV	:	Ordinary differential equations of 1st order and 1st degree (variables separable, homogenous, exact and linear). equations of 1st order but higher degree. Second Order Linear Equations with Constant Coefficients, Homogeneous Forms, Second Order Equations with Variable Coefficients, Variation of Parameters. Laplace Transforms and its Applications to Solutions of Differential Equations.

Books Recommended:-

1. Shantinarayan-Text Book of Calculus, Part-II, S. Chand and Co., Chapter-8 (Art. 24, 25, 26)
2. Shantinarayan-Text Book of Calculus, Part-III, S. Chand and Co., Chapter-1 (Art 1,2), 3, 4(Art.10 To 12 Ommitting Simpsons Rule), 5(Art-13) And 6(Art-15).
3. Analytical Solid Geometry by Shantinaryana & P.K . Mittal , S. Chand & Co. .
4. Santosh K. Sengar-Advanced Calculus, Chapters: 2, 4, 5, 6, 7, 11, 12, 13.
5. J. Sinharoy and S. Padhy-A Course of Ordinary and Partial Differential Equations, Kalyani Publishers. Chapters: 2(2.1 To 2.7), 3, 4(4.1 To 4.7), 5, 9(9.1, 9.2, 9.3, 9.4, 9.5, 9.10, 9.11, 9.13).
6. Mathematics for Degree Students By P.K . Mittal ,S.Chand& Co.(For B.Sc. 1st Year)

Books For References:-

1. David V. Weider-Advanced Calculus, Dover Publications.
2. Martin Braun-Differential Equations and their Applications-Martin Braun, Springer International.
3. M.D. Raisinghania-Advanced Differential Equations, S. Chand & Company Ltd., New Delhi.27

GE-II: Linear Algebra and Advanced Algebra

Unit-I	:	Vector space, subspace, span of a set, linear dependence and independence, dimensions and basis.linear transformations, range, kernel, rank, nullity, inverse of a linear map, rank-nullity theorem.
Unit-II	:	Matrices and linear maps, rank and nullity of a matrix, transpose of a matrix, types of matrices. Elementary row operations, system of linear equations, matrix inversion using row operations, determinant and rank of matrices, Eigen values, Eigen vectors, quadratic forms.
Unit-III	:	Group theory: definition and examples, subgroups, normal subgroups, cyclic groups, cosets, quotient groups, permutation groups, homomorphism.
Unit-IV	:	Ring theory: definition and examples, some special classes of rings, ideals, quotient rings, ring homomorphism. Isomorphism theorems. Zero divisors, integral domain, finite fields, finite field z/pz, field of quotients of an integral domain, polynomial ring, division algorithm, remainder theorem, factorization of polynomials, irreducible and reducible polynomials, primitive polynomials, irreducibility tests, Eisenstein criterion.

Books Recommended:-

1. V. Krishnamurty, V. P. Mainra, J. L. Arora-An Introduction To Linear Algebra, Affliated East-West Press Pvt. Ltd., New Delhi, Chapters: 3, 4(4.1 To 4.7), 5(Except 5.3), 6(6.1, 6.2, 6.5, 6.6, 6.8),7(7.4 Only).
2. I.H. Seth-Abstract Algebra, Prentice Hall Of India Pvt. Ltd., New Delhi. Chapters:13, 14, 15, 16,17,18,19,20.
3. Mathematics For Degree Students By P.K . Mittal ,S.Chand& Co.(For B.Sc. 1st Year)

Books For References:-

1. S. Kumaresan-Linear Algebra: A Geometric Approach, Prentice Hall Of India.
2. Rao AndBhimasankaran-Linear Algebra, Hindustan Publishing House.
3. S. Singh-Linear Algebra, Vikas Publishing House Pvt. Ltd., New Delhi.
4. Gilbert Strang-Linear Algebra & Its Applications, Cengage Learning India Pvt. Ltd.
5. I.N. Herstein-Topics In Algebra, Wiley Eastern Pvt. Ltd.
6. Gallian-Contemporary Abstract Algebra, Narosa Publishing House.
7. Artin-Algebra, Prentice Hall Of India.
8. V.K. Khanna And S.K. Bhambri-A Course In Abstract Algebra, Vikas Publishing House Pvt. Ltd.,New Delhi.

