(*Knowledge for Development*)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: **MAT 351**

COURSE TITLE: **ENGINEERING MATHEMATICS III**

DATE: 19/10/18 **TIME:** 8 AM -10 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) Write down how Fourier coefficients a_0, a_n and b_n can be obtained. (3 Marks)

b) Define Fourier Series as used in Engineering mathematics. (1 Mark)

c) State any four properties of Laplace Transforms. (4 Marks)

d) Prove that (i) $L(1) = \frac{1}{s}$ (4 Marks)

(ii) $L[Sinh(at)] = \frac{a}{s^2 + a^2}$ (6 Marks)

e) Write down the solutions to the following inverse Laplace transforms. (4 Marks)

i) $L^{-1}\left(\frac{1}{s^2 - a^2}\right)$ (ii) $L^{-1}\left(\frac{1}{s^2 + a^2}\right)$ (iii) $L^{-1}(1)$ (iv) $L^{-1}\left(\frac{s}{s^2 + a^2}\right)$

f) Evaluate $\lim_{\substack{x \to 0 \\ y \to 0}} \frac{2xy}{3x^2 + y^2}$ (2 Marks)

g) Find the unit vector normal to the surface $3x^2 + y^2 + 2z^2 = 8$ at $p(2,0,1)$ (5 Marks)

QUESTION TWO (20 MARKS)

a) Compute $\int_C F.dr$ where $F = \frac{iy - jx}{x^2 + y^2}$ and C is the circle $x^2 + y^2 = 1$ traversed counter-clockwise. (12 Marks)

b) If $\phi = x^2 y - 2y^3 z^2$. Find $grad.\phi$ at point $(-1,2,1)$ (8 Marks)

QUESTION THREE (20 MARKS)

a) Use Green's Theorem to evaluate $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square formed by the lines $y = \pm 1, x = \pm 1$ (8 Marks)

b) Find the Fourier half range even expression of the function

$f(x) = \left(-\frac{\pi}{L}\right) + 1, \ldots 0 \le x \le L$ given that $a_0 = \frac{1}{\pi}\int_0^{2\pi} f(x)dx$ (12 Marks)

QUESTION FOUR (20 MARKS)

a) State five advantages of Fourier series. (5 Marks)

b) Find $\frac{\partial u}{\partial r}$ and $\frac{\partial u}{\partial \theta}$ if $u = e^{r\cos\theta} \cdot Cos(rSin\theta)$ (9 Marks)

c) Find the directional derivative of the scalar function $f(x,y,z) = x^2 + xy + z^2$ at the point $A(-1,-1,1)$ in the direction of the line AB where B has coordinated $(-3,2,1)$ (6 Marks)

QUESTION FIVE (20 MARKS)

a) What are the differences between:

(i) Partial and Total Differential Equations. (2 Marks)

(ii) Vector and Scalar Quantity (1 Mark)

b) Find the Fourier Series for the function $f(x) = x^2$ in the interval $0 \le x \le 2\pi$ (10 Marks)

c) Find the Laplace transform of $t\cos(at)$ (7 Marks)