College of Science.
Department of Mathematics

كلية العلوم
قسم الرياضيات

First Midterm Exam
Academic Year 1445 Hijri- SecondSemester

Exam Information معلومات الامتحان			
Course name	Introduction to Partial Differential Equations		اسم المقرر
Course Code	425 MATH		رمز المقرر
Exam Date	2024-03-03	1445-08-22	تاريخ الامتحان
Exam Time	01: 00 PM		وقت الامتحان
Exam Duration	2 hours	ساعتان	مدة الامتحان
Classroom No.	F110		رقم قاعة الاختبار
Instructor Name	د. هدى الرشيدي		اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions: **تعليمات عامة:**

- Your Exam consists of 1 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
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- عدد صفحات الامتحان 1 صفحة. (بإستثناء هذه الورقة)
- يجب إبقاء الهواتف والساعات الذكية خارج قاعة الامتحان.
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هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	CLO 1.1 (4 marks)	QI(1)		
2	CLO 2.1 (4 marks)	QI(2)-QIV(1)		
3	CLO 2.2 (9 marks)	QII-QIV(2)		
4	CLO 2.3 (8 marks)	QIII		
5				
6				
7				
8				

EXAM COVER PAGE

King Saud University
Department of Mathematics
2^{nd} Semester 1445 H

425–MATH
First Midterm
Duration: 2 hours

Question I:

1. Classify each of the following PDEs as linear, quasilinear, or nonlinear and state its order and homogeneity:
   (a) $u_{tt} + (\sin y)u_{yy} - e^t \cos y = 0$.
   (b) $e^y u_{xxx} + e^x u = -\sin y + 10xu_y$.
   (c) $u_x u_{xxy} + e^x u u_y = 5x^2 u_x$.
   (d) $u_{tt}^2 + u_{xxxx} = 0$.
2. Find the PDE from $f(x^2+y^2+u^2, u) = 0$.

Question II:
By using change of variables; Solve the following linear PDEs:

1. $2u_x + 3u_y = 3x - 2y$
2. $5u_x + 4yu_y = 1 + e^{2x},\ y \neq 0$

Question III: **Write the solution in the explicit form**

1. Find the integral surface of the following PDE $x^2u_x + y^2u_y = u^2$ which passes through the curve $x = t$, $y = 2t$ and $u = 1$.
2. Find the solution to the partial differential equation $\frac{\partial u}{\partial x} + 3\frac{\partial u}{\partial y} = u^2$ that satisfies the condition $u(x,0) = \cos x$.

Question IV:

1. Determine whether the following Cauchy Problem has one solution or not?

$$u_x - u_y = 2 \text{ with initial conditions } x_0 = 2t, y_0 = -2t, u_0 = 2t, t > 0.$$

2. Find the solution of $xu_x + yu_y = 2xye^{-u}$.

Good Luck