FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE

REGULAR PROGRAMME

MAT 233: ORDINARY DIFFERENTIAL EQUATION 1

DATE: APRIL 2024	Duration: 2 Hours
INSTRUCTIONS: Answer Question ONE and any other TWO Questions	

Q1.

a. What is homogeneous equation **(1Mark)**

b. Explain what is meant by the term 'solution of a differential equation' **(2 Marks)**

c. Classify the following equation in terms of order, degree, homogeneous and non-homogeneous. **(4 Marks)**

 i. $\dfrac{d^2y}{dx^2} + 5\dfrac{dy}{dx} - y^2 = 0$

 ii. $\left(\dfrac{d^2y}{dx^2}\right)^2 + 6\left(\dfrac{dy}{dx}\right)^3 - y = \sin 2x$

d. Solve for y given

 i. $\dfrac{dy}{dx} + 2y = 0$ **(3 Marks)**

 ii. $\dfrac{dy}{dx} = \dfrac{x}{y}$ **(3 Marks)**

e. Test for the exactness of the following differential equations:

 i. $(3xy - y^2)dx + (x^2 - xy)dy = 0$ **(3 Marks)**

 ii. $2xy\dfrac{dy}{dx} + y^2 = e^{2x}$ **(3 Marks)**

f. Find the solution of initial value problem

 $\dfrac{dy}{dt} = \dfrac{-y(1+2t^2)}{t}$ $y(0) = 2$ **(5 Marks)**

g. Solve exact equation

 $(y^2 - 2x)\,dx + (2xy+1)\,dy = 0$ **(6 Marks)**

Q2.

a. Solve exact equation $(3x^2y - 1)dx + (x^3 + 6y - y^2)dy = 0$ $y(0) = 3$ **(6 Marks)**

b. By use of integrating factor solve the equation

 $\dfrac{dy}{dt} + \dfrac{1}{2}y = 2 + t$ **(7 Marks)**

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c. Solve higher order differential equation below
$$y''' - y'' - y' - 2y = 0$$ **(7 Marks)**

Q3.

a. Solve the equation $xy\frac{dy}{dx} = x^2 + y^2$ **(4 Marks)**

b. Solve the second order linear ODE'S with constant coefficient **(9 Marks)**
$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 15y = 0 \ \ given \ x = 0, y = 5 \ and \ \frac{dy}{dx} = 23$$

c. Determine the solution of the equation using method of undetermined coefficients
$$y'' - 4y' + 3y = 9x + 6$$ **(7 Marks)**

Q4.

a. Solve $6y'' - y' - y = 0 \quad y = 0 \ and \ y' = 10 \ when \ x = 0$ **(5 Marks)**

b. Solve the equation below by reducing to first order form
$$(1 + x^2)\frac{d^2y}{dx^2} = 2x\frac{dy}{dx}$$
The curve passes through points (0,-5) and (1,3) **(8 Marks)**

c. Applying operator method for particular integrals solve the equation
$$y'' + 4y' + 4y = e^{3x} + \cos 5X$$ **(7 Marks)**

Q5.

a. Find the general solution to the equation
$$y'' - 4y' + 3y = 10 \sin 2x + 15 \cos 2x$$ **(10 Marks)**
b. Solve $y'' + 2y' + y = x^2 e^{2x}$ **(10 Marks)**

END

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