Enclosure - III

DSE Allied courses in Mathematics offered to B.Sc. - Physics by Mathematics Department for students admitted from 2017-2018 and onwards

Semester – III			
17UPHDA09	**DSE Allied 5:** Mathematics - 3	**4hrs/week**	**4Credits**

Objectives:-

Upon completion of the course students will be able to

1. Define and utilize the concept of sequence and Series
2. Understand bounded sequence, convergence of sequence.
3. Define and identify the different kinds of series of positive terms.
4. Choose and apply tests for convergence of series including p-test, Comparison test, Cauchy's Root test, D'Alembert's Ratio test, Logarithmic Test, Raabe's test.
5. Solve problems of multiple integrals including double and triple integral.
6. Solve problems related improper integrals including Beta and Gamma functions.

Unit 1: Sequence **(10hrs)**

- Definition of a sequence
- Bounded sequences
- Convergence of a sequence
- Subsequences
- Monotonic sequences
- Cauchy's sequence, General principle of convergence of sequence (without proof).

  Some important sequences $\sqrt[n]{n}$: $\left\{\frac{a_1+a_2+\ldots+a_n}{n}\right\}$

Unit 2:Series **(10hrs)**

- Series of non-negative terms
- p-test, Comparison test, Ratio test, Raabe's test
- Alternative series, Absolute and conditional convergence, Convergence of power series. (All the tests without proof).

Unit 3: Vector Differentiation **(10hrs)**

- Vector point functions and Scalar point functions
- Vector Differentiation
- Laplace operator, Laplace equation
- Gradient, Divergence and Curl.

Unit 4: Multiple Integral **(9hrs)**

- Double and triple integrals
- Application of double and triple integration as area and volume
- Change of variable by Jacobian
- Change of variables from Cartesian to polar co-ordinates and triple integration in spherical co-ordinates and cylindrical co-ordinates.

Unit 5: Beta & Gamma Functions **(9hrs)**

- Beta and Gamma functions and relation between them
- Value of $\int_{-\infty}^{-} e^{-x^2} dx$ as gamma function, Duplication (Legendre) Formula (without proof).

TEXT BOOKS: -

1. S.C. Malik ,Mathematical Analysis , Wiley, Eastern Ltd., New Delhi
2. Shanti Narayan and P.K. Mittal, Integral Calculus, S.Chand and Company Ltd.

REFERENCE BOOKS:-

1. Shantinarayan, A course of Mathematical Analysis, S. Chand & Sons.
2. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Walter Rudin, Principle of Mathematical Analysis, MC Graw-Hill Book & Company, 2nd Edition.
4. Differential Calculus by Shanti Narayan, S.Chand & co., New Delhi

Semester – III			
17UPHDA11	**DSE Allied Practical 5:** Mathematics-III Practical	**5hrs/week**	**3Credits**

Objectives:-

Upon completion of the course students will be able to

1. Solve problems of Numerical Methods including graphical methods.
2. Analyze and find the solution of algebraic and transcendental equations using iterative methods.
3. Analyze and find the solution of algebraic and transcendental equations using direct methods.
4. Solve polynomial equation and find derivative of polynomials using numerical methods.

List of Practical

1. Example based on sequence and series.
2. Solution of algebraic and transcendental equation by Graphical method.
3. Solution of algebraic and transcendental equation by Bisection method.
4. Solution of algebraic and transcendental equation by False position method (Regula Falsi Method).
5. Solution of algebraic and transcendental equation by Iteration method.
6. Solution of algebraic and transcendental equation by Newton-Raphson's method.
7. Applications of Newton-Raphson's method.
8. Transformation of equation.
9. Derivatives of a polynomial by synthetic division method.
10. Horner's method for solving polynomial equation.

TEXT BOOKS: -

1. V. N. Vedamurthy and N. Ch. S. N. Iyendar, Numerical Methods, Vikas Publishing House Pvt Ltd.
2. S.C. Malik ,Mathematical Analysis , Wiley, Eastern Ltd., New Delhi

Semester – IV			
17UPHDA13	**DSE Allied 7 : Mathematics-4**	**4hrs/week**	**4Credits**

Objectives:-

Upon completion of the course students will be able to

1. Understand and define the concept of a vector space.
2. Understand and define the concept of linear combination and span and subspace
3. Solve the problems based on linear combination and span and subspace.
4. Understand, identify and critically analyse the linear dependence and independence of vectors, basis of a vector space, dimension of vector space.
5. Solve the problems based on linear dependence and independence of vectors, basis of a vector space, dimension of vector space.

