CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATIONS FOR THE AWARD OF BACHELOR OF SCIENCE IN MATHEMATICS.

MATH 326: METHODS OF APPLEID MATHS 1 TIME: 2 HOURS

INSTRUCTIONS

Answer question one and any other two questions

Adhere to the instructions on the answer booklet.

QUESTION ONE Compulsory.

a. Find the recurrence relation satisfied by coefficients in the series solution of the differential equation $y'' + x^2 y = 0$, about the point x = 0 and obtain a_4 *and* a_6 6mks

b. Solve in series the differential equation $y' - y = 0$, about the point x = 0 6mks

c. Identify the nature of the singular points of the equation

$$x(x-2)^2 y'' + 2(x-2)y' + (x+3)y = 0$$

6mks

d. Given the function $f(x) = \begin{cases} x, & -\pi < x < 0 \\ -x, & 0 < x < \pi \end{cases}$, Obtain a_0 *and* a_n 5mks

e. Obtain a_n , for the Fourier series represented by $f(x) = e^x$, as a cosine Fourier series over (0, 1) 5mks

f. Find the Laplace transform of $\dfrac{\sin 2t}{t}$ 5mks

QUESTION TWO

a. Prove that the Laplace transform of $L(e^{at}) = \dfrac{1}{s-a}, \quad s > a$ 5mks

b. Find the sine Fourier series for the function $f(x) = 1, \ in \ 0 < x < \pi$ 5mks

c. Find the Laplace transform of the following

i. $t^2 \cos 3t$ 5mks

ii. $te^{-t}\sin 2t$ 5mks

QUESTION THREE

a. Solve in series the differential equation, $\left(1-x^2\right)y''-2xy'+2y=0$ about the point x = 0 10mks

b. Given the differential equation $3xy''+2y'+y=0$, about the point x = 0.

i. Obtain the indicial equation of the differential equations and suggest a general solution to the equation. 6mks

ii. Find the recurrence relation satisfied by coefficients in the series solution of the differential equation and obtain a_1 4mks

QUESTION FOUR

a. Given the function $f(x)=x,\ 0\le x\le 2\pi$, Obtain the Fourier constants $a_0 .\ a_n\ and\ b_n$ 6mks

b. Find a Fourier series to represent $f(x)=x^2,\ -\pi\le x\le\pi$ 6mks

c. Find the inverse Laplace transform of $\frac{1}{s^2-9}$ 3mks

d. Using the Laplace transforms, to evaluate $\int_0^\infty te^{-3t}\sin t\,dt$ 5mks

QUESTION FIVE

a. Given the Bessel`s differential equation $x^2y''+xy'+\left(x^2-n^2\right)y=0$, about the point x = 0.

i. Obtain the indicial equation of the differential equation 8mks

ii. Find the recurrence relation satisfied by coefficients in the series solution of the differential equation and obtain a_2 5mks

b. Obtain $a_0\ and\ a_n\ and\ b_n$ for the Fourier series represented by $f(x)=\begin{cases}2, & -2<x<0\\ x, & 0<x<2\end{cases}$ 7mks