SEMESTER – IV

MATDSCT 4.1: Partial Differential Equations and Integral Transforms	
Teaching Hours: 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100 (SEE - 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Solve the Partial Differential Equations of the first order and second order
- Formulate, classify and transform partial differential equations into canonical form.
- Solve linear and non-linear partial differential equations using various methods; and apply these methods to solving some physical problems.
- Able to take more courses on wave equation, heat equation, and Laplace equation.
- Solve PDE by Laplace Transforms and Fourier Transforms

Partial Differential Equations:

Unit I: Basic concepts–Formation of a partial differential equations by elimination of arbitrary constants and functions, Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$, Standard types of first order non-linear partial differential equations, The integrals of the non-linear equation by Charpit's method. **14 Hrs**

Unit II: Homogeneous linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. **14 Hrs**

Integral Transforms:

Unit III: Laplace Transforms: Definition, Basic Properties. Laplace transforms of some standard functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. Inverse Laplace transforms and its properties. Solution of differential equations by using Laplace transforms. **14 Hrs**

Unit IV: Fourier Series and Transforms: Periodic functions. Fourier Coefficients.Fourier series of functions with period 2π and period $2L$. Fourier series of even and odd functions. Half range Cosine and Sine series. **14 Hrs**

Reference Books:

1. D. A. Murray, Introductory Course in Differential Equations, Orient and Longman
2. H. T. H.Piaggio, Elementary Treatise on Differential Equations and their Applications, CBS Publisher & Distributors, Delhi,1985.
3. G. F. Simmons, Differential Equations, Tata McGraw Hill.

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4. S. L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
5. M. D. Raisinghania, Ordinary Differential Equations & Partial Differential Equations, S. Chand & Company, New Delhi.
6. K.Sankara Rao, Introduction to Partial Differential Equations: PHI, Third Edition, 2015.
7. I. N. Sneddean, Elements of Partial differential equations, McGraw-Hill International Editions, 1986.
8. R. Murray and L. Spiegal (Schaum's Series), Laplace Transforms
9. Goel and Gupta, Laplace Transform.
10. Sudhir Kumar, Integral Transform Methods in Science & Engineering, CBS Engineering Series, 2017.
11. Murray R. Spiegal L, Fourier Transforms, Schaum' Series,
12. Earl David Rainville and Philip Edward Bedient–A short course in Differential Equations, Prentice Hall College Div; 6th Edition.
13. Sathya Prakash, Mathematical Physics, S Chand and Sons, New Delhi.

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PRACTICALS

MATDSCP 4.1: Practical's on Partial Differential Equations and Integral Transforms	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Teaching Hours: 56 Hours	**Max. Marks: 50 (S.A.-25 + I.A. – 25)**

Mathematics practical with Free and open Source Software (FOSS) tools for computer programs

Course Learning Outcomes: This course will enable the students to

- Learn Free and Open Source software (FOSS) tools or computer programming.
- Solve problems on Partial Differential Equations and Integral Forms
- To find Laplace transform of various functions
- To finf the Fourier Transform of periodic functions
- To solve differential equations by using Integral transforms.

Programs using Scilab/Maxima/Python:

Elements of Partial differential equations and Integral transforms using FOSS

1 Solutions of Linear Partial differential equations of type1 to type4 and Lagrange's method
2 Solutions of partial differential equation using Charpit's method.
3 Solutions of Second order homogenous partial differential equation with constant coefficients.
4 Solutions to the partial differential equations using separation of variables method (Heat/ Wave/Laplace).
5 Finding the Laplace transforms of some standard and periodic functions.
6 Finding the inverse Laplace transform of simple functions
7 Verification of Convolution Theorem.
8 To solve ordinary linear differential equation using Laplace transform.
9 To solve Integral equation using Laplace transform.
10 To find full range Fourier series of some simple functions with period 2 and 2L
11 To find Half range sine and cosine series of some simple functions and ploting them.
12 To find Cosine Fourier transforms.
13 To find Sine Fourier transforms.

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Open Elective Course

(For students of Science stream who have not chosen Mathematics as one of the Core Course)

MATOET4.1(A): Partial Differential Equations	
Teaching Hours: 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (SEE-60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- explain the concept of the differential equation.
- Classifies the differential equations concerning their order and linearity.
- Explains the meaning of the solution of a differential equation.
- solve first-order ordinary differential equations.
- Solves exact differential equations and Converts separable and homogenous equations to exact differential equations by integrating factors.
- Solves Bernoulli differential equations.
- Will be able to find the solution to higher-order linear differential equations.