SKILL ENHANCEMENT COURSES(SEC)

(Credit: 2 Each, Total Marks:50)

SEC-I TO SEC-II

SEC-I

Communicative English and Writing Skill(Compulsory)

SEC-II (Any One of the Following)

1-Computer Graphics

Development of Computer Graphics: Raster Scan and Random Scan Graphics Storages, Displays Processors and Character Generators, Colour Display Techniques, Interactive Input/Output Devices. Points, Lines and Curves: Scan Conversion, Line-Drawing Algorithms, Circle and Ellipse Generation, Conic-Section Generation, Polygon filling Anti Aliasing. Two-Dimensional Viewing: Coordinate Systems, Linear Transfor-Mations, Line and Polygon Clipping Algorithms.

Books Recommended:-

1. D. Hearn and M.P. Baker-Computer Graphics, 2nd Ed., Prenticehall of India, 2004.
2. J.D. Foley, A Van Dam, S.K. Feiner And J.F. Hughes-Computer Graphics: 2nd Ed., Addison-Wesley, Ma, 1990.
3. D.F. Rogers-Procedural Elements in Computer Graphics, 2nd Ed., Mcgraw Hill Book Company,2001.
4. D.F. Rogers and A.J. Admas-Mathematical Elements In Computer Graphics, 2nd Ed., Mcgrawhill Book Company, 1990.

2-Logic and Sets

Introduction, Propositions, Truth Table, Negation, Conjunction and Disjunction. Implications, Biconditional Propositions, Converse, Contra Positive and Inverse Propositions and Precedence of Logical Operators. Propositional Equivalence: Logical Equivalences. Predicates & Quantifiers: Introduction, Quantifiers, Binding Variables and Negations. Sets, Subsets, Set Operations and the Laws of Set Theory and Venn Diagrams. Examples Of finite and Infinite Sets. Finite Sets and Counting Principle. Empty Set, Properties of Empty Set. Standard Set Operations. Classes of Sets. Power Set of a Set. Difference and Symmetric Difference of Two Sets. Set Identities, Generalized Union and Intersections. Relation: Product Set, Composition of Relations, Types of Relations, Partitions, Equivalence Relations With Example of Congruence Modulo Relation, Partial Ordering Relations, Nary Relations.

Books 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.
4. Discrete Mathematics ,R.K Bhist & H.SDhami Oxford University Press Kolkota .
5. Discrete Mathematics N.C.H Iyengar& Others Vikas Pub.House New Delhi.

3-Combinartorial Mathematics

Basic Counting Principles, Permutations and Combinations (With and Without Repetitions), Binomial theorem, Multinomial Theorem, Counting Subsets, Set-Partitions, Stirling Numbers Principle of Inclusion and Exclusion, Derangements, Inversion Formulae Generating Functions: Algebra of Formal Power series, Generating Function Models, Calculating Generating Functions, Exponential Generating Functions. Recurrence Relations: Recurrence Relation Models, Divide and Conquer Relations, Solution of Recurrence relations, Solutions by Generating Functions. Integer Partitions, Systems of Distinct Representatives.

Books Recommended:-

1. J.H. Van Lint and R.M. Wilson-A Course in Combinatorics, 2nd Ed., Cambridge University Press,2001.
2. V. Krishnamurthy-Combinatorics, Theory and Application, A_Liated East-West Press 1985.
3. P.J. Cameron-Combinatorics, Topics, Techniques, Algorithms, Cambridge University Press, 1995.
4. M. Jr. Hall-Combinatorial Theory, 2nd Ed., John Wiley & Sons, 1986.
5. S.S. Sane-Combinatorial Techniques, Hindustan Book Agency, 2013.
6. R.A. Brualdi-Introductory Combinatorics, 5th Ed., Pearson Education Inc., 2009.

