FACULTY OF INDUSTRIAL SCIENCES & TECHNOLOGY
TEST 1

COURSE	**:**	**ORDINARY DIFFERENTIAL EQUATIONS**
COURSE CODE	**:**	**BUM2133**
LECTURER	**:**	**SAMSUDIN BIN ABDULLAH** **NOR AIDA ZURAIMI BINTI MD NOAR** **NOR ALISA BINTI MOHD DAMANHURI** **LAILA AMERA BINTI AZIZ** **NURFATIHAH BTE MOHAMAD HANAFI**
DATE	**:**	
DURATION	**:**	**1 HOUR & 30 MINUTES**

NAME :_____

_____

I.D. NUMBER:_____

QUESTION	MARKS
1-4	
5	
6	
7	
TOTAL MARKS	40

INSTRUCTIONS TO CANDIDATES

1. This question paper consists of **SEVEN** questions. Answer all questions.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

This examination paper consists of **TEN (10)** printed pages including the front page

Question 1-4, multiple choice. Circle the correct answer.

1. Given

(i) $\left(\frac{dy}{dx}\right)^2 = 5x+6$ is a first order and second degree.

(ii) $\left(\frac{d^2y}{dx^2}\right)^7 - \left(\frac{dy}{dx}\right)^{20} + 9 = 0$ is a second order and seventh degree.

(iii) $\left(\frac{d^3y}{dx^3}\right)^2 = 78xe^8$ is a second order and third degree.

Which of the above statements is/are **TRUE**?

(a) (i) only
(b) (i) and (ii) only
(c) (i) and (iii) only
(d) (iii) only

(2 MARKS)

2. Which of the following equation is a third order nonlinear ordinary differential equation?

(a) $\left(\frac{dy}{dx}\right)^3 + y\frac{dy}{dx} = 1$

(b) $\frac{d^3y}{dt^3} + \frac{d^2y}{dt^2} + \frac{dy}{dt} + y = 1$

(c) $\left(\frac{dy}{dt}\right)^3 + t^3y = 0$

(d) $\frac{d^3z}{dt^3} + z\frac{dz}{dt} = 1$

(2 MARKS)

3. Which of the following differential equations is homogeneous?

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

(b) $\frac{dy}{dx} = \frac{y^4 + 3xy}{x^2}$

(c) $\frac{dy}{dx} = \frac{x + y}{y^2}$

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

(2 MARKS)

4. A cup of coffee has a temperature of $95^0 C$ and is in a room where the temperature is $20^0 C$. Let T is the temperature of the coffee after t minutes. Assuming Newton's Law of cooling and k is a positive constant, which of the following equations describes T?

(a) $\frac{dT}{dt} = k(T - 20)$

(b) $\frac{dT}{dt} = -k(T - 20)$

(c) $\frac{dT}{dt} = -k(T - 95)$

(d) $\frac{dT}{dt} = k(T - 95)$

(2 MARKS)

QUESTION 5

Find the particular solution of the differential equation

$$t^3 \frac{dy}{dt} + 4t^2 y = e^{-t}; \qquad y(-1) = 0 .$$

(10 MARKS)

Solution

QUESTION 6

Consider the equation

$$\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = \sin 2t - 3\cos 2t$$

(i) Find the complementary function, $y_c(t)$.

(ii) Use the method of undetermined coefficients to find the general solution of the equation.

(10 MARKS)

Solution

QUESTION 7

Consider the equation

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = e^{-3x}$$

i) Find the complementary function $y_c(x)$

ii) Use the method of variation of parameters to find the general solution.

(12 MARKS)

END OF QUESTION PAPER

APPENDIX

THE METHOD OF VARIATION OF PARAMETERS

$$y(t) = y_c(t) + y_p(t)$$

where

$$y_p(t) = u(t)y_1(t) + v(t)y_2(t)$$

and $u(t),\ v(t),$ can be found from

$$u'y_1 + v'y_2 = 0$$

$$u'y_1' + v'y_2' = \frac{f(t)}{a}$$

OR

$$y_p(t) = uy_1 + vy_2$$

$$W = \begin{vmatrix} y_1 & y_2 \\ y_1' & y_2' \end{vmatrix}, \qquad u = -\int \frac{y_2 f(t)}{aW}\,dt \qquad v = \int \frac{y_1 f(t)}{aW}\,dt$$