

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 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. 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; θ = θ_0 . (5 marks)

Question THREE

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

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = 5y = 0 \text{ given}$$
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 $\int_{1}^{3} \frac{5}{x} dx$. (3 marks)
- (b) Use the trapezoidal rule with 8 intervals to obtain $\int_{1}^{3} \frac{5}{x} dx$. (6 marks)
- (c) Use Simpson's rule with 8 intervals to obtain $\int_{1}^{3} \frac{5}{x} dx$. (4 marks)
- (d) Determine the percentage error in determining $\int_{1}^{3} \frac{5}{x} dx$ 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

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

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