Bharati College
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Lesson Plan (CORE, Semester II, January, 2023 to June 2023)

Name of Teacher	Dr. Ankit Gupta	Department	Mathematics
Course	B.Sc (H) Mathematics	Semester	Second
Paper	Calculus	Academic Year	2022-23

Learning Objectives

The primary objective of this course is :

- The exciting world of differential equations.
- Their applications and mathematical modeling

Learning Outcomes

On completion of this course, the student will be able to:
- Learn the basics of differential equations and compartmental models.
- Formulate differential equations for various mathematical models.
- Solve first order non-linear differential equations, linear differential equations of higher order and system of linear differential equations using various techniques.
- Apply these techniques to solve and analyze various mathematical models.

Lesson Plan

Week No.	Theme/ Curriculum	Any Additional Information

Week		
Week 1-4	• Concept of implicit, general, and singular solutions for the first order ordinary differential equation; Bernoulli's equation, Exact equations, Integrating factors, Initial value problems, Reducible second order differential equations. • Applications of first order differential equations to Newton's law of cooling, exponential growth and decay problems	Allocation of Assignment I
Week 5 – 8	• General solution of homogenous equation of second order, Principle of superposition for a homogenous equation, Wronskian and its properties, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients • Method of variation of parameters, Method of undetermined coefficients.	
Week 9 - 12	• Two-point boundary value problems, Cauchy-Euler's equation, System of linear differential equations, Application of Second order differential equation: Simple pendulum problem. • Introduction to compartmental models, Lake pollution model, Density-dependent growth model.	
Week 13 - 15	• Interacting population models, Epidemic model of influenza and its analysis, Predator-prey model and its analysis, Equilibrium points, Interpretation of phase plane.	Allocation of Assignment II

References

1. Barnes, Belinda & Fulford, Glenn R. (2015). Mathematical Modeling with Case Studies, Using Maple and MATLAB (3rd ed.). CRC Press. Taylor & Francis Group.
2. Edwards, C. Henry, Penney, David E., & Calvis, David T. (2015). Differential Equations and Boundary Value Problems: Computing and Modeling (5th ed.). Pearson Education.
3. Ross, Shepley L. (2014). Differential Equations (3rd ed.). Wiley India Pvt. Ltd.