**National University**

**Of Computer & Emerging Sciences**

**Karachi**

**Course Outlines of BS (CS) Degree Program**

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| **Course Instructor** | Dr. Fahad Riaz/ Ms Amber/ Ms. Asma/ Ms. Afreen | **Semester** | Spring |
| **Batch/Section(s)** | 2018 / Sec A, B,C,D,E,F,G,H | **Year** | 2021 |
| **Course Title** | MT224 Differential Equations | **Credit Hours** | 3 |
| **Prerequisite(s)** | MT119- Calculus and Analytical Geometry | **Course TA** | 1AZZZ |

**Text Book(s)**

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| 1.Title of book | Advanced Engineering Mathematics, 4th edition | | |
| Author(s) | *Dennis G.Zill* | Publisher | John Wiley & Sons. |



**Reference Book(s)**

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| --- | --- | --- |
| Advanced Engineering Mathematics 10th edition | | |
| *Erwin Kreyszig* | Publisher | McGraw-Hill |
| Differential Equations and Boundary Value Problems 3rd edition | | |
| *Edwards Penney* | Publisher | Pearson |
| Introduction to Engineering Mathematics | | |
| *H.K.DASS* | Publisher | S.Chand and Company ltd |



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| **Course Description:** |
| This course is based primarily on differential equations. The focus of this course will be on the solution of first and higher-order differential equations and applications of ordinary differential equations (ODE’s) to problems from the physical, biological, and social sciences. |



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| **Course Objective:** |
| This is an introductory course on Differential equations which includes in-depth coverage of methods of solving differential equations and mathematical modeling with differential equations. |



**Tentative Lecture Schedule:** Differential Equations with Modelling Application, 9thEdition.Zill

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| --- | --- | --- | --- |
| **Week** | **Contents/Topics** | **Exercises** | **Questions** |
| 1 | **Introduction to Differential Equations:**  Differential Equations and their Classification  Solutions or Integrals of Differential Equations  Formation of the differential equation.  **Initial Value Problems:**  First and Second-Order IVPS | 1.1  1.2 | 1-8,11-18  21-24,27-32  37,38 ,44,47  1-14,31-33 |
| 2 | **The solution of First Order Differential Equations:**  Variable Separable form.  Linear Differential Equations | 2.2  2.3 | 1-30  1-24,25-30,31-34 |
| 3 | Exact and Non-Exact form (Integrating Factor) | 2.4 | 1-16,21-25,37-30 |
| 4 | Solution by substitution (Homogeneous)  Bernoulli Differential Equations | 2.5  2.5 | 1-14,23-30  15-22  **Quiz-1** |
| 5 | Applications of First-Order Differential Equations (Linear Models)  **Growth & Decay, Newton Law of cooling, Series circuits** | 2.7 | Example: 1,2,4,6  2-4,13-15,31-33 |
| 6 | **Midterm 1** |  |  |
| 7 | **Higher-Order Differential Equations:**  Initial and Boundary value problem.  Homogeneous DEs’, Linear Dependence and Independence, Wronskian  Non-homogeneous Linear Differential Equation.  Reduction of order | 3.1    3.2 | 1-4,7,8,13,19,  23-30,31-34    1-14 |
| 8 | Homogeneous Linear Equations with Constant Coefficients (complimentary solution) | 3.3 | 1-14,15-25,29-40 |
| 9 | Undetermined coefficients Method  (Superposition approach) Particular Solution | 3.4 | 1-25,27-30  37-40  **Quiz-II** |
| 10 | Variation of parameters.  Cauchy Euler equation. | 3.5  3.6 | 1-18,19-22,25  1-15,19-24,25-30 |
| 11 | **Power Series solution of Differential equation:**  Review of Power series. Radius of convergence  Solution about ordinary Points at x=0 | 5.1 | 1-6,17-28,29-32 |
| 12 | **Midterm 2** |  |  |
| 13 | **The Laplace Transform:**  Laplace transform  Inverse Laplace transforms  Transforms of Derivatives | 4.1  4.2 | 1-36  1-30,  **Quiz-III**  31-40 |
| 14 | Translation on the s-axis and y-axis  Derivatives of Transform, Transforms of Integrals: Convolution Theorem | 4.3  4.4 | 1-18,  21-30,37-48  1-10 |
| 15 | Application of Laplace transforms  The Dirac Delta Function | 4.5 | 1-10 |
| 16 | Numerical solutions of ODE( if time permits ) |  |  |

**Grading Criteria:**

**Marks Distribution:**

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| **Particulars** | **% Marks** |
| 1. Class participation/Attendance | 05 |
| 2. Quizzes | 10 |
| 3. Assignments | 05 |
| 4. First Mid Exam | 15 |
| 5. Second Mid Exam | 15 |
| 6. Final Exam | 50 |
| **Total:-** | **100** |