National University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Basic Sciences

MATH-243: Vector Calculus (3+0): BEE-2k20-B Fall 2021

Quiz - 5: Partial Differential Equations	
CLO-3: Develop analytical solutions of partial differential equations.	
Maximum Marks: **10**	Instructor: Dr. Naila Amir
Date: **24 – 12 – 2021**	Duration: 10 Minutes
Name: Master Solution	CMS ID:

Question:
Classify the following partial differential equations in terms of:

(a) Order & Degree.

(b) linearity (linear/quasi-linear/non-linear).

(c) homogeneity (homogeneous/non-homogeneous)

(d) Furthermore, if it is a linear/ quasi-linear 2nd order partial differential equation, **classify it as parabolic, elliptic, or hyperbolic.**

1. $u_{yy}e^{u_{yy}} + u_{xy} + 2u_{xz} = \sin(xz).$

(a) Order = 2
Degree = can't be determined
[due to presence of $e^{u_{yy}}$]

(b) Non-linear PDE.
[product $u_{yy}e^{u_{yy}}$]

(c) Non-homogeneous
[$\sin(xz)$ independent of u]

(d) Not applicable because PDE is non-linear.

2. $u_{xx} - 2xyu_{xy} + xu_y + yu_xe^{u_x} = u.$

(a) Order = 2
Degree = 1

(b) Quasi-linear
[due to $u_xe^{u_x}$]

(c) Homogeneous
[all terms involve u]

(d) $A = 1,\ B = -2xy,\ C = 0$

$B^2 - 4AC = 4x^2y^2 - 4(1)(0)$

$= 4x^2y^2 > 0 \quad \forall\ x \neq y$

Thus, the given PDE is hyperbolic.