.King Saud University
College of Science
Introduction to Differential Equations
Course Syllabus
First Semester 1438 - 1439

1. Course General Information:

Course Title: Introduction to deferential equations	**Course Code: MATH 225**
Course Level: 4	**Course Prerequisite: MATH 201** **Co-requisites for this course (if any): None**
Lecture Time: 9-10 am	**Credit Hours: 4**

2. Faculty Member Responsible for the Course:

Name	Rank	Office Number and Location	Office Hours	Email Address
Mongi Blel	Professor	1A148	-	mblel@ksu.edu.sa

3. Course Description:

Students are introduced to: Classification of differential equations, Existence and Uniqueness. Methods of solving of first order differential equations: Separable equations, exact equations, special integrating factors, substitution and transformation, Linear differential equations with constants coefficients, Bernoulli equations, method of reduction of order. Higher order linear differential equation. Homogeneous linear equation with constant coefficients, method of variation of parameters, undetermined coefficient method, superposition principle, Cauchy-Euler equations, reduction of order method. Laplace transformations. Power series. Linear System of equations.

4. Course Academic Calendar

Week	Basic material to be covered
1	Classification of differential equations and their origin: interval of definition, Solutions, Cauchy initial value problems: Existence and Uniqueness.
(2-4)	Method of solving of first order differential equations: Separable equations, exact equations, special integrating factors, substitution and transformation, Linear differential equations with constants coefficients, Bernoulli equations, method of reduction of order.
(5-6)	Higher order linear differential equation (HOLDE): Basic theory of HOLDE Existence-Uniqueness theorem, linearly independent and dependent functions, Wronskian.
(7-10)	Method of solving of HOLDE: Homogeneous linear equation with constant

	coefficients, method of variation of parameters, undetermined coefficient method, superposition principle, Cauchy-Euler equations, reduction of order method
(10-12)	Laplace transformations: Definitions and properties, inverse Laplace transformation, applications: solving initial value problems.
(12-15)	Power series Solutions of linear differential equations of second order with Polynomial coefficients near an ordinary point. Linear system of differential equations: Solving system by elimination, matrix methods for linear system.
(16)	Final Examination

5. Course Objectives:

The main purpose for this course is to introduce the following concepts:

- Classification of differential equations.
- Solving first order differential equations
- Solving higher order linear differential equation
- Laplace transformations
- Power Series
- System of differential equations.

6. Course References:

6.1 Textbooks:

A first Course in Differential equations, Zill, 2002

6.2 Essential References Materials (Journals, Reports, etc.)

6.4 Websites:

1- http://faculty.ksu.edu.sa/ialolyan/default.aspx
2- Internet sites relevant to the course

6.5 Other learning material such as computer-based programs/CD, professional standards or regulations and software.

- Some computer programs exist relevant to course materials

7. Teaching Methods:

- For each topic we give some examples for the students and encourage them to discover the relevant concepts.
- At the beginning of each lecture, a discussion is conducted with the students about what has been done in the previous lecture in order to establish a link with the current lecture.
- At the end of each lecture, a summary is given.
- Discussions in the class
- Independent study
- Student's' Representation.

8. Learning Outcomes:

8.1 Knowledge and Understanding:

After studying this course, the student will acquire the following knowledge and be able to:

- Recognize the type and order of Differential Equation (DE), and solve first order DE. State the roles under which the DE has a unique solution. Outline the solution of linear DE and Bernoulli equation.
- Describe the linearly independent and dependent functions, and outline its use to find Wronskian.
- Describe homogeneous equations and solve them with constant coefficients. Solve nonhomogeneous equations and Cauchy Euler equations.
- Write the definition of Laplace transformation and describe the properties of Laplace transformation. Recognize the inverse of Laplace transformation. Use Laplace transformation to solve initial value problems.
- Define the power series, and their properties
- Outline the solution of linear DE using power series.
- Describe the linear system of equations.

8.2 Cognitive Skills (Thinking and Analysis):

After studying this course, the student will able to:

- Recognize the order and type of DE.
- Find the solution of first order DE.
- Test the DE for the existence and unique solution.
- Solve linear DE and Bernoulli equation.
- Evaluate Wronskian of the functions and determine if the functions are linearly independent or dependent.
- Find the solution of homogeneous and nonhomogeneous equations and Cauchy Euler equations.
- Find the solution of initial value problem using Laplace transformation.
- Evaluate the solution of DE using power series, and Solve linear system of DE.

8.3 Interpersonal Skills and Responsibility:

After studying this course, the student is expected to:

- To participate in the discussion
- Study, learn and work independently.
- Work effectively in teams.
- Meet deadlines and manage time properly.
- Exhibit ethical behaviour and respect different points of view.

8.4 Communication, Information Technology and Numerical Skills

After studying this course, the student is expected to be able to:

- Present mathematics to others, both in oral and written form clearly and in a well-organized manner.
- Use IT facilities as an aid to mathematical processes and for acquiring available information.
- Use library to locate mathematical information.

9. Methods of Assessment:

Course Assessment	Mark
Class activates (in class quizzes, and homework)	10
Midterm exams I	25
Midterm exams II	25
Final Examination	40
Total	**100**

10. Course Policies:

- All exams are closed book.
- The final exam will be comprehensive.

11. Attendance Policy:

Absence from lectures and/or tutorials shall not exceed 25%. Students who exceed the 25% limit without an accepted medical or emergency excuse shall not be allowed to take the final examination and shall receive a grade of "DN" for the course.