4-Information Security

Overview of Security: Protection Versus Security; Aspects of Securitydata Integrity, Data Availability, Privacy; Security Problems, User Authentication, Orange Book. Security Threats: Program Threats, Worms, Viruses, Trojan Horse, Trap Door, Stack and Bu_Er over Ow; System Threats- Intruders; Communication Threats- Tapping and Piracy. Security Mechanisms: Intrusion Detection, Auditing and Logging, Tripwire, System-Call Monitoring.

Books Recommended:-

1. C. Peeger and S.L. Peeger-Security in Computing , 3rd Ed., Prentice-Hall of India, 2007.
2. D. Gollmann-Computer Security, John Wiley And Sons, Ny, 2002.
3. J. Piwprzyk, T. HardjonoAnd J. Seberry-Fundamentals of Computer Security, Springer- Verlagberlin, 2003.
4. J.M. Kizza-Computer Network Security, Springer, 2007.
5. M. Merkow and J. Breithaupt-Information Security: Principles and Practices, Pearson Education,2006.

B.A. / B.SC. MATHEMATICS COURSE (REGULAR)

Structure under

CHOICE BASED CREDIT SYSTEM

FOR

SESSION 2016-2017

BERHAMPUR UNIVERSITY

Core Courses

B.A/B.Sc.- Mathematics

SEMESTER-1

C-I: Differential Calculus

(Credit: 06, Marks-100)

Theory: 80 Marks+ Mid Sem: 20 Marks

5 Lectures, 1 Tutorial(Per week per student)

C- : Differential Calculus

Unit-I	:	Limit and continuity ($\in and\ \delta$ definition), Types of discontinuity, Differentiability of functions, successive Differentiation, Leibnitz theorem.
Unit-II	:	Partial differentiation, Euler's Theorem of homogeneous functions, tangent and normals.
Unit-III	:	Rolles Theorem, Lagranges Mean value Theorem, Cauchys Mean value theorem, taylor's Theorem, Taylor's series, Maclaurina's series of six x, Cos x, e^x, log $(1+x)$, $(1+x)^m$, Maxima and Minima, Inderminant form.
Unit-IV	:	Curvature and Asymptotes. Singular Points, Tracing of Curves, Parametric representation of Curves and tracing of Parametric Curves, polar co-ordinates and tracing of curves in polar co-ordinator.

Book Recommended:

Shantinarayan: Differential Calculus, S.Chand & Co.

Chapters: 3(3.1,3.2,3.6,3.7,3.8), 4(4.1),5,6,7(7.1-7.8), 8(8.1-8.6), 9,10,11(11.1-11.6),14(14.1-14.6),15,16,17.

Reference Books:

1. Santosh K, Sengar: Advanced Calculus, Cinegage India Publications.
2. H. Anton, I. Birens and S. Davis :Calculus, Jhon Wiley and Sons Inc. , 2002.
3. Shantinarayan: Text Book of Calculus Part-II, S. Chand & Co.
4. Shantinarayan: Text Book of Calculus Part-III, S. Chand & Co.

SEMESTER-II

C-2: Differential Equations

(Credit: 06, Marks-100)

Theory: 80 Marks+ Mid Sem: 20 Marks

5 Lectures, 1 Tutorial(Per week per student)

Unit-I	:	First Order First Degree Equations: variable separable Homogeneous Equations, Exact Equations, Integrating factors, Linear Equations, Equations Reducible to Linear form. Equations of First Order but of Higher Degree: Equations Solvable for *p*, Equations Solvable for *y* Equations solvable for *x*, Equations with one variable missing, Equations homogeneous in *x* and *y*, the Clairaut Equation, The Lagrange Equation.
Unit-II	:	Homogeneous Linear Equations with constant coefficients, Non-homogeneous Linear Equations with constant coefficients, The method of variation of parameters. The Cauchy-Euler equation, simultaneous differential equation & total differential equation.
Unit-III	:	Order and degree of partial differential equations, concept of linear and non-linear partial differential equations, linear partial differential equation of first order, Lagranges method, Charpits method.
Unit-IV	:	Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Book Recommended:

J. Sinha Roy and S, Padhy, A Course on Ordinary and Partial Differential Equations, kalyani Publishers, New Delhi, Ludhiana, 2012.

