



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

ECU 200: ENGINEERING MATHEMATICS V

DATE: Friday 20th April, 2012

TIME: 8.00 a.m. – 10.00 a.m.

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO.

QUESTION ONE (30 MARKS)

- (a) Define the fourier series of a function $f(x)$ defined over the interval $-L < x < L$ with period 2π . [4 marks]
- (b) Given that $f(x) = x$ for $0 < x < 2\pi$, use the series defined in 1(a) above to determine the fourier series of $f(x)$. [6 marks]
- (c) Determine the Laplace transform of $f(t) = t^2 + e^{2t}$ [6 marks]
- (d) (i) Given that $F(s) = \frac{S}{S^2 + 4S + 13}$ find $f(t)$. [4 marks]
- (ii) Evaluate $\int_0^{\infty} e^{-x} x^4 dx$ [4 marks]
- (e) Evaluate (i) $\int_{3.5}^{2.5}$ [3 marks]
- (ii) $\frac{\int_{3/2}^{\sqrt{3/2}}}{\int_{-1/2}^{\sqrt{3/2}}}$ [3 marks]

QUESTION TWO (20 MARKS)

- (a) Given the function $f(x)$ as

$$f(x) = \begin{cases} 0 & -\pi < x < 0 \\ x & 0 < x < \pi \end{cases}$$

$$\text{and } f(x) = f(x + 2\pi)$$

- (i) State the period of the function. [1 mark]
 - (ii) Sketch the graph of the function. [2 marks]
 - (iii) Determine the fourier co-efficients. [4 marks]
 - (iv) State the fourier series of the function. [3 marks]
- (b) Differentiate between an odd and an even function. State the properties of each function. [6 marks]
- (c) Evaluate $\int x^3 \sin x dx$ [4 marks]

QUESTION THREE (20 MARKS)

- (a) (i) Define a laplace transform. [3 marks]
- (ii) Find the inverse laplace transform of

$$F(S) = \frac{S + 4}{S(S-1)(S^2 + 4)}$$
 [6 marks]

- (b) Using the laplace transform, find the solution of the initial value problem
 $y'' - 4y' + 4y = 64 \sin 2t$ where
 $y(0) = 0$ and $y'(0) = 1$ [7 marks]
- (c) Evaluate $\int_0^\infty t e^{-3t} \sin t dt$ [4 marks]

QUESTION FOUR (20 MARKS)

- (a) Given that $F(s) = \frac{5}{3s+2} + \frac{1}{s^2+25} + \frac{1}{s^4} + \frac{2s}{(s+1)^2}$
find $L[f(t)]$ [7 marks]
- (b) (i) Use Laplace transform to solve the equation $y'' - 2y' + y = e^t$ given that $y(0) = 1$
and $y'(0) = 2$. [6 marks]

- (ii) Solve the same equation in b(i) above using other methods and compare their results. [3 marks]

- (c) Show that $L[\cos at] = \frac{s}{s^2 + a^2}$ [4 marks]

QUESTION FIVE (20 MARKS)

- (a) (i) Define the gamma function.
(ii) Use the definition of gamma to evaluate the following integral

$$\int_0^{\infty} \sqrt{y} e^{-y^3} dy + \int_0^{\infty} \sqrt{x} e^{-3\sqrt{x}} dx$$

- (b) Evaluate the following

(i) $\frac{6\sqrt[8]{3}}{5\sqrt[2]{3}}$

(ii) $\sqrt[5]{2}$

- (c) Given that Beta function is defined as $B(x, y) = \frac{\sqrt{x} \sqrt{y}}{\sqrt{x+y}}$

- Compute (i) $B(2.5, 1.5)$
(ii) $B(3.5, 0.5)$