MODULE PORTFOLIO
ODD SEMESTER ACADEMIC YEAR 2020/2021

MODULE NAME	:	Partial Differential Equation	LECTURER:
MODULE CODE	:	4420103110	
CLASS	:	2019	
SEMESTER	:	3	
DATE	:		
COURSE LEARNING OUTCOMES	:	**Knowledge (KNO-1)** Demonstrating mathematical knowledge and mathematical insight CLO-1: Demonstrate mathematical knowledge in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation **Knowledge (KNO-2)** Identifying and explaining the characteristics of mathematical problems CLO-2: Identify the characteristic of mathematical problem in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation CLO-3: Explain the characteristics of mathematical problems in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation **Skill (SKI-2)** Applying the basic principles of mathematics to solve simple* mathematical problems. CLO-4: Implement basic principle of mathematics to solve the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation. **Competences (COM-3)** Solving mathematical problems using technology CLO-5: Solve mathematical problem in the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation using technology.	
LEARNING STRATEGIES	:	Lectures are carried out by activating students with the following strategies: Lectures. Discussions. Practices. Presentations. and Group Assignments	
ASSESSMENT	:	The assessment carried out during the lecture includes the following three components. 1. Assignment (Quiz and Presentation)	

2. Midterm Exam (UTS)
3. Final Exam (UAS)

1. Assignment (Tugas)

✔ Assignments were given twice in one semester, before UTS (a quiz) and after UTS (a presentation)

✔ The quiz was an independent/individual task in the form of a description of the materials that have been discussed before the UTS

✔ The quiz was held in the classroom for 100 minutes

✔ The presentation was a group assignment in the form of a group presentation about the materials to be discussed after the UTS.

✔ Each group presented one material while the other groups provided an assessment of the progressing group according to the Presentation Assessment Rubric

✔ The assignment was carried out to see the achievements of the PLO and CLO which are in accordance with the characteristics of the ordinary differential equation module

2. Midterm Exam (UTS)

✔ UTS was held at the 8th meeting

✔ UTS was carried out in the classroom with an implementation time of 100 minutes according to the module schedule

✔ The UTS was carried out to see the achievements of the PLO and CLO which are in accordance with the characteristics of the ordinary differential equation module

3. Final Exam (UAS)

✔ UAS was held at the 16th meeting

✔ UAS was carried out in the classroom with an implementation time of 100 minutes which follows the UAS implementation schedule of the department

✔ The UAS was carried out to see the achievements of the PLO and CLO which are in accordance with the characteristics of the ordinary differential equation module

Assessmen Plan

PDE	KNO-1	KNO-2	SKI-2	COM-3
CLO-1	Tugas, UTS, UAS			
CLO-2		Tugas, UTS, UAS		

CLO-3		Tugas, UTS, UAS		
CLO-4			Tugas	
CLO-5				Tugas

Weight of Test Ability

PDE	KNO-1	KNO-2	SKI-2	COM-3
Tugas	20%	20%	30%	30%
UTS	40%	60%	0%	0%
UAS	40%	60%	0%	0%

The Calculation of PLO's Weight

PLO's Weight				
	T	UTS	UAS	
KNO-1	0.2	0.4	0.4	1
KNO-2	0.2	0.6	0.6	1.4
SKI-2	0.3	0	0	0.3
COM-3	0.3	0	0	0.3
	1	1	1	3

LEARNING OUTCOMES

:

The Calculation of PLO and The predicate of PLO for each students

NO	NIM	SCORE OF PLO				PREDICATE OF PLO			
		KNO-1	KNO-2	SKI-2	COM-3	KNO-1	KNO-2	SKI-2	COM-3
1	15030214023	52.69	50.83	75.00	75.00	F	F	G	G
2	17030214025	66.62	65.33	82.00	82.00	S	S	E	E
3	17030214044	70.92	69.83	84.00	84.00	G	S	E	E
4	17030214056	63.62	61.83	85.00	85.00	S	S	E	E
5	17030214058	72.69	71.67	85.00	85.00	G	G	E	E
6	17030214059	62.00	60.33	82.00	82.00	S	S	E	E
7	18030214004	59.62	57.50	85.00	85.00	S	S	E	E
8	18030214005	70.38	69.17	85.00	85.00	G	S	E	E

