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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR

THIRD YEAR, FIRST SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

(MATHEMATICS AND COMPUTER SCIENCE)

Date:

Time: 8.30am –10.30am

KMA 311 - PARTIAL DIFFERENTIAL EQUATIONS

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS

QUESTION ONE (30 MARKS)

a) Form the partial differential equation by eliminating the arbitrary function $z = ax^2 + by^3$

(6 marks)

b) By making the substitution $u = x + ay$, solve the equation $z^2 = 1 + p^2 + q^2$

(5 marks)

c) Solve the equation $p + q = \sin x + \sin y$ (6 marks)

d) Find the integral surfaces of the equation $\dfrac{dx}{y+z} = \dfrac{dy}{-(x+z)} = \dfrac{dz}{x-y}$

(6 marks)

e) Show that the direction cosines of the tangent at (x, y, z) to the conics $ax^2 + by^2 + cz^2 = 1$ and $x + y + z = 1$ are proportional to $(by - cz, cz - ax, ax - by)$

(7 marks)

QUESTION TWO (20 MARKS)

a) Solve the Lagrange's linear equation $x^2(y - z)p + y^2(z - x) = z^2(x - y)$

(10 marks)

b) Find the complete and singular integral of $(p^2 + q^2)y = qz$

(10 marks)

QUESTION THREE (20 MARKS)

a)   Find the orthogonal trajectories on the surface $x^2 + y^2 = \alpha z^2$ of its intersection with the family of planes parallel to the xy plane i.e $z = k$

(12 marks)

b)   Find the Lagrange equation whose solution is given by $\phi(xyz, x^2 + y^2 + z^2) = 0$

(8 marks)

QUESTION FOUR(20 MARKS)

a)   Check the integrability hence or otherwise solve $(x^2 z - y^3)dx + 3xy^2 dy + x^3 dz = 0$

(12 marks)

b)   Find the general solution of the equation $x^2 p + y^2 q = (x + y)z$

(8 marks)

QUESTION FIVE (20 MARKS)

a)   Solve the following differential equation $ydx - (x + z)dy + ydz = 0$

(6 marks)

b)   Find the family of curves associated with the differential equation

$$\frac{dx}{x^2 - y^2 - z^2} = \frac{dy}{2xy} = \frac{dz}{2xz}$$

(7 marks)

c)   Derive the Partial Differential equation associated with the following surface by eliminating the arbitrary function $f(x^2 + y^2 + z^2, z^2 - 2xy) = 0$

(7 marks)