



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF
SCIENCE (MECHANICAL ENGINEERING)

EMM 103: MATHEMATICS FOR ENGINEERS 1

DATE: Friday 16th December 2011

TIME: 2.00p.m – 4.00p.m

Instructions: Answer Any Three questions

Question one (20 marks)

a) Evaluate the following Integrals.

i) $\int \frac{xe^x}{(1+x)^2} dx$ (5 marks)

ii) $\int \sin(1-x) [2 - \cos(1-x)^4] dx$ (5 marks)

b) A particle moves in a straight line and its acceleration after t seconds is $\cos^2 t$

i) determine the expressions for its velocity Vm/s and its displacement x meters after t seconds, given that $t=0$, the velocity is $2m/s$ and the displacement is -4 meters

ii) Determine the displacement after $\pi/3$ seconds (7 marks)

(3 marks)

Question two (20 marks)

a) Evaluate the integral

$$\int \frac{1}{6-6x-5x^2} dx$$
 (7 marks)

b) Find the area generated by the curve $x = a(\theta - \sin \theta)$, $y = a(1 - \cos \theta)$ between $\theta = 0$ and $\theta = \pi$, rotates about the x -axis through a complete revolution.

(13 marks)

Question three (20 marks)

- a) Since the inauguration of Fridah's express at the beginning of 1998, the number of passengers (in millions) flying on the commuter airline has been growing at the rate of

$$R(t) = 0.1 + 0.2te^{-0.4t}$$

Passengers per year ($t = 0$ corresponding to the beginning of 1998). Assuming that the trend continues through 2002, determine how many passengers will have flown on Fridah's express by that time. (7 marks)

- b) Evaluate the integral

$$\int \frac{x^3 + x + 4}{(x^2 + 1)(x^2 - 2x + 1)} dx \quad (13 \text{ marks})$$

Question four (20 marks)

- a) Find the area of the region completely enclosed by the graphs

$$f(x) = x^3 - 3x + 3 \text{ and } g(x) = x + 3$$

(7 marks)

- b) Find the length of the curve $x = 5(2t - \sin 2t)$, $y = 10\sin^2 t$, between $t = 0$ and $t = \pi$

(8 marks)

- c) Evaluate the following integral

$$\int_0^{2\pi} \int_0^3 r^3 (9 - r^2) dr d\theta \quad (5 \text{ marks})$$

Question five (20 marks)

- a) By use of Simpson's rule with two intervals to show that

$$4 \int_0^1 \frac{1}{1+x^2} dx = \pi \quad (6 \text{ marks})$$

- b) Using the concept of multiple integrals, find the volume of the solid enclosed by the plan $z=0$, the planes $x=1$, $x=4$, $y=2$, $y=5$ and the surface $z=x+y$. Show the development of the problem concept

(8 marks)

- c) Evaluate the integral

$$\int \sin^6 x \cos^3 x dx \quad (6 \text{ marks})$$

