(*Knowledge for Development*)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER

Special/supplementary EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND

BACHELOR OF SCIENCE (MATHEMATICS)

COURSE CODE: MAT 422

COURSE TITLE: **PDE II**

DATE: 02/02/2021 **TIME: 2 PM -4 PM**

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 2 Printed Pages. Please Turn Over.

QUESTION ONE (30 MARKS)

(a) Solve the differential equation $\frac{\partial^4 z}{\partial x^4} + \frac{\partial^4 z}{\partial y^4} - 2\frac{\partial^4 zy}{\partial x^2 \partial y^2}$ (10Mks)

(b) Find the general solution of the equation $Xu_X - Yu_Y + u = X$ (10Mks)

(c) Solve the equation $r - 2s + 2t = 0$ (10Mks)

QUESTION TWO (20 MARKS)

(a) State the laws due to Fourier that derive the equation of heat conduction in a rod (2Mks)

(b) Derive the Laplace equation $\nabla^2 u = 0$ in three dimension (8Mks)

Find a particular integral of the equation $\frac{\partial^2 z}{\partial x^2} - \frac{\partial z}{\partial y} = e^{2x+y}$ (10Mks)

QUESTION THREE (20 MARKS)

(a) Find the solution of the initial boundary value problem for the heat equation $k^2 u_{xx} = u_t$ satisfying the following initial boundary conditions

$$\left.\begin{array}{l} u_x(0,t) = 0 \\ u_x(\pi,t) = 0 \end{array}\right\} 0 \leq t < \infty$$

And $u(x,0) = x \quad 0 \leq x \leq \pi$ (10Mks)

(b) Find a surface satisfying the differential equation $t = 6x^3 y$ which contains the two lines $y = 0 = z$ and $y = 1 = z$ (10Mks)

QUESTION FOUR (20 MARKS)

a) A variable z is defined in terms of the variable x and y as the results of elimination from the equations.

$$z = t_x + y\,f(t) + g(t)$$
$$0 = x + yf(t) + g(t)$$

Prove that whatever the functions f and g may be the equation $rt - s^2 = 0$ is satisfied.

(10Mks)

b) Reduce the equation $r + x^2 t = 0$ to canonical form. (10Mks)

QUESTION FIVE (20 MARKS)

a) Find the general solution of the equation $r - 2\sin x - t\,cos^2 x - q cos\,x = 0$ (10 Mks)

b) Solve the equation $s = 2x + 2y$ (10 Mks)