MACHAKOS UNIVERSITY

University Examinations for 2021/2022 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONIC ENGINEERING)

BACHELOR OF SCIENCE (MECHANICAL ENGINEERING)

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECU 203: ENGINEERING MATHEMATICS VIII

DATE: 25/8/2022 **TIME: 2.00-4. 00 PM**

INSTRUCTIONS

Answer **question One (Compulsory)** and any other **Two questions**

QUESTION ONE (30 MARKS)

a) i) Define a periodic function (2 marks)

ii) Give one example of a periodic function (2 marks)

iii) Define the Laplace transform of $f(x)$ (2 marks)

b) Determine the Laplace transforms of:

i. e^{at} (3 marks)

ii. $\cos at$ (3 marks)

c) Determine;

i. $L^{-1}\{\frac{4s-5}{s^2-s-2}\}$ (5 marks)

ii. $L^{-1}\{\frac{2s-3}{s(s-3)}\}$ (5 marks)

iii. $L^{-1}\{\frac{1}{s^2+9}\}$ (5 marks)

d) Determine the Laplace transforms of

i. L $\{1 + 2t - {}^{1}/{}_{3}\, t^4$ (2 marks)

ii. L $\{5e^{2t}$-$3e^{-t}\}$ (2 marks)

iii. sin^2t (2 marks)

iv. Cos h 3x (2 marks)

QUESTION TWO (20 MARKS)

a) Obtain the Fourier Series for the periodic function $f(x)$defined as

$f(x) = \{^{-k\,,\ \ -\pi<x<0}_{k\ ,\ \ \ 0<x<\pi}$ (16 marks)

The function is periodic outside this range with period 2π

b) If in the F(s) above k=1, deduce the series for ${}^{\pi}/_{4}$ at the point x=${}^{\pi}/_{2}$ (4 marks)

QUESTION THREE (20 MARKS)

Use the Laplace Transform to solve the differential equations

a) $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 13y = 0$ given that x =0, y=3, $\frac{dy}{dx} = 7$ (10 marks)

b) $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} = 9$ given that x=0, y=0, y' =0 (10 marks)

QUESTION FOUR (20 MARKS)

Determine the Fourier Series for the full wave rectified sine wave

Commented [SK1]:

$i = 5\ sin\frac{\emptyset}{2}$

QUESTION FIVE (20 MARKS)

Consider Bessel's equation

$$Z^2y''(z) + zy'(z) + (z^2 - v^2)y = 0$$

Where $v \geq 0$, Find the Frobenius Solution that is asymptotic to t^vas t$\rightarrow 0$. by multiplying this solution by a constant find the solution

$$J_v(z) = \sum_{k=1}^{\infty} \frac{(-1)^k}{k!\Gamma(k+v+1)} ({}^{Z}/_{2})^{2k+v}$$