Question Bank 2021-2022

Partial Differential Equations

Solve the following questions in section 1.1 in our text book " an introduction to partial differential equations by Walter A. Strauss:

Q2) 1) (a) 2) 3) (b) 4) 5) (c) 6) (e) Q3 1) (b) 2) (d) 3) (f) 4) (h) Q4 and Q11

Additional problem I:
In the following table, state the order of each of the partial differential equations. Are they linear or nonlinear? For each nonlinear equation, CIRCLE a term that makes it nonlinear. For each linear equation, tell whether it is homogeneous or non-homogeneous. Use Y or N for the last two columns.

Partial Differential Equations	Order	Linear (Y/N)	Homogeneous (Y/N)
$x\,u_{tt} - y^2 \sin(x)\,u_{xx} = e^x u_x$			
$u_{yy}\,u_{xx} + u_{xxy} = 0$			
$\sqrt{\tan(x^4\,e^y)}\;u_y + x - y\,u_x = 0$			

In our text book solve the following questions

Section 1.2: Q1, Q3, Q5, and Q 7

Additional problem II:

Find the solution of the equation $xu_x + yu_y = 0$ with the condition $u(x, 2) = 8x - 3$ Find and sketch the region in the xy plane in which the solution is uniquely determined.

Supplementary question

Find the general solution of the equation 3u_yy +u_xy = 0.

Partial Differential Equations

Homework Assignment 2

Solve the following questions in our text book

Section 2.1: Q1, Q2, and Q9

Additional problem I:
Consider $u_{tt} = c^2 u_{xx}$, for $(-\infty < x < \infty \; and \; t > 0)$ subject to the initial conditions $u(x,0) = \varphi(x)$ and $u_t(x,0) = \psi(x)$. If $\varphi(x)$ and $\psi(x)$ are both odd. Then prove that the solution $u(x,t)$ is also an odd function of x. (hint: consider $u(x,t)$ and $u(-x,t)$).

Section 2.2: Q1, Q2, Q3, and Q5

Additional problem II:
Consider $\rho \, u_{tt} = T \, u_{xx}$, for $(-\infty < x < \infty \; and \; t > 0)$ subject to the initial conditions $u(x,0) = \varphi(x)$ and $u_t(x,0) = \psi(x)$, where $\varphi(x) = 2$ and

$$\psi(x) = \begin{cases} 0 & if \; x < 0, \\ e^{-x} & if \; x \geq 0 \end{cases}$$

Calculate the energy.

April 5, 2022 H.W. P1

Example: Find the solution of

$u_{xx} + u_{yy} = 0$ for $0 < x < l$, $0 < y < l$

$u(0,y) = 0$, $u(l,y) = 0$

$u(x,0) = 0$, $u(x,l) = 1$

Example1: Find the solution of

$u_{xx} + u_{yy} = 0$ for $0 < x < l$, $0 < y < l$,

$u_x(0,y) = 0$, $u_x(l,y) = 0$,

$u(x,0) = 0$, $u(x,l) = 1$.