Unit 1: Vector space (10hrs)

- Introduction of Vector space, Definition of a Field, Definition of Vector space, Properties of Vector space, Some Standard Vector space, Examples of Vector space
- Linear Combination and Span and Subspace, Concept of Linear combination and its examples, Concept of Linear span and its examples, Concept of Subspaces ,Sum and Direct sum of subspaces and their examples, Complementary subspace, Disjoint subspace, Quotient space, Theorem related to subspaces and Linear span

Unit 2: Linear Dependence and Independence of Vectors (10hrs)

- Linearly dependence of vectors, Linearly independence of vectors, Theorem and Examples based on this, Geometrical Representation of Linearly Dependence and Independence of vectors

Unit 3: Basis of a Vector space & Dimension of a Vector space (10hrs)

- Basis of a vector space, Co-ordinates of vectors respect to basis, Existence theorem for basis, Invariance of the number of the elements of a basis set, Examples and theorem of basis
- Definition of a dimension of Vector space, Existence of Complementary subspace of subspace of finite dimensional vector space, Dimension of sum of subspaces, Example based on dimension, Theorem based on dimension.

Unit 4: Linear Transformation (9hrs)

- Concept of Linear Transformation, Zero and Identity Linear Transformation, Properties of Linear Transformation, Example based on Linear Transformation, Range space of Linear Transformation
- Nullity and rank of Linear Transformation, Theorem and Example based on Linear Transformation.

Unit 5*:* Curvature, Asymptotes and multiple points (9hrs)

- Various formulae for curvature(formulae for Cartesian coordinates, parametric equations and Polar coordinates only),

- Newton's method for curvature at origin, Concavity, Convexity and point of inflexion, Asymptotes parallel to co-ordinate axes, oblique type and algebraic methods,
- Rules for finding asymptotes. Multiple points, Types of double points.

TEXT BOOKS: -

1. Krishnamurthy, Mainra and Arora, An Introduction to Linear Algebra
2. Shanti Narayan, Differential Calculus, S.Chand & co., New Delhi
3. Shanti Narayan , A course of mathematical Analysis, S.Chand & Co., New Delhi

REFERENCE BOOKS:-

1. J.N. Sharma and A.R. Vasishtha, Linear Algebra, Krishna Prakashan Mandir, Meerut
2. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi
3. Shanti Narayan, A text book of Modern Abstract Algebra, S.Chand & Co., New Delhi
4. S. K. Jain, A. Gunawardena & P.B. Bhattacharya, Basic Linear Algebra with Matlab

Semester – IV			
17UPHDA15	**DSE Allied Practical 7:** Mathematics-IV Practical	**5hrs/week**	**3Credits**

Objectives:-

Upon completion of the course students will be able to

1. Understand and define the concept of a vector space.
2. Understand and define the concept of linear combination and span and subspace
3. Solve the problems based on linear combination and span and subspace.
4. Understand, identify and critically analyse the linear dependence and independence of vectors, basis of a vector space, dimension of vector space.
5. Solve the problems based on linear dependence and independence of vectors, basis of a vector space, dimension of vector space.

List of Practical

1. Example based on theory of vector space.
2. Example based on theory of span of a set of vectors.
3. Example based on theory of subspace of various type vector space.
4. Find the complementary space for the given subspace of a vector space (at least 4 example).
5. Test the linearly dependent vectors of the given set of vectors of a vector space.
6. Test the linearly independent vectors of the given set of vectors of a vector space.
7. Check whether the given subset of vectors is/ are bases.
8. Find the dimension of a given vector space or a subspace.
9. Verify rank nullity theorem.
10. Find all asymptotes for given curve

TEXT BOOKS: -

1. Krishnamurthy, Mainra and Arora, An Introduction to Linear Algebra
2. Shanti Narayan, Differential Calculus, S.Chand & co., New Delhi
3. Shanti Narayan , A course of mathematical Analysis, S.Chand & Co., New Delhi

REFERENCE BOOKS:-

1. J.N. Sharma and A.R. Vasishtha, Linear Algebra, Krishna Prakashan Mandir, Meerut
2. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi
3. Shanti Narayan, A text book of Modern Abstract Algebra, S.Chand & Co., New Delhi
4. S. K. Jain, A. Gunawardena & P.B. Bhattacharya, Basic Linear Algebra with Matlab