

Details of Course

| Course Title | Course Structure | | | Pre-Requisite |
|--------------------------------|------------------|---|---|--|
| MC 210: Differential Equations | L | T | P | Basic knowledge of calculus and matrix |
| | 3 | 0 | 2 | |

Course Objective: To impart the knowledge of ordinary and partial differential equations and to analyze and solve the physical problems.

Course Outcome (CO):

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| CO1 | Evaluate linear systems of differential equations, both homogeneous and non-homogeneous by matrix method and Sturm-Liouville boundary value problems including orthogonality properties. |
| CO2 | Analyse the stability of linear and non-linear differential equations through phase portrait diagram. |
| CO3 | Formulate partial differential equations, evaluate linear, quasi linear and non-linear first order PDEs and address Cauchy's problem for first order PDE. |
| CO4 | Solve homogeneous and non-homogeneous linear PDE with constant coefficients and classify second order PDE to determine characteristics. |
| CO5 | Apply the method of separation of variables to solve initial and boundary value problem including heat equation, wave equation and Laplace equation. |

| S. No. | Contents | Contact hours |
|--------|--|---------------|
| 1. | Ordinary differential Equations I (ODEs): Solutions of linear system of differential equations (homogenous and non-homogenous) by matrix method, Sturm-Liouville boundary values problems including characteristic functions and orthogonality. | 8 |
| 2. | Ordinary differential equations II: Linear and Non-linear autonomous systems, Phase plane, Paths, Critical Points and its types, Stability of the critical points, Phase plane analysis, Liapunov's direct method, periodic solutions, limit cycle. | 8 |
| 3. | Partial differential equations I (PDEs): Formation of PDEs, Linear and Quasi- linear first order PDEs (Lagrange form), Cauchy's problem for first order PDEs, Non-linear first order PDEs: Standard forms and Charpit's method. | 8 |
| 4. | Partial differential equations II: Linear Homogeneous and Non-homogeneous second and higher order PDEs with constant coefficients, Classification of second order PDEs, Characteristic equations and characteristic curves, method of separation of variables. | 9 |
| 5. | Applications of partial differential equations: One-dimensional heat equation, one-dimensional wave equation, two-dimensional heat equation (solution of Laplace equation in Cartesian and polar coordinates). | 9 |
| | Total | 42 |

Suggested Books:

| S. No. | Name of Books/Authors/Publishers | Year of Publication |
|--------|--|---------------------|
| 1. | Martin Braun, Differential equations and their applications, Springer, 4 th Edition | 1993 |
| 2. | S. L. Ross, Introduction to Ordinary Differential Equations, John Wiley & Sons, 4 th Ed. | 1989 |
| 3. | R.K Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa, 5 th Ed. | 2017 |
| 4. | K S Rao, Introduction to Partial Differential Equations, Prentice Hall India, 3 rd Edition | 2011 |
| 5. | E. Kreyszig, Advanced Engineering Mathematics, Wiley Publications, 10 th Edition | 2017 |
| 6. | Peter V.O. Neil: Partial Differential equations: Peter V. O'Neil, Wiley Publication, 3 rd Ed. | 2014 |