



FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE
FIRST SEMESTER EXAMINATIONS (MARCH 2017)
2016/2017 ACADEMIC SESSION

COURSE CODE: MTH 309

COURSE TITLE: DIFFERENTIAL EQUATION II

DURATION: 2 Hours

COURSE LEADER: Mrs. Titilayo Akinwumi

HOD's SIGNATURE

INSTRUCTIONS:

1. YOU ARE TO ANSWER **THREE** QUESTIONS OUT OF **FIVE**
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING THE EXAM
3. YOU ARE NOT ALLOWED TO BORROW CALCULATORS AND WRITING MATERIALS

1a. Using the method of Wronskian, determine if the set of functions $f(t) = e^t$ and

$g(t) = e^{2t}$ are linearly independent or not. (4 Marks)

b. Verify that the given y_1 is a solution to the differential equation

$$y'' - 5y' + 6y = 0, y_1 = e^{2x}, \quad (3\text{Marks})$$

c. Hence find the general solution to the differential equation

$$y'' - 5y' + 6y = 0, y_1 = e^{2x}, \text{ using the method of reduction of order.} \quad (13\text{ Marks})$$

2a. Evaluate (i) $\frac{\Gamma(5)}{2\Gamma(3)}$ (ii) $\frac{\Gamma(1.5)}{\Gamma(2.5)}$ (6 Marks)

b. By method of variation of parameters, find the general solution of

$$y'' + y = \tan x \text{ where } y_1 = \cos x \text{ and } y_2 = \sin x \quad (14\text{ Marks})$$

3a. Define the following (i) Ordinary point (ii) Regular singular point (3 Marks)

b. Determine whether $x = 0$ is an ordinary point of the differential equation

$$y'' - xy' + 2y = 0 \text{ and find the recurrence formula for the power series around } x = 0 \quad (7\text{ Marks})$$

c. Find the general solution of the differential equation $y'' - xy' + 2y = 0$

using power series method. (10 Marks)

4a. Determine $\int_0^1 x^5(2-x)^4 dx$ (ii) $\int_0^\infty x^8 e^{-2x} dx$ (8 Marks)

b. Using the Laplace transform, find the solution of $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4e^{2t}$, $y(0) = -3$, $y'(0) = 5$ (12 Marks)

5a. Evaluate $\int_0^\pi \sin^2 4\theta \cos^5 4\theta d\theta$ (4 Marks)

b. Determine the singular point of the differential equation (3 Marks)

$$3x^2y'' - xy' + y = 0$$

c. Using the method of Frobenius, find the general solution near $x = 0$ of

$$3x^2y'' - xy' + y = 0 \quad (13\text{ Marks})$$