9	18030214006	70.15	69.00	84.00	84.00	G	S	E	E
10	18030214010	65.23	63.50	86.00	86.00	S	S	E	E
11	18030214011	69.77	68.50	85.00	85.00	S	S	E	E
12	18030214012	59.23	57.00	86.00	86.00	S	S	E	E
13	18030214016	66.92	65.17	88.00	88.00	S	S	E	E
14	18030214017	75.00	74.17	85.00	85.00	G	G	E	E
15	18030214018	77.92	77.33	85.00	85.00	G	G	E	E
16	18030214019	74.00	73.17	84.00	84.00	G	G	E	E
17	18030214020	75.92	75.00	87.00	87.00	G	G	E	E
18	18030214021	77.08	76.33	86.00	86.00	G	G	E	E
19	18030214025	66.00	64.67	82.00	82.00	S	S	E	E
20	18030214026	67.77	66.50	83.00	83.00	S	S	E	E
21	18030214027	67.77	66.50	83.00	83.00	S	S	E	E
22	18030214033	54.92	52.83	80.00	80.00	F	F	E	E
23	18030214034	59.08	57.17	82.00	82.00	S	S	E	E
24	18030214035	65.77	64.33	83.00	83.00	S	S	E	E
25	18030214036	79.31	78.67	87.00	87.00	G	G	E	E
26	18030214040	57.38	55.33	82.00	82.00	S	S	E	E
27	18030214046	61.08	59.17	84.00	84.00	S	S	E	E
28	18030214047	74.62	73.83	84.00	84.00	G	G	E	E
29	18030214048	88.08	88.33	85.00	85.00	E	E	E	E
30	18030214052	79.54	78.83	88.00	88.00	G	G	E	E
31	18030214053	89.31	89.50	87.00	87.00	E	E	E	E
32	18030214054	80.23	79.83	85.00	85.00	E	G	E	E
33	18030214058	68.00	66.83	82.00	82.00	S	S	E	E
34	18030214060	66.38	64.83	85.00	85.00	S	S	E	E
35	18030214064	58.62	56.50	84.00	84.00	S	S	E	E
36	18030214065	60.15	58.17	84.00	84.00	S	S	E	E
37	18030214066	59.46	57.33	85.00	85.00	S	S	E	E

38	16030214009	80.00	80.00	80.00	80.00	E	E	E	E
39	17030214029	49.23	46.67	80.00	80.00	F	F	E	E
40	18030214001	74.62	74.17	80.00	80.00	G	G	E	E
41	18030214002	58.46	56.67	80.00	80.00	S	S	E	E
42	18030214003	75.38	75.00	80.00	80.00	G	G	E	E
43	18030214007	69.23	68.33	80.00	80.00	S	S	E	E
44	18030214008	60.77	59.17	80.00	80.00	S	S	E	E
45	18030214009	79.23	79.17	80.00	80.00	G	G	E	E
46	18030214013	78.85	78.75	80.00	80.00	G	G	E	E
47	18030214014	64.62	63.33	80.00	80.00	S	S	E	E
48	18030214015	66.54	65.42	80.00	80.00	S	S	E	E
49	18030214022	76.15	75.83	80.00	80.00	G	G	E	E
50	18030214023	73.85	73.33	80.00	80.00	G	G	E	E
51	18030214029	55.38	53.33	80.00	80.00	S	F	E	E
52	18030214030	67.69	66.67	80.00	80.00	S	S	E	E
53	18030214031	58.46	56.67	80.00	80.00	S	S	E	E
54	18030214032	65.38	64.17	80.00	80.00	S	S	E	E
55	18030214037	66.15	65.00	80.00	80.00	S	S	E	E
56	18030214038	63.08	61.67	80.00	80.00	S	S	E	E
57	18030214039	61.54	60.00	80.00	80.00	S	S	E	E
58	18030214044	49.23	46.67	80.00	80.00	F	F	E	E
59	18030214045	55.38	53.33	80.00	80.00	S	F	E	E
60	18030214050	50.77	48.33	80.00	80.00	F	F	E	E
61	18030214051	60.00	58.33	80.00	80.00	S	S	E	E
62	18030214055	60.00	58.33	80.00	80.00	S	S	E	E
63	18030214056	60.77	59.17	80.00	80.00	S	S	E	E
64	18030214057	58.46	56.67	80.00	80.00	S	S	E	E
65	18030214061	65.00	63.75	80.00	80.00	S	S	E	E
66	18030214062	60.77	59.17	80.00	80.00	S	S	E	E