Unit I: Basic concepts–Formation of a Partial differential equations by elimination of arbitrary constants and functions – Solution of partial differential equations – Solution by Direct integration, Lagrange's linear equations of the form $Pp + Qq = R$. **14 Hrs**

Unit II : Standard types of first order non-linear partial differential equations, The integrals of the non-linear equation by Charpit's method. Homogeneous Linear partial differential equations with constant coefficients. Partial differential equations of the second order. Classification of second-order partial differential equations, canonical forms. **14 Hrs**

Unit III: Classification of second order linear equations as hyperbolic, parabolic, and elliptic. Solutions of the Heat equation, Laplace equation and Wave equation (using separation of variables). **14 Hrs**

Reference Books:

1. D.A. Murray, Introductory course in Differential Equations, Orient and Longman
2. H.T. H.Piaggio, Elementary Treatise on Differential Equations and their applications, C.B.S Publisher & Distributors, Delhi,1985.
3. G.F.Simmons, Differential Equations, Tata McGraw Hill 14
4. S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.
5. M.R. Speigel, Schaum's outline of Laplace Transform
6. M. D. Raisinghania, Ordinary Differential equations & Partial differential equations, S. Chand & Company, New Delhi.
7. K.Sankara Rao, Introduction to Partial Differential Equations: PHI, Third Edition, 2015.
8. I. N. Snedden, Elements of Partial differential equations,

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OpenElective Course

(For students of other than science stream)

MATOET4.1(B) : Mathematical Finance	
Teaching Hours: 3Hours/week	**Credits: 3**
Total Teaching Hours:42Hours	**Max.Marks:100 (S.A-60+I.A.-40)**

Course Learning Outcomes: Thiscourse will enable the students to

- Understand how compute profit and loss, discount and Banker's discount.
- Understand the concept of Linear equations and inequalities and their use in the solving the Linear Programming Problems.
- Formulation of Transportation Problem and its application in routing problem.

Unit-I: Commercial Arithmetic

Bill of exchange, Bill of discounting procedure. Basic formula related to profit, loss, discount and brokerage, Successive discount, True discount, Banker's discount.

14 Hrs

Unit-II: Linear Programming

Linear equations and inequalities- Rectangular coordinates, straight line, parallel and intersecting lines and linear inequalities, Introduction to linear programming, Mathematical formulation of LPP, Solution of a LPP by graphical method, special cases in graphical method

14 Hrs

Unit-III: Transportation problem

Introduction, Formulation of Transportation problem, Initial basic feasible solution, Steps in solving a transportation problem, optimality check, special cases in Transportation problem. The Traveling salesman Problem (Routing Problem).

14 Hrs

Reference Books:

1. R S Aggarwal, Objective Arithmetic, S. Chand & Company Ltd.
2. Mizrahi and Sullivan, Mathematics for Business and Social Sciences an Application approach.
3. Qazi Zameeruddin, Vijay K Khanna, S K Bhambri, Business Mathematics- II Edition, Vikas Publishing House.
4. S. Kalavathy, Operation Research, Fourth edition, Vikas publication house Pvt. Ltd.
5. Sreenivasa Reddy M, Operations Research 2nd edition, Sanguine Technical publishers, Bangalore.
6. S. D. Sharma, Operation Research,

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Open Elective Course

(For students otherthan science stream)

MATOET 4.1 (C): Mathematics for Social Sciences	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 60 + I.A. – 40)**

Course Learning Outcomes: This course will enable the students to

- Understand the mathematical concept of sets and counting problems.
- Understand the concept of Probability and its applications in social sciences.
- Understand the concept of limits and continuity of functions and its applications in business and social sciences.

Unit-I

Sets, counting, permutations, combinations, counting problems, binomial theorem and problems thereon. Probability – Introduction, sample space and assignment of probabilities, properties of the probability of an event, probability of equally likely events, conditional probability, Baye's formula and examples thereon.

14 Hours

Unit-II

Limit and continuity, Derivative- interpretation, derivative formulas, general derivatives for differentiation, composite functions, higher order derivatives and problems thereon.

14 Hours

Unit-III

Applications of the derivative – Relative maxima and Relative minima, Absolute maximum and Absolute minimum, Applied problems, Concavity, Asymptotes, Marginal analysis, Models- Maximizing tax revenue, Optimal trade-in time, and minimizing inventory cost.

14 Hours

REFERENCE BOOKS

1. Abe Mizrahi and Michael Sullivan, Mathematics for Business and Social Sciences and Applied Approach – Third Edition, Wieley.
2. Carl P. Simon and Lawrence Blume, Mathematics for Economists, Viva Books Private Limited, New Delhi, 2015.
3. L. Peccati, M. D'Amico and M. Cigola , Maths for Social Sciences, , Springer.

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