KABARAK   **UNIVERSITY**

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: MATH 312

COURSE TITLE: ORDINARY DIFFERENTIAL EQUATIONS

STREAM: **SESSION V**

DAY: **TUESDAY**

TIME: **2.00 – 4.00 P.M.**

DATE: **07/04/2009**

INSTRUCTIONS:

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

PLEASE TURN OVER

Question One (30 Marks)

a) Given the differential equation $\ddot{} - 2\dot{} + 2{} = 0$ determine whether $= ({}\cos{} + {}\sin{})$ is its complete primitive where and are arbitrary constants. (4 Marks)

b) Determine the values of and so that $({}) = {} + {} + 2\sin{}$ will satisfy the conditions $(0) = 0$ and $(0) = 0$. (5 Marks)

c) Solve $({} - 4){} \cdot {} = {}$ (6 Marks)

d) Determine if the functions $({}) = {}\cos{}$ and $({}) = {}\sin{}$ are linearly dependent or linearly independent. (3 Marks)

e) Solve differential equation $\dfrac{}{} = \dfrac{}{}$. (6 Marks)

f) The differential equation for a circuit in which self-inductance and capacitance neutralize each other is $\dfrac{}{} + \dfrac{}{} = 0$. Find the current as a function of given that is the maximum current and $= 0$ when $= 0$ (6 Marks)

Question Two (20 Marks)

a) Solve the following homogeneous linear differential equation $\dfrac{}{} + 3\dfrac{}{} + {} = {}$. (8 Marks)

b) Solve the simultaneous equations,

$$\dfrac{}{} + {} = 0 \dots\dots\dots({})$$
$$\dfrac{}{} - {} = 0 \dots\dots\dots({})$$

(6 Marks)

c) Solve the initial value problem: $= \sqrt{{} + 1}$, $(0) = 1$. (6 Marks)

Question Three (20 Marks)

a) Show that the differential equation $(3{} + 2{}){} + (2{} - {}){} = 0$ is not exact. Then reduce it to an exact form and solve it. (12 Marks)

b) Given the differential equation $({} + {}){} = 2\cos{} + 3{} + 2 + 3$. Determine its complementary function and the particular integral, hence write the general solution. (8 Marks)

Question Four (20 Marks)

a) The mass of a crystalline deposit increases at a rate which is proportional to its mass at that time. The deposit has started around a crystal seed of **5** .

  (i) Find an expression of its mass at time .   (4 Marks)

  (ii) If in **30** minutes the mass of the deposit increases by **1** , what will be the mass of the deposit after **10** hours.   (4 Marks)

b) Solve the differential equation $\dfrac{d^2y}{dx^2} - 5\dfrac{dy}{dx} + 6y = 0$ subject to $y(0) = -1$ and

        $y'(0) = 1$.   (9 Marks)

c) Use the method of integrating factor to solve the differential equation:

$$\dfrac{dy}{dx} + \dfrac{y}{x} = -3.$$ (3 Marks)

Question Five (20 Marks)

a) An electric circuit consists of an inductance of **0.1** , a resistance of **20** h and a condenser of capacitance **25** .

  (i) Write down the differential equation for the circuit.   (3 Marks)

  (ii) Find the Charge, , and the current, , at any time given that at $= 0$

        $= 0.05$, $= \dfrac{dq}{dt} = 0$.   (12 Marks)

b) Use the method of separation of variables to solve the differential equation

$$\dfrac{dy}{dx} = (1 +) .$$ (5 Marks)