King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics

Math 513 Final Exam, Term 162

Duration: 180 minutes

***Name*:** .....

1. Use separation of variables to solve:

$$u_{tt} = u_{xx}, \qquad 0 < x < 2, \qquad t > 0,$$
$$u(0,t) = u(2,t) = 0,$$
$$u(x,0) = 0, \qquad u_t(x,0) = 1.$$

2. Use Laplace transform to solve:

$$u_{xx} + u_{yy} = 0, \qquad 0 < x < \infty, \qquad 0 < y < 2,$$
$$u(0,y) = 1, \qquad u(x,0) = u(x,2) = 0.$$

3. Use Fourier transform to solve:

$$u_t = u_{xx}, \qquad -\infty < x < \infty, \qquad t > 0,$$
$$u(x,0) = \begin{cases} 3, & |x| < 5, \\ 0, & \text{otherwise.} \end{cases}$$

4. Solve:

$$(ru_r)_r + ru_{zz} = 0, \qquad 0 < r < 1, \qquad 0 < z < 2,$$
$$u(1,z) = 0, \qquad u(r,0) = 0, \qquad u(r,2) = 4.$$

5. Use d'Alembert formula to solve:

$$u_{tt} = u_{xx}, \qquad -\infty < x < \infty, \qquad t > 0,$$
$$u(x,0) = \begin{cases} 1 - |x|, & |x| \le 1, \\ 0, & |\mathrm{x}| > 1, \end{cases}$$
$$u_t(x,0) = 0, \qquad -\infty < x < \infty.$$

Sketch $u(x,3)$.

Q	1	2	3	4	5	Total
Max	20	20	20	20	20	100
Points						