Chapters: 1,2(2.1 to 2.7), 3,4(4.1 to 4.7), 5,11,12,13(13.1 – 13.5)

Books for Reference:

1. Martin Braun, Differential Equations and their Applications, Springer International.
2. M.D. Raisinghania- Advanced Differential Equation, S. Chand & Company Ltd., New Delhi.
3. S.L.Ross, differential Equations, John Wiley & Sons, India, 2004.

SEMESTER-III

C-3: Real Analysis

(Credit: 06, Marks-100)

Theory: 80 Marks+ Mid Sem: 20 Marks

5 Lectures, 1 Tutorial(Per week per student)

Unit-I	:	Field Structure and order structure, Bounded and unbounded sets, supremum, Infimum, Completenerss in the set of Real numbers, Absolute value of Real numbers. Neighbourhood of a point open sets, closed sets and countable sets: Limit points of a set, closed sets: closure of a set, countable and uncountable sets, Bolzano Weirstrass Theorem for sets.
Unit-II	:	Real Sequences: Sequences, Limit Points of a Sequence, Limits Infecior and Superior, Convergence Sequences, Non-Convergent Sequences(Definitions), cauchy's General Principle of Convergence, Algebra of Sequences, Monotonic Sequence. Some Important Theorems of Sequences : Sandwich Theorem, Cauchy's first theorem on limits Cesaro's theorem, Monotonic Sequences, Subsequences.
Unit-III	:	Infinite Series: Positive term series, comparison tests for positive term series, Cauchy's Root Test, D'Alember Ratio Test, Raabe's Test, Logarithmic Test, Integral Test, Gauss Test Uniform convergence.
Unit-IV	:	Sequences and series of functions, pointwise and uniform-convergences, Mn-test, M-test, statement of results about uniform conversences, differentiability and integrability of function, power series and radius of convergence.

Book Recommended:

1. S.C.Malik and Savita Arora-Mathematica Analysis, New Age International Publications(New Edition).

Chapters: 1,2,3,4, 12(1-4), 13(1-2)

Books for Reference:

1. Shantinarayan, Dr. M.D. Raisinghania: Elements of Real Analysis, S. Chand & Company Pvt. Ltd., New Delhi.
2. G. Das & S. Pattanayak: Fundamentals of Mathematical Analysis, TMH Publishing Co.
3. D. Somasundaram and B. Choudhury: A First course on Mathematical Analysis, Narosa Publishing House.
4. R. G. Bartle & D.R. Sherbert: Introduction to Real Analysis, Jhon Wiley and Sons India.
5. S.L Gupta & Nisha Rani: Real Analysis, Vikas Publishing House Pvt. Ltd., New Delhi.

SEMESTER-IV

C-4: Algebra

(Credit: 06, Marks-100)

Theory: 80 Marks+ Mid Sem: 20 Marks

5 Lectures, 1 Tutorial(Per week per student)

Unit-I	:	Equivalence relations, Functions, composition of functions Invertible functions, one to one correspondence and cardinality of a set. Well ordering property of positive integers. Division algorithm, divisibility and Euclidean algorithm, Congruence relation between integers, principle of Mathematical Induction statement of Fundamental Theorem of Arithmetic.
Unit-II	:	Definition and examples of groups, examples of abelian and non-abelian groups, the group z_n integers under addition modulo n cyclic groups from number system, complex roots of unity, the permutation group symmetric(n).
Unit-III	:	Subgroups, cyclic Subgroups, A Counting Principle, Normal Subgroups and Quotient Groups. Homorphis.
Unit-IV	:	Definition and Examples of Rings, Some Special Classes of Rings, Homomorphisms, Subrings and Ideals, Integral domain and Fields with examples.