67	18030214063	87.69	88.33	80.00	80.00	E	E	E	E
68	18030214067	60.77	59.17	80.00	80.00	S	S	E	E
69	18030214068	60.00	58.33	80.00	80.00	S	S	E	E
70	18030214069	59.23	57.50	80.00	80.00	S	S	E	E

E = Excellent
G = Good
S = Satisfy
F = Fail

LEARNING OUTCOMES ANALYSIS

:

PLO Assessment Rubric

PLO	Description	Excellent $x \geq 80$	Good $70 \leq x < 80$	Satisfy $55 \leq x < 70$	Fail $x < 55$
KNO-1	Able to demonstrate mathematical knowledge and mathematical insight	Students be able to demonstrate mathematical knowledge in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 80.	Students be able to demonstrate mathematical knowledge in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 70 and less than 80.	Students be able to demonstrate mathematical knowledge in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 55 and less than 70.	Students be able to Demonstrate mathematical knowledge in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score less than 55.
KNO-2	Able to identify and explain the characteristics of mathematical problems	Student be able to identify the characteristic of mathematical problem in the first-order linear of PDEs, the second-order linear of PDEs, the wave	Student be able to identify the characteristic of mathematical problem in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation and	Student be able to identify the characteristic of mathematical problem in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation and	Student be able to identify the characteristic of mathematical problem in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation and

			equation and the heat equation and explain the characteristics of mathematical problems in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 80.	explain the characteristics of mathematical problems in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 70 and less than 80..	explain the characteristics of mathematical problems in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score at least 55 and less than 70	explain the characteristics of mathematical problems in the first-order linear of PDEs, the second-order linear of PDEs, the wave equation and the heat equation with score less than 55.
	SKI-2	Able to apply the basic principles of mathematics to solve simple* mathematical problems.	Student be able to implement basic principle of mathematics to solve the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation with score at least 80.	Student be able to implement basic principle of mathematics to solve the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation with score at least 70 and less than 80.	Student be able to implement basic principle of mathematics to solve the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation with score at least 55 and less than 70.	Student be able to implement basic principle of mathematics to solve the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation with score less than 55.
	COM-3	Able to solve mathematical problems using technology	Student be able to solve mathematical problem in the first-order linear of PDEs, second-order linear of PDEs, wave equation and	Student be able to solve mathematical problem in the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation using	Student be able to solve mathematical problem in the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation using	Student be able to solve mathematical problem in the first-order linear of PDEs, second-order linear of PDEs, wave equation and heat equation using

	heat equation using technology with score at least 80.	technology with score at least 70 and less than 80	technology with score at least 55 and less than 70.	technology with score less than 55

	CLASSICAL VALUE OF PLO			
	KNO-1	KNO-2	SKI-2	COM-3
Max	89.31	89.50	88.00	88.00
Rat	66.66	65.36	82.20	82.20
Min	49.23	46.67	75.00	75.00
	ACHIEVEMENT NUMBER OF PLO			
E	5.00	4.00	69.00	69.00
G	18.00	16.00	1.00	1.00
S	42.00	43.00	0.00	0.00
F	5.00	7.00	0.00	0.00
	70.00	70.00	70.00	70.00
	ACHIEVEMENT PERCENTAGE OF PLO (%)			
E	7.14	5.71	98.57	98.57
G	25.71	22.86	1.43	1.43

