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:APRIL2016

TIME:2HOURS

DATE: Pick DateMay2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion 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, $\frac{dx}{dt}$; 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.

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

(c) Determine the particular solution to the differential equation

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

Given at t=0, y=2 and $\frac{dy}{dt} = 4$ (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 $\int_{x=0}^{x=2} \int_{y=0}^{y=2x} (y + xy + xy^2) dy dx$ (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; $\theta=\theta_0$. (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 $\int_1^3 \frac{1}{\sqrt{x}}dx$ using 4 intervals. (5 marks)

Question FIVE

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

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

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

$\int_0^6 \int_0^4 K(x^2+y^2)dydx$ (4 marks)

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