



# THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

## *Department of Mathematical Sciences*

### MTS 309 - Elementary Differential Equations II

#### COURSE PARTICULARS

**Course Code:** MTS 309

**Course Title:** Elementary Differential Equations II

**No. of Units:** 3

**Course Duration:** Two hours of theory and one hour of tutorial per week for 15 weeks.

**Status:** Compulsory

**Course Email Address:** mts309@gmail.com

**Course Webpage:** <http://www.mts.futa.edu.ng/courseschedule.php?coursecode=mts%309>

**Prerequisite:** MTS 201, MTS 209

#### COURSE INSTRUCTORS

**Doctor S. J. Kayode,**

*Room 18, Academic Building,*

*Federal University of Technology, Akure, Nigeria*

**Phone:** +2348033974438

**Email:** sjkayode@futa.edu.ng

#### COURSE DESCRIPTION

This course is a follow-up to MTS 209 – Elementary Differential Equations I. It is designed for students in Mathematics to equip them with methods of solving differential equations and other special functions. The topics to be covered in this course include series solutions to second order linear equations – Bessel, Legendre equations; hypergeometric functions/equations; Gamma and Beta functions; Sturm-Liouville problems; orthogonal polynomials and functions; Fourier series and transform; solution of Laplace, wave and heat equations by Fourier method.

#### COURSE OBJECTIVES

The objectives of this course are to:

- equip students with a deeper knowledge of some special functions/equations modeled from physical processes;
- introduce students to analytical solutions of some types of second order linear differential equations with series solutions;
- enable students to solve some special partial linear differential equations - Laplace, wave and heat equations.

## COURSE LEARNING OUTCOMES / COMPETENCIES

At the completion of the course, student will be able to:

*(Knowledge based)*

- define some special functions and explain their uses;
- explain the relationship of some of the special functions;
- classify linear partial differential equations;
- explain the application of the special functions to solving physical processes;

*(Skills)*

- deduce the recurrence relations from given generating functions to determine Bessel, Legendre and some other special polynomials of degree  $n$ ;
- solve :
  - second order linear ordinary differential equations with series solution method;
  - Laplace, wave and heat equations with Fourier series method;
- determine Beta, Gamma functions and Sturm-Liouville problems

## GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Class Attendance	5%
Quizzes/Assignments	15%
Test(s)	10%
<u>Final Examination</u>	<u>70%</u>
<b><u>TOTAL</u></b>	<b><u>100%</u></b>

## GENERAL INSTRUCTIONS

**Attendance:** It is expected that every student will be in class for lectures and also participate in all tutorial classes. Attendance records will be kept and used to determine each person's qualification to sit for the final examination. In case of illness or other unavoidable cause of absence, the student must communicate as soon as possible with the Course Lecturer, indicating the reason for the absence.

**Academic Integrity:** Violations of academic integrity, including dishonesty in assignments, examinations, or other academic performances are prohibited. You are not allowed to make copies of another person's work and submit it as your own. All cases of academic dishonesty will be reported to the University Management for appropriate sanctions in accordance with the guidelines for handling students' misconduct as spelt out in the Students' Handbook.

**Assignments and Group Work:** Students are expected to submit assignments as scheduled. Failure to submit any given assignment, as at when due, will earn you zero for that assignment. Only under extenuating circumstances for which a student has notified the Course Lecturer in advance, will late submission of assignments be permitted.

**Code of Conduct in Lecture Rooms:** Students should turn off their cell phones during lectures. Students are prohibited from engaging in other activities (such as texting, watching videos, etc.) during lectures. Fighting and noise making are strictly prohibited during lectures.

## READING LIST

<sup>1</sup>Boyce, W. E. and DiPrima, R. C.: *Elementary Differential Equations and Boundary Value Problems*. John Wiley & Sons Inc, 2001

<sup>1</sup>Duffy, D.G.: *Advanced Engineering Mathematics*. CRC Press LLC, New York, 1998

<sup>1</sup>Jeffery, A.: *Advanced Engineering Mathematics*. Harcourt/Academic Press, San Diego, California, 2002

<sup>1</sup>John Bird: *Higher Engineering Mathematics, Fifth Edition*. John Bird. Published by Elsevier Ltd, New York, 2006

<sup>2</sup>Larry, C.A.: *Special Functions for Engineers and Applied Mathematicians*. Macmillan Book Company, New York, 1985

<sup>2</sup>Spiegel, M.R.: *Advanced Mathematics Schaum's Outline Series in Mathematics*. McGraw-Hill Book Company, New York, 1971

<sup>2</sup>Zill, D. G.: *A First Course in Differential Equations with Applications*. Prindle, Weber and Schmidt, Boston Massachusetts, 1979

### Legend

1- Available on the Internet.

2- Available as Personal Collection

## COURSE OUTLINE

Week	Topic	Remarks
1-2	Introduction and Course Overview Series solution of second order linear equations	During this first class, the expectation of the students from the course will be administered.
3 - 4	Bessel, Legendre and hypergeometric functions and equations	Class quiz and exercise will be administered to the students.
5	Gamma and Beta functions	Class quiz and exercise will be administered to the students.
6	Sturm-Liouville problems	Class quiz and exercise will be administered to the students.
7	Legendre equations and functions	Class quiz and exercise will be administered to the students.
8	Mid-Semester's Test	Review of previous work and administration of mid-semester's test

9 - 10	Orthogonal Polynomials and functions Fourier series	Class quiz and exercise will be administered to the students.
11	Fourier Transformation	Class quiz and exercise will be administered to the students.
12 - 13	Solutions of Laplace, Heat and Wave equations	Class quiz and exercise will be administered to the students.
14	Revision	Students prepare for semester's examinations. Evaluation will be done to assess how far the students' expectations for the course have been met.
15	Semester's Examinations	This is the week Semester final examination.