S	60.00	61.43	0.00	0.00
F	7.14	10.00	0.00	0.00
	100.00	100.00	100.00	100.00

ACHIEVEMENT PERCENTAGE OF PLO

CLASSICAL VALUE OF PLO
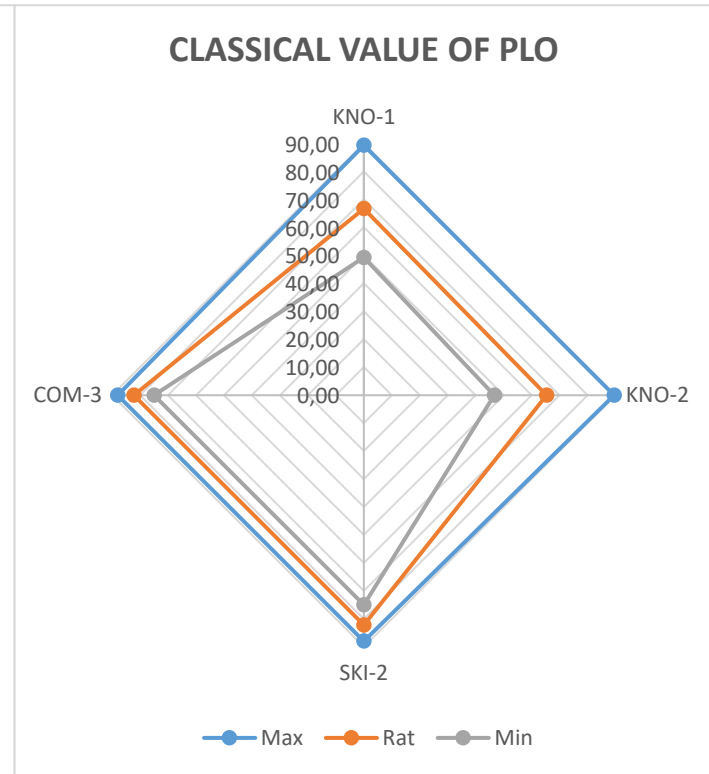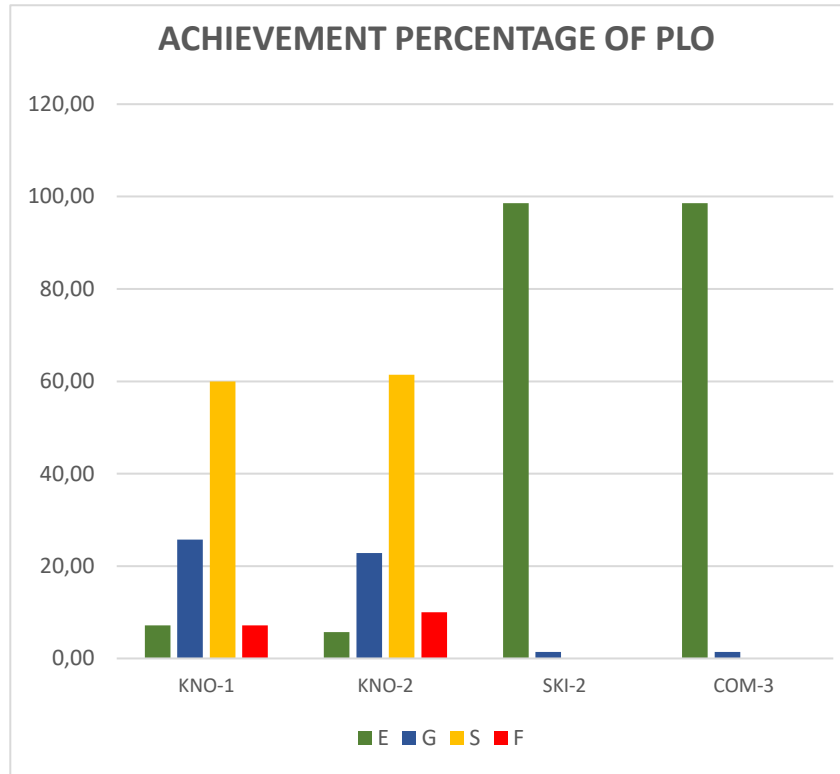
STUDENT'S LEARNING PERFORMANCE ANALYSIS	:	In general, the students in partial differential equation course have mastered the knowledge, skill, and competences. From 70 students, 7.14% of students achieved excellent criteria in KNO-1, 5.71% of students achieved excellent criteria in KNO-2, 98.57% of students achieved excellent criteria in SKI-2 and 98.57% of students achieved excellent criteria in COM-3. We can also see that some students achieved satisfy criteria in KNO-1 and KNO-2. However, there are still some students have failed in this course. It's about 7.14% and 10% of student have failed criteria in KNO-1 and KNO-2, respectively. It seems that they have some difficulties in demonstrating and identifying the characteristic of the mathematical

		problem specifically in the wave and heat equation. They also have problem to explain the characteristic of mathematical problem in the wave and heat equation.
RECOMMENDATION FOR FUTURE LEARNING	:	Several recommendations based on the last course of partial differential equation for better course in the future are as follow: 1. Motivate the students more in identifying the characteristic of the wave and heat equation, explaining the characteristics of mathematical problems in the wave and heat equation. They have to practice more in implementing basic principle of mathematics to solve the wave and heat equation. Beside the presentation of the materials, the students should be asked to share their opinion in class. This should extend the students understanding better and force them to read thoroughly 2. Several products by the students can be extended and develop more for students own portfolios
RECOMMEDATION FOR INSTITUTION	:	NA