Book Recommended:

I.N.Herstein: Topics in algebra, John Wiley and Sons(3^{rd} edition).

Chapters: 1,2(2.1 to 2.7), 3(3.1-3.4, 3.6)

Reference Books:

1. Joseph A. Gallian: Contemporary Abstract Algebra (4^{th} Edition), Narosa Publishing House, New Delhi.
2. M.K. Sen, Shamik Ghosh, Parthsarathi, Mukhopadhya: Topics in Abstract Algebra, Second Edition, University Press.

SEMESTER-V

DISCIPLINE SPECIFIC ELECTIVE COURSES(DSE)

(Credit: 06, Marks-100)

Theory: 80 Marks+ Mid Sem: 20 Marks

5 Lectures, 1 Tutorial(Per week per student)

DSE-A(Any One of the following)

1. LINEAR ALGEBRA

Unit-I	:	Vector space, Subspace, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence basis and dimension, dimension of subspaces.
Unit-II	:	Linear transformations, Null Space, Range, Rank and Nulity of a Linear Transformation, Matrix Representation of a linear transformation, Algebra of Linear Transformations.
Unit-III	:	Dual space, dual basis, double dual, eigen value and eigen vector, characteristic polunomial.
Unit-IV	:	Isomorphism, Isomorphism theorems, Invertibility and Isomorphisms, change of co-ordinate matrix.

Book Recommended:

V. Krishnamurthy, V.P.Mainra, J.L.Arora: An Introduction to Linear Algebra, East-West Press Pvt. Ltd., New Delhi.

Books for Reference:

1. Stephen, H, Friedberg, Arnold J, Insel Tawrence, F. 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, Indian Reprint, 2007.
3. S. Lang: Introduction to Linear Algebra, 2nd Ed. Springer, 2005.

1. MECHANICS

Unit-I	:	Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body. Laws of friction.
Unit-II	:	Problems of equilibrium under forces including friction, centre of gravity, work and potential energy.
Unit-III	:	Velocity and acceleration of a particle along a curve, radial and transverse components (plane curve) tangential and normal components (Space)
Unit-IV	:	Newtons Law of Motion, Simple Harmonic Motion. Simple pendulum, Projectile Motion.

Book Recommended:

1. A.S.Ramsey, Statics, CBS Publishers and Distributors(Indian Reprint), 1998.
2. A.P.Roberts: Statics and Dynamics with Background in Mathematics, Cambridge University Press, 2003.

Books for Reference:

1. P.Duriapandian, Laxmi Duraipandian, Muthamizh jayapragasam: Mechanics(For B.Sc. Students of Mathematics, Physics and Engineering Courses of all Indian Universities), S.Chand & Company Ltd., New Delhi.
2. J.L.Synge and Griffith-Mechanics, Mc Graw-Hill.
3. Grant R fowles- Analytical Mechanics, Cengage Learning India Pvt. Ltd.

SEMESTER-VI

DSE-B (Any one of the following)

1. NUMERICAL METHODS

Unit-I	:	Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation, Transcendental and Poly-nomial equations, Bisection Method, Newtons Method, Secant Method, Rate of Convergence of these methods.
Unit-II	:	System of Linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi Method, Gauss Seidel Method and Their Convergence analysis.
Unit-III	:	Interpolation: lagrange and Newtons Methods. Error bounds, finite difference operators, Gregory forward and backward difference interpolation.
Unit-IV	:	Numerical Integration: Trapezoidal rule, Simpsons rule, Simpsons $3/8^{th}$ rule, Booles Rule, Mid point rule, composite Trapezoidal rule, composite Simpsons rule. Ordinary Differential Equations: Eulers Method, Runge-Kutta Methods of orders two and four.

Book Recommended:

B.P.Acharya and R.N.Das-A course on Numerical Analysis Kalyani Publishers, New Delhi, Ludhiana.

