Enclosure - II

DSE Allied courses in Mathematics offered to B. Sc. PCM (Majoring in Physics) by Mathematics Department for the students admitted from AY 2017-2018 and onwards

Semester – I			
17UPHDA01	**DSE-Allied 1: Mathematics-I**	**4hrs/week**	**4Credits**

Objectives:-

Upon completion of the course students will be able to

1. Verify the existence of limits and calculate the limit (if exist) of single variable function.
2. State and prove L'Hospital's rule for Indeterminate forms of limits and implement the L'Hospital's rule for limits to calculate the limit of function of single variable.
3. Define, identify and solve the differential equations of first order and first degree including Bernoulli's differential equation and First Order Exact differential equation.
4. Define, identify and solve differential equations of first order and higher degree.
5. Define, identify and solve Linear differential equations of higher order.

Unit 1: Indeterminate Forms **(8 hrs)**

- L'Hospital's rules for various indeterminate forms (Without proof).
- Various indeterminate forms like $\frac{0}{0}$ form, $\frac{\infty}{\infty}$ form, $\infty - \infty$ form, $0.\infty$ form, 0^0 form, ∞^0 form

Unit 2: Taylor's theorem, expansions and indeterminate forms (10 hrs)

- Taylor's theorem (Without proof)
- Maclaurin's theorem (Without proof)
- Taylor's and Maclaurin's infinite series expansions
- Expansions of e^x, $\sin x$, $\cos x$, $(1+x)^n$, $\log(1+x)$ under proper conditions.

Unit 3: Differential Equations of First Order and First Degree (10 hrs)

- Definition and method of solving of Differential Equation of the form Variable separable
- Homogeneous Differential Equation
- Linear differential equations of first order and first degree.
- Definition and method of solving **Bernoulli's** differential equation and Definition and methods of solving **Exact** differential equation

Unit 4: Differential equations of first order and higher degree (10 hrs)

- Differential equations of first order and first degree solvable for x, solvable for y, solvable for p
- Clairaut's form of differential equation and Lagrange's form of differential equations.

Unit 5: Linear differential equations of higher order (10 hrs)

- Linear differential equations of higher order with constant coefficients. Operator D
- Meaning of auxiliary equation, Roots of auxiliary equation and solution of auxiliary equation $f(D)y = 0$ for real roots and complex roots, Operator 1/D.
- Solution of differential equations of the type $f(D)y = X$. Meaning of complimentary function(C.F.) and Particular integral(P.I.)
- Methods to obtain Particular integral (P.I.) when $X = e^{ax}$, $X = \sin(ax+b)$, $X = \cos(ax+b)$, $X = x^m$, $X = e^{ax}V$.

TEXT BOOKS: -

1. M. D. Raisinghania, Ordinary & Partial Differential Equation, S. Chand and Co.
2. Dr. R. C. Shah, Differential equations , Books India Publications – 5 th edition
3. Harikrishna, Differential Calculus, Atlantic Publication.

REFERENCE BOOKS:-

1. James Stewart, Calculus, Sixth Edition.
2. M. J. Strauss, G. L. Bradley and K. J. Smith, (2007) Calculus (3rd Edition), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi,.
3. H. Anton, I. Bivens and S. Davis, Calculus (7th Edition), John Wiley.

Semester – I			
17UPHDA03	**DSE Allied Practical 1:** Mathematics-I Practical	**5hrs/week**	**3Credits**

Objectives:-

Upon completion of the course students will be able to

1. Understand the domain and range of given functions including polynomials, and hyperbolic functions and plot graph of the same using those domain and range.
2. Implement the L'Hospital's rule for limits to calculate the limit of function of single variable.
3. Verify the Mean Value Theorems for given real valued function in given domain.

List of Experiments

1. Draw the graph of y =sinx or y = cosx or y =tanx.
2. Draw the graph of y =secx or y = cosecx or y =cot x.
3. Draw the graph of $y = \sin^{-1} x$ or $y = \cos^{-1} x$ or $y = \tan^{-1} x$.
4. Draw the graph of $y = \sec^{-1} x$ or $y = \cos ec^{-1} x$ or $y = \tan^{-1} x$.
5. Draw the graph of y =sinhx or y = coshx or y =tanhx.
6. Draw the graph of y =sechx or y = cosechx or y =cothx.
7. Plotting of graphs of function of type the greatest integer function, even and odd positive integer.
8. Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
9. Evaluate limit using L'Hospital rule.
10. Expansions of functions in infinite power series using Taylor's and Maclaurin's formula.

TEXT BOOKS: -

1. Harikrishna,Differential Calculus, Atlantic Publication.
2. M. D. Raisinghania, Ordinary & Partial Differential Equation, S. Chand and Co.
3. Dr. R. C. Shah, Differential equations , Books India Publications – 5 th edition.