DOCUMENT OF ODD SEMESTER MIDTERM EXAMINATION
ACADEMIC YEAR 2021/2022

Course/Code : Partial Differential Equation
Lecturers : Rudianto Artiono, M.Si
Program/Class : S1/2019E
Date and Time : Tuesday, 12 Oktober 2021
Duration : 100 minutes
Type : Closed

1. Write your answers on a sheet of paper with **identification** on each sheet.
2. Avoid using a pencil in writing answers.
3. Photograph/scan your answer sheet so that your answers can be read properly.
4. Sort the answers from the smallest question number and upload your answers in one file (pdf) with the file name: **NIM_NAMA**.
5. Work independently **without any resources but yourself**

1. Determine the lowest order partial differential equation whose solution is a function of the following two variables

   a. $u = f(x - ct) + g(x + ct)$, f and g are arbitrary functions

   b. $z = e^{ax+by}$, a and b are arbitrary constants.

   (Score 20)

2. Determine the general solution of the following first-order PDE

$$z_x - 2z_y = 3x^2 \sin(y + 2x)$$

   (Score 20)

3. Find the general solution of the following PDE

$$5\frac{\partial z}{\partial x} + 4\frac{\partial z}{\partial y} + z = x^3 + 2e^{3y}$$

   (Score 20)

4. Determine the classification and the general solution of the following second-order PDE

$$z_{xx} - 2z_{xy} + z_{yy} = 4e^{y-3x}$$

   (Score 20)

5. Determine the classification and the general solution of the following second-order PDE

$$x^2 z_{xx} - y^2 z_{yy} = xy$$

   (Score 20)

--Good Luck--

BLUE PRINT OF ODD SEMESTER MIDTERM EXAMINATION

Examination Subjects   : Partial Differential Equation

Lectures   : Team

Program   : Mathematics

No.	Indicator	Test	Key of the answer	Cognitive Domain	Score
1.	Able to solve first-order linear partial different equation	Determine the lowest order partial differential equation whose solution is a function of the following two variables a. $u = f(x - ct) + g(x + ct)$, f and g are arbitrary functions b. $z = e^{ax+by}$, a and b are arbitrary constants.	• Find the second partial derivative respect to Ux and Ut • Find the second partial derivative respect to Uxx and Utt • Substitute each other	C4	20
2.	Able to determine the solution of a first-order quasilinear inhomogeneous PDP using the Cauchy method.	Determine the general solution of the following first-order PDE $z_x - 2z_y = 3x^2 \sin(y + 2x)$	• Find the parameter A, B, and C • Substitute into Zh to find the homogen solution • Find the particular solution • Rearrange the solution to get the general solution	C4	20
3.	Able to determine the solution of a first-order quasilinear inhomogeneous PDP using the Cauchy method.	Find the general solution of the following PDE $5\dfrac{\partial z}{\partial x} + 4\dfrac{\partial z}{\partial y} + z = x^3 + 2e^{3y}$	• Find the parameter A, B, and C • Substitute into Zh to find the 1omogeny solution • Find the particular solution	C5	20

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			• Rearrange the solution to get the general solution		
4	Able to determine the general solution of the second-order PDE using symbolic equations	Determine the classification and the general solution of the following second-order PDE $z_{xx} - 2z_{xy} + z_{yy} = 4e^{y-3x}$	• Find the homogen solution through factorization • Find the particular solution • Rearrange the solution to get the general solution	C4	20
5	Able to determine the general solution of the second -order PDE using symbolic equations	Determine the classification and the general solution of the following second-order PDE $x^2 z_{xx} - y^2 z_{yy} = xy$	• Find the homogen solution through factorization • Find the particular solution • Rearrange the solution to get the general solution	C4	20

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DOCUMENT OF EVEN SEMESTER FINAL EXAMINATION
ACADEMIC YEAR OF 2021/2022

Course	: Persamaan Diferensial Parsial
Lecturer	: Team
Program/Class	: S1 Mathematics/2019
Date and Time	: Tuesday, 14 Desember 2021
Duration	: 100 minutes
Type	: Closed

1. Write your answers on a sheet of paper with **identification** on each sheet.
2. Avoid using a pencil in writing answers.
3. Photograph/scan your answer sheet so that your answers can be read properly.
4. Sort the answers from the smallest question number and upload your answers in one file (pdf) with the file name: **NIM_NAMA**.
5. Work independently **without any resources but yourself**

Complete all of the following questions.

