(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN EXAMINATION

2020/2021 ACADEMIC YEAR

THIRD YEAR, FIRST SEMESTER

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **MAT 351**

COURSE TITLE: ENGINEERIG MATHEMATICS III

DATE: 15/7/2021 TIME: 9 AM – 11 AM

INSTRUCTIONS TO CANDIDATES

Answer Question **One** and **Any** other **TWO** Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

(a) Find, from first principles the laplace transform for the function
$f(t) = e^{3t}$ (6 marks)

(b) Find the directional derivative for the surface $\emptyset(x, y, z) = x^2z + 2xy^2 + yz^2$ At the point $(1, -1, 1)$ in the direction of the vector $\boldsymbol{A} = 2\boldsymbol{i} + 3\boldsymbol{j} - 4\boldsymbol{k}$

(5 marks)

(c) Evaluate $\lim_{x \to 3} \frac{x^3 - 10}{x - 3}$ (5 marks)

(d) Express $f(x) = x$ in Fourier series on the interval [-3, 3] (8 marks)

(e) Evaluate the inverse Laplace transform for the function $f(s) = \frac{3s+5}{s^2+7}$

(6 marks)

QUESTION TWO (20 MARKS)

(a) (i) Express $f(s) = \frac{1}{(s-1)(s-2)(s+4)}$ in partial fractions

(ii) Hence evaluate the inverse laplace transform for $f(s)$ (8 marks)

(b) Use the laplace transform to solve the initial value problem
$\frac{dy}{dt} - 2y = e^{5t}$ subject to $y(0) = 3$ (8 marks)

(c) Evaluate using the tables the Laplace transform for
$f(t) = cos3t$ (4 marks)

QUESTION THREE (20 MKS)

(a) Given $\boldsymbol{P} = x^2z\boldsymbol{i} + xy\boldsymbol{j} + y^2\boldsymbol{k}$ *and* $\boldsymbol{Q} = yz^2i + xy\boldsymbol{j} + x^2z\boldsymbol{k}$, determine an expression for $grad\ (\boldsymbol{P}.\boldsymbol{Q})$ (8 marks)

(b) If $\boldsymbol{F} = xy^2\boldsymbol{i} - 2yz\boldsymbol{j} + xyz\boldsymbol{k}$, determine at the point (1, -1, 2) $Curl\ \boldsymbol{F}$

(8 marks)

(c) Show whether the vectors **A , B** and **C** are coplanar or not, if
$A = \boldsymbol{i} + 2j - 3\boldsymbol{k},\ \boldsymbol{B} = 2i - \boldsymbol{j} + 2\boldsymbol{k},\ \boldsymbol{C} = 3\boldsymbol{i} + \boldsymbol{j} - \boldsymbol{k}$ (4 marks)

QUESTION FOUR (20 MARKS)

(a) Distinguish between an odd and an even function, giving one example for each (4 marks)

(b) Find the half-range Fourier sine series expansion for the function

$f(x) = x$ (8 marks)

(c) Find the Fourier series expansion for the function

$$f(x) = \begin{cases} 0 & -\pi < x < -\frac{\pi}{2} \\ 4 & -\frac{\pi}{2} < x < \frac{\pi}{2} \\ 0 & \frac{\pi}{2} < x < \pi \end{cases}$$

$$f(x + 2\pi) = f(x)$$ (8 marks)

QUESTION FIVE (20 MARKS)

(a) Find the total differential for the function

$f(x) = ye^{x+y}$ (6 marks)

(b) Evaluate $\lim_{x\to\infty} \frac{2x+7}{x+4}$ (6 marks)

(c) Find the domain of the function $f(x, y, z) = \frac{\sqrt{x+y+z-7}}{2x-1}$ (5 marks)

(d) Discuss the continuity of the function $f(x, y) = \frac{x-2y^3}{x^2+y^2}$ (3 marks)