



UNIVERSITY EXAMINATIONS 2019/2020 ACADEMIC YEAR

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

END OF SEMESTER EXAMINATION FOR

DIPLOMA IN ELECTRICAL/MECHANICAL AND BUILDING AND CIVIL ENGINEERING

ECU MATHEMATICS VII ORDINARY DIFFERENTIAL EQUATIONS

YEAR 2 SEM 1

SEPT -DEC 2019

INSTRUCTIONS: Answer question **ONE** and any other **TWO** questions

QUESTION ONE 30MKS

a) Solve the following differential equations

i) $3 \frac{dy}{dx} + x = 6$ (2mks)

ii) $4 \frac{dy}{dx} = \sec 2y$ (3mks)

iii) $(x - y)ydx - x^2dy = 0$ (5mks)

b) Solve

$$\frac{d^2y}{dx^2} - 5 \frac{dy}{dx} + 6y = 24 \quad (8mks)$$

c) A body moves so that at time t seconds its displacement x meters from a fixed-point O satisfies the differential equation

$$\frac{d^2x}{dt^2} - 2 \frac{dx}{dt} + 2x = 2e^t. \text{ Find the general equation for } x. \quad (5mks)$$

d) Obtain the general solution of the equation

$$x^2y - x^3 \frac{dy}{dx} = y^4 \cos x \quad (8mks)$$

QUESTION TWO 20MKS

a) Use Laplace transforms to solve the differential equation

$$\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 2e^{3t} \text{ given that at } t = 0, x = 5 \text{ and } \frac{dx}{dt} = 7 \quad (10 \text{ marks})$$

b) Use the method of undetermined coefficients to solve the D.E

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = e^{2x} \text{ given that } x = 0, y = 1 \text{ and } \frac{dy}{dx} = 3 \quad (10 \text{ mks})$$

QUESTION THREE 20MKS

a) Solve the differential equation $xy \frac{dy}{dx} = x^2 + y^2$ given that when $x = 1, y = 0$ (9mks)

b) Use the method of undetermined coefficient to solve the differential equation

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 10y = \sin 3x \text{ Given that } y = 0 \text{ and } \frac{dy}{dt} = 1 \text{ when } t = 0 \quad (11 \text{ mks})$$

QUESTION FOUR 20MKS

Solve the following differential equations

a) $4x^2 \frac{dy}{dx} = 3x^2 + y^2$ (7mks)

b) $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 3 = 0$ given that $x = 0$ and $\frac{dx}{dt} = 3$ at $t = 0$ (8mks)

c) $(x + y) = (x - y) \frac{dy}{dx}$ (5mks)

QUESTION FIVE 20MKS

a) Given that $y = 3$ when $x = 2$ obtain a particular solution to the equation

$$(1 + x^2) \frac{dy}{dx} + \frac{y}{x} = 3xy + 5x$$

(5mks)

b) Use the method of undetermined coefficients to solve the equation

$$15 \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} - y = 3x + 65 \sin x \quad (10 \text{ mks})$$

c) Solve $\frac{xy^2}{(x^3 + y^3)} \frac{dy}{dx} = 1$ given that $y = 3$ when $x = 1$ (5mks)