1. Solve the following second order differential equations

    a. $z_{xx} - 5z_{xy} + 6z_{yy} = e^{x+y}$ (15)
    b. $z_{xx} + z_{xy} - 6z_{yy} = \cos(2x + y)$ (15)
    c. $z_{xx} - z_{yy} + 2z_x + 1 = y^2 + 2\sin(2x + y) - x^2y$ (20)

2. Determine the solution of the wave equation with the following Dirichlet condition (25)
    PDE $: U_{tt} = 25U_{xx} \qquad 0 < x < 3, \qquad t > 0$
    Boundary Condition $: U(0, t) = U(L, t) = 0$

    Initial Condition $: U(x, 0) = \dfrac{1}{4}\sin \pi x$

    $\qquad\qquad\qquad U_t(x, 0) = 10 \sin 2\pi x$

3. Prove that (25)

    $$U(x, t) = \sum_{n=1}^{\infty} A_n \sin\left(\frac{n\pi}{l}x\right) e^{-k\left(\frac{n\pi}{l}\right)^2 t}$$

    $$\text{with } A_n = \frac{2}{l} \int_0^l \sin\left(\frac{n\pi}{l}x\right) \phi(x) dx$$

    is a solution of the heat equation with the following Dirichlet condition
    PDE $: U_t = kU_{xx} \qquad 0 < x < L, \qquad t > 0$
    Boundary Condition $: U(0, t) = U(L, t) = 0$
    Initial Condition $: U(x, 0) = \phi(x).$

-------------------- Good Luck ------------------------

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`BLUE PRINT OF ODD SEMESTER FINAL EXAMINATION

Examination Subjects   : Partial Differential Equation

Lectures   : Team

Program   : Mathematics

No.	Indicator	Test	Key of the answer	Cognitive Domain	Score
1.	Able to classify two-variable almost-linear PDP and to solve two-variable almost-linear PDP	Solve the following second order differential equations $a.\ z_{xx} - 5z_{xy} + 6z_{yy} = e^{x+y}$ $b.\ z_{xx} + z_{xy} - 6z_{yy}$ $= cos\ cos\ (2x + y)$ $c.\ z_{xx} - z_{yy} + 2z_x + 1$ $= y^2 + 2\ sin\ sin\ (2x + y) - x^2 y$	Determine each parameter then solve the equation	C3	15 15 20
2.	Able to solve the wave equation along with the characteristics of the solution and its application	Determine the solution of the wave equation with the following Dirichlet condition PDE: $U_{tt} = 25U_{xx}, 0 < x < 3, t > 0$ $Boundary\ Condition$: $U(0,t) = U(L,t) = 0$ $Initial\ Condition$: $U(x,0) = \dfrac{1}{4}\ sin\ sin\ \pi x$ $U_t(x,0) = 10\ sin\ sin\ 2\pi x$	• Use the separation variable • Find the solution of characteristics equation • Use the Fourier transform • Find the solution from the Fourier	C4	25
3.	Able to solve the heat equation along with the	Prove that	• Use the separation variable	C4	25

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characteristics of the solution and its application	$U(x,t)$ $$= \sum_{n=1}^{\infty} A_n$$ $$sin \, sin \left(\frac{n\pi}{l} x\right) e^{-k\left(\frac{n\pi}{l}\right)^2 t}$$ with A_n $$= \frac{2}{l} \int_0^l$$ $$sin \, sin \left(\frac{n\pi}{l} x\right) \phi(x) dx$$ is a solution of the heat equation with the following Dirichlet condition PDE: $$U_t = kU_{xx}, 0 < x < L,$$ $$t > 0$$ $Boundary \, Condition$: $$U(0,t) = U(L,t) = 0$$ $Initial \, Condition$: $$U(x,0) = \phi(x)$$	● Find the solution of characteristics equation ● Use the Fourier transform ● Find the solution from the Fourier		