Chapters: 1,2(2.1 to 2.4, 2.6, 2.8, 2.9), 3(3.1 to 3.4, 3.6 to 3.8, 3.10), 4(4.1, 4.2), 5(5.1, 5.2, 5.3), 6(6.1, 6.2, 6.3, 6.10, 6.11), 7(7.1, 7.2, 7.3, 7.4 & 7.7)

Books for Reference:

1. M.K.jain, S.R.K. Iyenger and R.K.Jain, Numerical Methods for Scientific and Engineering Computation 6^{th} Edi, New Age International Publisher, India, 2007.
2. Uri M. Ascher and Chen Grief, A First Couse in Numerical Method 7^{th} Ed. PHI Learning Private Limited, 2013.

2. LINEAR PROGRAMMING

Unit-I	:	Introduction to linear programming problems(LPP), Mathematical formulation of the LPP with illustrations, Graphical method, General Linear Programming problems. Canonical & standard form of LPP. Theory of Simplex method, Optimality and unboundedness, the Simjplex algorithm, simplex method in tableau format, Introduction to artificial variables. Two phase method. Big-M

		method and their comparisons.
Unit-II	:	Duality in LPP: Introduction, General Primal-Dual pair, Formulation of the Dual problem, Primal Dual relationships, Duality theorems, Complementary slackness theorem. Duality & Simplex method Economic interpretation of the Duality.
Unit-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 starting basic solution. Algorithm for solving transportation problem. Assignment problem and its mathematical formulation, Solujtion methods of Assignment problem, Special cases in Assignment problems.
Unit-IV	:	Games and Strategies : Introduction, Formulation of two person zero sum games, solving two person zsero sum games. Maxmin-Minimax principle, Games without saddle points, Games with mixed strategies, Graphical solution procedure to (2 x n) and (m x 2) games.

Books Recommended:

1. Kanti Swarup, 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).

Book for References:

1. G. Hardly, Linear Programming, Narosa Publishing House, New Delhi, 2002.
2. N.V.R. Naidu, G.Rajendra and T. Krishna Rao, Operations Research, I.K. International Publishing House Pvt. Ltd. New Delhi, Bangalore.
3. R.Veerachamy and V. Rabi Kumar: Operations Reserarch, I.K. International Publishing House Pvt. Ltd., New Delhi, Bangalore.
4. P.K.Gupta and D.S.Hira, Operations Research, S. Chand and Company Pvt. Ltd., New Delhi.
5. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherah: Linear Programming and Network Flows, 2nd Ed. John Wiley and Sons, India, 2004.
6. F.S. Hiooller and G.J. Lieberman Introduction to Operations Research 9 th Ed., Tata McGraw Hill, Singapore, 2009.
7. Hamdy A. Taha Operations Research, An Intriduction, 8th Ed. Prentice Hall India, 2006.
8. Uri M. Ascher and chen Gried, a first Course in Numerical Method, 7th Edition, PHI Learning Private Limited, 2011.

FOR B.A (REGULAR) STUDENTS

Generic Electives/Interdisciplinary

(Credit: 06 Each, Marks:100)

GE-I & GE-II

GE-I: Calculus And Ordinary Differential Equations

Unit-I	:	Curvature, asymptotes, tracing of curves (cartenary, cycloid, folium of descartes, astroid, limacon,cissoid& loops), rectification, quardrature, volume and surface area of solids of revolution.
Unit-II	:	Sphere, cones and cylinders, conicoid.
Unit-III	:	Explicit and implicit functions, limit and continuity of functions of several variables, partial derivatives, partial derivatives of higher orders, homogeneous functions, change of variables, mean value theorem,taylors theorem and maclaurins theorem for functions of two variables. maxima and minima of functions of two and three variables, implicit functions, lagranges multipliers. multiple integrals.
Unit-IV	:	Ordinary differential equations of 1st order and 1st degree (variables separable, homogenous, exact and linear). equations of 1st order but higher degree. Second Order Linear Equations With Constant Coefficients, Homogeneous

		Forms, Second Order Equations With Variable Coefficients, Variation Of Parameters. Laplace Transforms And Its Applications To Solutions Of Differential Equations.

