



(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
3RD YEAR FIRST SEMESTER MAIN EXAMINATION

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE**

COURSE CODE: MAA 314/MAA 315

**COURSE TITLE: METHODS/ANALYTIC APPLIED
MATHEMATICS**

DATE: 16/05/2022

TIME: 9:00 AM - 11:00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 3 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

- (a) Define the term power series (2 marks)
- (b) Using the Ratio test find the radius and the interval of convergence of $\sum_{n=0}^{\infty} \frac{(-1)^n (x-2)^{2n}}{(n+1)9^n}$ (5 marks)
- (c) Find singular points of the following differential equation and classify each singular point as either regular or irregular $x^2(x-2)y'' + (5x-1)y' + 2(3+5x^2)y = 0$ (5 marks)
- (d) Classify the following Second order linear Partial Differential Equations (6 marks)
- $K^2 U_{xx} = U_t$
 - $C^2 U_{xx} = U_{tt}$
 - $C^2 U_{xx} + U_{yy} = 0$
- (e) Proof that $\sqrt{x+1} = x\sqrt{x}$ (3 marks)
- (f) Find $\sqrt{-5.42}$. (2 marks)
- (g) Generate $P_n(x)$ for $n = 0, 1, 2, 3$ using the Rodrigues formula (7 marks)

QUESTION TWO (20 MARKS)

Use the method of power series to find the solution near $x = 0$ of the differential equation given by $2x^2 y'' + xy' + (x^2 - 1)y = 0$

QUESTION THREE (20 MARKS)

- (a) Find the Laplace transformation of $f(t) = e^{2t} + st - 3$. (3 marks)
- (b) Evaluate $L^{-1} \left\{ \frac{2s+3}{s(s+1)(s-2)} \right\}$. (7 marks)
- (c) Find the Fourier series of $f(x) = \begin{cases} 2 & -\pi \leq x \leq 0 \\ 1 & 0 \leq x \leq \pi \end{cases}$ (10 marks)

QUESTION FOUR (20 MARKS)

- (a) Prove that $J_0'(x) = -J_1(x)$ (5 marks)
- (b) Show that $\frac{d}{dx} X^{-n} J_n(x) = -X^{-n} J_{n+1}(x)$ (5 marks)

(c) Evaluate $\int^{\infty} x^{\frac{1}{2}} e^{-x^3} dx$ (5 marks)

(d) Expand $f(x) = x$ from $-2 \leq x \leq 2$ in a fourier sin series (5 marks)

QUESTION FIVE (20 MARKS)

(a) Use the method of separation of variables to solve the equation
 $U_x - 2U_t = U$ Show that $U(x, 0) = 6e^{-3(x)}$ (10 marks)

(b) Find the first 3 non zero terms for the Legendre series for $f(x)$ where (10 marks)

$$f(x) = \begin{cases} 0 & -1 \leq x \leq 0 \\ 1 & 0 \leq x \leq 1 \end{cases}$$