**Shyama Prasad Mukherji College for Women**

**Teaching Plan**

Course and Year: **B.Sc.(H) 2022-23**

Semester: **V**

Paper: **DSE-1 (ii): Mathematical Modeling and Graph Theory**

To be taught individually or in sharing: **In sharing**

Faculty: **Dr. Deepak Bhati and Ms. Alka**

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

No. of Classes(per week)**: 4 Lectures, 4 Periods practical (per week per student)**

**Course Objectives:** The main objective of this course is to teach students how to model  
physical problems using differential equations and solve them. Also, the use of Computer  
Algebra Systems (CAS) by which the listed problems can be solved both numerically and  
analytically.

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

1. The use of mathematics software to observe the implementations of the above  
   mentioned methods efficiently, and to enhance the problem-solving skills.
2. To solve physical problems using differential equations.

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| **Teaching Plan**  **Weeks 1 and 3:** Power series solution of a differential equation about an ordinary point, Solution about a regular singular point. Legendre’s equation. The method of Frobenius. [2] Chapter 8 (Sections 8.1 to 8.3)  **Week 4:** Bessel’s equation. Bessel’s function of first kind. [2] Chapter 8 [Section 8.5 up to Equation (19), page 551)]  **Weeks 5 and 6:** Laplace transform and inverse transform, Application to initial value problem up to second order. [2] Chapter 7 (Sections 7.1 to 7.3)  **Weeks 7 and 8:** Monte Carlo Simulation Modeling**:** Simulating deterministic behavior (area under a curve, volume under a surface), Generating Random Numbers**:** Middle square method, Linear congruence. Queuing Models**:** Harbor system, Morning rush hour. [3] Chapter 5 (Sections 5.1 to 5.2, and 5.5)  **Weeks 9 and 10:** Overview of optimization modeling, Linear Programming Model: Geometric solution, Algebraic solution, Simplex method, Sensitivity analysis. [3] Chapter 7  **Weeks 11 and 12:** Graphs, Diagraphs, Networks and subgraphs, Vertex degree, Paths and cycles, Regular and bipartite graphs, Four cube problem, Social networks. [1] Chapter 1 (Section 1.1), and Chapter 2  **Weeks 13 and 14:** Exploring and traveling, Eulerian and Hamiltonian graphs, Applications to dominoes, Diagram tracing puzzles, Knight’s tour problem, Gray codes. [1] Chapter 3 |

**Note**: [1] Chapter 1 (Section 1.1), Chapter 2 (Sections 2.1 to 2.4), Chapter 3 (Sections 3.1 to  
3.3) are to be reviewed only. This is in order to understand the models on Graph Theory.

**Readings (in APA format)**

**References:**

1. **Aldous, Joan M., & Wilson, Robin J.** (2007). Graphs and Applications: An Introductory Approach. Springer. Indian Reprint.
2. **Edwards, C. Henry, Penney, David E., & Calvis, David T.** (2015). Differential Equation and Boundary Value Problems: Computing and Modeling (5th ed.). Pearson.
3. **Giordano, Frank R., Fox, William P., & Horton, Steven B.** (2014). A First Course in  
   Mathematical Modeling (5th ed.). Brooks/Cole, Cengage Learning.

# **Additional Readings:**

# [**Jean-Claude Fournier**](https://www.wiley.com/en-ie/search?pq=%7Crelevance%7Cauthor%3AJean-Claude+Fournier)**,** Graphs Theory and Applications: With Exercises and Problems, Wiley-ISTE.

# [**Hamdy A. Taha**](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Hamdy+A.+Taha&search-alias=stripbooks)**,** Operations Research An Introduction to Research By Pearson.

**E-references:**

1. Mathematical Science - VLE, University of Delhi.
2. Paul’s Online Math’s Notes
3. NPTEL Video Lectures
4. mathfaculty.fullerton.edu/mathews/n2003/Web

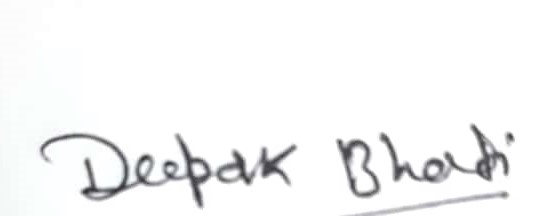
**Methodology of Teaching**:

1. Chalk and Board teaching method.
2. Problem solving method.
3. Tutorials for doubt clearings.
4. Encourage students to raise questions.
5. Regular assessment of students through tests, assignments and presentations.
6. Guide students how to read and write research articles.
7. Mentor students to present research paper at various platforms.
8. Participating with students in academic activities by visiting different colleges.

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| **ASSESSMENT:**  Tentative schedule of assessments/ assignments:  Class Test 1 and Assignment 1: At the end of 5th week of Session.  Class Test 2 and Assignment 2: At the end of 8th week of Session.  Mock Test: Based on complete syllabus at the end of 14th week of Session.  **Criteria of Assessment:**  Class Tests, Assignments, Presentations by students, Discussion in the class and Viva. |



Ms. Alka



Dr. Deepak Bhati