Books Recommended:-

1. Shantinarayan-Text Book Of Calculus, Part-II, S. Chand And Co., Chapter-8 (Art. 24, 25, 26)

2. Shantinarayan-Text Book Of Calculus, Part-III, S. Chand And Co., Chapter-1 (Art 1,2), 3, 4(Art.10 To 12 Ommitting Simpsons Rule), 5(Art-13) And 6(Art-15).

3.Analytical Solid Geometry By Shantinaryana& P.K . Mittal ,S.Chand& Co. .

4. Santosh K. Sengar-Advanced Calculus, Chapters: 2, 4, 5, 6, 7, 11, 12, 13.

5. J. SinharoyAnd S. Padhy-A Course Of Ordinary And Partial Differential Equations, Kalyani Publishers. Chapters: 2(2.1 To 2.7), 3, 4(4.1 To 4.7), 5, 9(9.1, 9.2, 9.3, 9.4, 9.5, 9.10, 9.11, 9.13).

6.Mathematics For Degree Students By P.K . Mittal ,S.Chand& Co.(For B.Sc. 1st Year)

Books For References:-

1. David V. Weider-Advanced Calculus, Dover Publications.

2. Martin Braun-Differential Equations And Their Applications-Martin Braun, Springer International.

3. M.D. Raisinghania-Advanced Differential Equations, S. Chand & Company Ltd., New Delhi.27

GE-II: Linear Algebra and Advanced Algebra

Unit-I	:	Vector space, subspace, span of a set, linear dependence and independence, dimensions and basis.linear transformations, range, kernel, rank, nullity, inverse

		of a linear map, rank-nullity theorem.
Unit-II	:	Matrices and linear maps, rank and nullity of a matrix, transpose of a matrix, types of matrices. Elementary row operations, system of linear equations, matrix inversion using row operations, determinant and rank of matrices, Eigen values, Eigen vectors, quadratic forms.
Unit-III	:	Group theory: definition and examples, subgroups, normal subgroups, cyclic groups, cosets, quotient groups, permutation groups, homomorphism.
Unit-IV	:	Ring theory: definition and examples, some special classes of rings, ideals, quotient rings, ring homomorphism. Isomorphism theorems. Zero divisors, integral domain, finite fields, finite field z/pz, field of quotients of an integral domain, polynomial ring, division algorithm, remainder theorem, factorization of polynomials, irreducible and reducible polynomials, primitive polynomials, irreducibility tests, Eisenstein criterion.

Books Recommended:-

1. V. Krishnamurty, V. P. Mainra, J. L. Arora-An Introduction To Linear Algebra, Affliated East-West Press Pvt. Ltd., New Delhi, Chapters: 3, 4(4.1 To 4.7), 5(Except 5.3), 6(6.1, 6.2, 6.5, 6.6, 6.8),7(7.4 Only).

2. I.H. Seth-Abstract Algebra, Prentice Hall Of India Pvt. Ltd., New Delhi. Chapters:13, 14, 15, 16,17,18,19,20.

3.Mathematics For Degree Students By P.K . Mittal ,S.Chand& Co.(For B.Sc. 1st Year)

Books For References:-

1. S. Kumaresan-Linear Algebra: A Geometric Approach, Prentice Hall Of India.

2. Rao AndBhimasankaran-Linear Algebra, Hindustan Publishing House.

3. S. Singh-Linear Algebra, Vikas Publishing House Pvt. Ltd., New Delhi.

4. Gilbert Strang-Linear Algebra & Its Applications, Cengage Learning India Pvt. Ltd.

5. I.N. Herstein-Topics In Algebra, Wiley Eastern Pvt. Ltd.

6. Gallian-Contemporary Abstract Algebra, Narosa Publishing House.

7. Artin-Algebra, Prentice Hall Of India.

8. V.K. Khanna And S.K. Bhambri-A Course In Abstract Algebra, Vikas Publishing House Pvt. Ltd.,New Delhi.