College of Science.
Department of Mathematics

كلية العلوم
قسم الرياضيات

Second 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	**2024-04-21**	**1445-10-12**	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:

- Your Exam consists of 1 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
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تعليمات عامة:

- 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 (1 mark)	QII(1)		
2	CLO 2.1 (4.5 marks)	QII(2)		
3	CLO 2.2 (6.5 marks)	QI(1),QII(3)		
4	CLO 2.3 (13 marks)	QI(2),QIII, QIV		
5				
6				
7				
8				

EXAM COVER PAGE

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

425–MATH
Midterm 2
Duration: 2 hours

Question I:

1. Solve the following PDEs:
   (a) $3u_{tt} + 10u_{xt} + 3u_{xx} = \sin(x+t)$.
   (b) $z_{yy} - xz_y = x^2$, where $x \neq 0$.
2. Find the solution of $u_{xy} + u_x = x$ where $u(t,t) = t^2, u_y(t,t) = 0$.

Question II:

$$u_{xx} + 4u_{xy} + u_x = 0. \quad (1)$$

1. Classify the equation (1).
2. Reduce the equation (1) to its canonical form.
3. Solve the canonical form that you obtained in Part 2.

Question III:

$$u_{xx} - 2u_{xy} - 3u_{yy} = 0. \quad (2)$$

Find the solution of the PDE (2) in $\mathbb{R}^2$, which satisfies

$$u(s,s)|_{\Gamma_0} = \sin(s), \quad u_n(s,s)|_{\Gamma_0} = 1,$$

where $\Gamma_0 = \{(x,y)|x = y = s, s \in \mathbb{R}\}$ and u_n is a derivative of u in the direction of Γ_0.

Question IV:

Find the solution to the boundary condition problem(Hint: take λ^2 is as a separation constant):

$$u_{xx} + u_{yy} = 0, \quad 0 < x < 1, \quad 0 < y < 1,$$
$$u_x(0,y) = 0, \quad u(1,y) = 4; \quad 0 < y < 1$$
$$u(x,0) = 0, \quad u_y(x,1) = 0; \quad 0 < x < 1.$$

Good Luck