NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science Honours in Applied Mathematics	
QUALIFICATION CODE: 35BAMS	**LEVEL:** 8
COURSE CODE: PDE 801S	**COURSE NAME:** PARTIAL DIFFERENTIAL EQUATIONS
SESSION: JULY 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 86

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Prof A. S. EEGUNJOBI
MODERATOR:	Prof O.D. MAKINDE

INSTRUCTIONS
1. Answer ALL the questions in the booklet provided. 2. Show clearly all the steps used in the calculations. 3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

QUESTION 1 [20 marks]

1. (a) From the following equations, form partial differential equations by eliminating the arbitrary contacts g, h and j.

   i.
   $$z = gxe^{y} + \frac{g^2e^{2y}}{2} + h$$
   (5)

   ii.
   $$z = g(x+y) + h(x-y) + ght + j$$
   (5)

   (b) By eliminating arbitrary functions from the followings, form the partial differential equation

   i.
   $$z = (x-y)f(x^2+y^2)$$
   (5)

   ii.
   $$f(x^2-y^2, xyz) = 0.$$
   (5)

QUESTION 2 [25 marks]

2. (a) Solve the following differential equations by using Lagrange's method

   i.
   $$(mz-ny)p + (nx-lz)q = ly - mx$$
   (5)

   ii.
   $$(x^2-y^2-yz)p + (x^2-y^2-2z)q = z(x-y)$$
   (5)

   (b) Solve the following differential equations using Charpit method

   i.
   $$(p^2+q^2)y = qz$$
   (7)

   ii.
   $$p = (z+qy)^2$$
   (8)

QUESTION 3 [21 marks]

3. (a) Classify, reduce to normal form and hence solve

$$3u_{xx} + 10u_{xy} + 3u_{yy} = 0$$

(7)

(b) Classify, reduce to normal form and hence solve

$$u_{xx} + 2u_{xy} + u_{yy} = 0$$

(7)

(c) Classify and reduce to normal form

$$y^2 u_{xx} + x^2 u_{yy} = 0$$

(7)

QUESTION 4 [20 marks]

4. (a) The temperature at one end of a $50cm$ long bar with insulated sides, is kept at $0°C$ and that the other end is kept at $0°C$ until steady-state condition prevails. The two ends are then suddenly insulated and kept so. Find the temperature distribution (10)

(b) Find the solution of the Cauchy problem

$$u_{tt} - c^2 u_{xx} = 0, \qquad x \in \mathbb{R}, \quad t > 0, \quad u(x,0) = f(x), \quad u_t(x,0) = g(x), \quad x \in \mathbb{R}.$$

(10)

End of Exam!