**Shyama Prasad Mukherji College**

**Teaching Plan**

**Course and Year: B. A/B.Sc./B.com, II yr (Aug-Dec, 2022)**

**Semester: III**

**Taught Individually or Shared: Shared**

**Paper: GE-3: Differential Equations (with Practicals)**

**Faculty: Pardeep Kumar and Mrs. Alka Goel**

**No. of Classes (per week): 4 Lectures, 4 Practicals (per week)**

**Total Marks: 150 (Theory: 75, Internal Assessment: 25, and Practical: 50)**

**Duration: 14 Weeks (56 Hrs. Theory + 56 Hrs. Practical) Examination: 3 Hrs.**

**Course Objectives:** To introduce various types of differential equations and variety of methods to solve ordinary and partial differential equations with basic applications to real life problems.

**Course Learning Outcomes:** The course will enable the students to

1. Solve the exact, linear and Bernoulli equations and find orthogonal trajectories.
2. Apply the method of variation of parameters and undetermined coefficient to solve linear differential equations.
3. Formulate and solve various types of first and second order partial differential equations.

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| **Teaching Plan** | |
| **Name of the Paper**  **GE-3: Differential Equations (with Practicals)** | **Weeks 1 and 2:** First order ordinary differential equations: Basic concepts and ideas, First order exact differential equation, Integrating factors and rules to find integrating factors.  **Practical 1:** Solution of first order differential equation.  **Week 3:** Linear equations and Bernoulli equations, Orthogonal trajectories and oblique trajectories.  **Practical 2:** Plotting of second order solution family of differential equation.  **Weeks 4 and 5:** Basic theory of higher order linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.  **Practical 3:** Plotting of third order solution family of differential equation.  **Weeks 6 and 7:** Linear homogenous equations with constant coefficients, Linear non-homogenous equations, Method of undetermined coefficients.  **Practical 4:** Solution of differential equation by variation of parameter method.  **Weeks 8 and 9:** Method of variation of parameters, Cauchy−Euler equations, Simultaneous differential equations.  **Practical 5:** Solution of system of ordinary differential equations.  **Week 10:** Partial differential equations**:** Basic concepts and definitions, Mathematical problems; First order equations**:** Classification and construction.  **Practical: Basics of Mathematica**  **Weeks 12 :** Geometrical interpretation, Method of characteristics, General solutions of first order partial differential equations.  **Practical 6:** Solution of Cauchy problem for first order partial differential equations.  **Week 13:** Canonical forms and method of separation of variables for first order partial differential equations.  **Practical 7:** Plotting the characteristics of the first order partial differential equations.  **Week 14:** Second order partial differential equations**:** Classification, Reduction to canonical forms, with constant coefficients, General solutions.  **Practical 8:** Plot the integral surfaces of first order partial differential equations with initial data.  **Readings:**   1. Kreyszig, Erwin. (2011). *Advanced Engineering Mathematics* (10th ed.). Wiley India. 2. Myint-U, Tyn and Debnath, Lokenath (2007). *Linear Partial Differential Equations for Scientist and Engineer*s (4th ed.). Birkkäuser Boston. Indian Reprint. 3. Ross, Shepley. L. (1984). *Differential Equations* (3rd ed.). John Wiley & Sons.   **Suggested Readings:**   1. Sneddon I. N. (2006). *Elements of Partial Differential Equations*. Dover Publications. 2. Martha L.A. and James P.B. (1993). *Differential Equation with Mathematica*, Academic Press, London. 3. N. M. Kapoor (2006). *A Text book of Differential Equations.* Pitambar Publishing Company (P.) Ltd. 4. M. D. Rajsinghania (2015). *Advanced Differential Equations.* [SChand Publications](https://www.kopykitab.com/Schand). 5. R. Kent Nagle, Edward B. Saff, Arthur David Snider (2017). *Fundamentals of Differential Equations.* Pearson.   **e-references:**   1. **Mathematical Science - VLE , University of Delhi.** 2. **Paul’s Online Maths Notes.** 3. **NPTEL Video Lectures.** |



**Sub topics to be covered and their order along with the respective time frames (if any)**

 Homogeneous differential equations, reducible to homogeneous, variable separable method, solution of linear differential equation, reducible to linear differential equations.

**Methodology of Teaching:**

1. **Online teaching Platform is used for teaching such as: Google meet, Microsoft Team or Zoom.**
2. **Using online available resources.**
3. **Using Different Softwares (Mathematica, MS-Office) .**
4. **Visualize the Mathematical Concept by 2D and 3D-Imaging through some Softwares. (Mathematica)**
5. **Encourage students to participate in the academic activities of the college and department as well as in other colleges.**

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| **ASSESSMENT** |  |
| **Tentative date of assessments/ assignments:** | **Test-1 in mid September**  **Assignment-1 in end of September.**  **Test-2 and Assignment-2 in mid October**  **Test-3 in mid November.** |

**Criteria of Assessment: Written Test/ Assignment/ Presentations/Performance in Inter-College Academic Activities.**