Semester – II			
17UPHDA05	**DSE Allied 3: Mathematics- 2**	**4hrs/week**	**4Credits**

Objectives:-

Upon completion of the course students will be able to

1. Define and utilize the concept of matrix, Understand the concept of Rank of a matrix and compute the rank of a given matrix.
2. Solve the systems of linear equations using concept of matrix and elementary row operations, Understand the elementary row operation.
3. Define Maxima, Minima, Saddle points of function of several variables.

Unit 1: Sphere **(8 hrs)**

- Standard form, Central form, Vector form
- General equation of sphere with center (α, β, γ) and radius a
- Plane section of a sphere, intersection of two spheres, Sphere with a given diameter, Sphere through a given circle, Intersection of a sphere and a line, Power of a point
- Equation of a tangent plane, Equation of normal to the sphere, Condition for the plane lx + my + nz = p touches the sphere x2 + y2 +z2 + 2ux + 2vy + 2wz + d = 0.

Unit 2: Cylinder **(8 hrs)**

- Definition of a cylinder, equation of a cylinder with given Generator parallel to the line $\frac{x}{l}=\frac{y}{m}=\frac{z}{n}$ and guiding curve $ax^2+2hxy+by^2+2gx+2fy+c=0, z=0$
- The equation of right circular cylinder with axis $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$ and radius r.

Unit 3: Partial Differentiation **(11 hrs)**

- Limit and continuity of function of several variables.
- Partial derivatives, Partial derivatives of higher order
- Partial differentiation of composite function
- Homogeneous function, Euler's theorem on homogeneous function of two and three variables, Total differential and chain rule

Unit 4: Applications of Partial Derivatives **(9 hrs)**

- Errors and approximate values, Jacobians, Taylor's theorem of function of two variables
- Maxima, Minima, Saddle points of function of several variables, Lagrange's method of undetermined multipliers.

Unit 5: Concept of a matrix **(12 hrs)**

- Some special matrices, adjoint of a matrix, Non-singular and singular matrices, inverse of a matrix, Symmetric and skew symmetric matrices, Hermitian and skew Hermitian matrices
- Elementary row and column operations on a matrix, row and column vectors, linear independence of row and column matrices, rank of a matrix, row and column rank of a matrix, equivalence of row and column ranks.
- Characteristic equation of a matrix, eigen values and eigen vectors of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix.

TEXT BOOKS: -

1. Shanti Narayana and P.K. Mittal, Textbook of Matrices, S.Chand and Company Ltd, 11^{th} Edition.
2. P.K. Jain & Khalid Ahmad, A Text book of Analytical Geometry of three dimensions.

REFERENCE BOOKS:-

1. David C. Lay,(2007) Linear Algebra and its Applications (3rd Edition), Pearson Education Asia, Indian Reprint.
2. David V. Widder, Advanced Calculus, Prentice Hall of India Pvt Ltd.
3. R.J.T. Bell , Elementary Treatise on Co-ordinate geometry of three dimensions, Mac Millan & Co.

Semester – II			
17UPHDA07	**DSE Allied Practical 3:** Mathematics-II Practical	**5hrs/week**	**3Credits**

Objectives:-

Upon completion of the course students will be able to

1. Understand the domain and range of given functions and plot the graph of the same using those domain and range.
2. Understand and use Cayley-Hamilton theorem to find the inverse of the given matrix.
3. Utilize various methods including Gauss elimination method, Gauss Jorden method and Cramer's rule in order to solve the system of linear equations.

List of Experiments

1. Draw the graph of $y = e^x$ or $y = 2^x$ or $y = 3^x$.
2. Draw the graph of $y = \log_e x$ or $y = \log_{10} x$.
3. Draw the graph of cycloid.
4. To find inverse of a matrix using Cayley- Hamilton theorem.
5. To find the rank of matrix.
6. To find inverse of a matrix using Gauss-Elimination Method.
7. To solve the system of simultaneous linear algebraic equations using Gauss Elimination Method.
8. To solve the given system of simultaneous linear algebraic equations using Gauss-Jordan Method.
9. To solve the given homogeneous system of simultaneous linear algebraic equations.
10. To solve the given non-homogeneous system of simultaneous linear algebraic equations

TEXT BOOKS: -

1. Shanti Narayana and P.K. Mittal, Textbook of Matrices, S.Chand and Company Ltd, 11th Edition.

REFERENCE BOOKS:-

1. David C. Lay,(2007) Linear Algebra and its Applications (3rd Edition), Pearson Education Asia, Indian Reprint.