Universität des Saarlandes
Fachrichtung 6.1 – Mathematik
PD Dr. Darya Apushkinskaya

UNIVERSITÄT DES SAARLANDES

PDE and Boundary-Value Problems (Winter Term 2013/2014)
Assignment H7 - Homework

Problem 7.1 (The Exterior Dirichlet Problem - 10 Points)

What is the solution to the exterior Dirichlet problem

$$\begin{array}{ll} \text{PDE} & \Delta u = 0, \qquad\qquad 1 < r < \infty \\ \text{BC} & u(1,\phi) = 1 + \cos\phi \end{array}$$

Problem 7.2 (The Dirichlet Problem- 8 Points)

Solve the Dirichlet problem

$$\begin{array}{ll} \text{PDE} & \Delta u = 0, \qquad\qquad 1 < r < 2 \\ \text{BCs} & \begin{cases} u(1,\theta) = \cos\theta \\ u(2,\theta) = \sin\theta \end{cases} \end{array}$$

Problem 7.3 (Questionnaire - 10 Points)

1. The equation $u_{tt} = u_{xx}$ is commonly called the _____ equation.
2. The term u_x in the equation $u_t = Du_{xx} - \nu u_x$ is related to the _____ of the material.
3. The Legendre polynomials $\{P_n(x)\}$ are _____ on the interval $[0, 1]$.
4. In order for separation of variables to work, the PDE must be _____ and _____.
5. An integral transform that we generally use on the time variable is due to _____.
6. The normal derivative at the boundary of a region is related to the _____ of material across the boundary.

7. The ODE in r we must solve when solving the vibrating circular membrane is due to _____.

8. A useful way to solve the equation $u_t = Du_{xx} - \nu u_x$ is by _____ coordinates.

9. The PDE $r^2R'' + rR' - \lambda^2 R = 0$ is called _____ equation.

10. The PDE $u_{xx} + u_{yy} = f(x, y)$ is named after _____.

Deadline for submission: Friday, January 31, 12am