TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MARINE ENGINEERING

EMR 2309: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2HOURS

DATE: Pick Date May 2016

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE :

    (a) The Velocity of a body, V, is equal to its rate of change of distance,

    $\dfrac{dx}{dt}$; Determine an equation for x in terms of t given $V=U+at$, where 'U' and 'a' are

    constants and x=0 when t=0.   (5 marks)

    (b)   Determine in particular solution of the differential equation.

$$\frac{dy}{dx} + 2x = y \text{ given that when x=0, y=2.}$$ (8 marks)

    (c)   Determine the particular solution to the differential equation

$$4\frac{d^2 y}{dt^2} - 12\frac{dy}{dt} + 9y = 0$$

    Given at t=0, y=2 and $\dfrac{dy}{dt} = 4$ (8 marks)

(d) Evaluate $\int_0^{\pi/2} \frac{1}{1+\frac{1}{2}\sin^2\theta} d\theta$, Using Simpson's rule with six intervals correct to 3 decimal places. (5 marks)

(e) Determine $\int_{x=0}^{x=2} \int_{y=0}^{y=2x} (y + xy + xy^2)dydx$ (4 marks)

Question TWO

(a) Solve the following first order differential equations

(i) $x\frac{dy}{dx} + \frac{y^2}{x} = y$ (6 marks)

(ii) $(x+2)\frac{dy}{dx} = 3 - \frac{2y}{x}$ (9 marks)

(b) The rate at which a body cools is given by the equation

$\frac{d\theta}{dt} = -k\theta$, where θ is the temperature of the body above its surrounding and k is a constant.

Solve for θ, given that at t=0; θ=θ₀. (5 marks)

Question THREE

(a) Determine the particular solution of the differential equation.

$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = 5y = 0$ given

when x=0, y=1 and $\frac{dx}{dt}$ =5. (8 marks)

(b) Solve the differential equation $2\frac{d^2y}{dx^2} + 5\frac{dy}{dx} = 3y = 4Sin2x$ (12 marks)

Question FOUR

(a)   Obtain $\int_1^3 5/x\,dx$. (3 marks)

(b)   Use the trapezoidal rule with 8 intervals to obtain $\int_1^3 5/x\,dx$. (6 marks)

(c)   Use Simpson's rule with 8 intervals to obtain $\int_1^3 5/x\,dx$. (4 marks)

(d)   Determine the percentage error in determining $\int_1^3 5/x\,dx$ using

    (i)   Trapezoidal rule (1 mark)

    (ii)   Simpsons Rule. (1 mark)

(e)   Use the Mid Ordinate rule to obtain $\int_1^3 \dfrac{1}{\sqrt{x}}\,dx$ using 4 intervals. (5 marks)

Question FIVE

(a)   Determine the area of a plane figure bounded by the curves.

$$y_1 = (x-1)^2 \text{ and } y_2 = 4-(x-3)^2$$ (9 marks)

(b)   Determine the following double integral, given K is a constant

$$\int_0^6 \int_0^4 K(x^2 + y^2)\,dy\,dx$$ (4 marks)

(c)   Determine the volume of the solid bounded by the planes x=0, y=0, Z=x, z=2 and y=4-x² in the first quadrant. (7 marks)