



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: 2 HOURS

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,

$\frac{dx}{dt}$; 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

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

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.

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

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

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