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NPTEL

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Courses » Partial Differential Equations (PDE) for Engineers: Solution by Separation of Variables

Announcements Forum Progress Mentor

Assignment 3

Due on 2016-04-06, 22:00 IST

Submitted assignment

1) Consider PDE: $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0;$ Subject to at x=0, $u = u_0$; x=1, u=0; y=0, u=0; y=1, u=0;
The eigen functions are

(a) $\sin(n\pi x)$

(b) $\sin(n\pi y)$

(c) $\cos[(2n-1)\frac{\pi}{2}y]$

3 points

2) Consider PDE: $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0;$ subject to at x=0, $u = u_0$; x=1, u=0; y=0, $\frac{\partial u}{\partial y} = 0$; y=1, u=0;
The eigen functions are

(a) $\sin(n\pi x)$

(b)$\sin(n\pi y)$

(c) $\cos[(2n-1)\frac{\pi}{2}x]$

(d) $\cos[(2n-1)\frac{\pi}{2}y]$

3 points

3) An elliptical PDE physically models a system:

(a) At steady state

(b) at unsteady state

(c) at the start up of the plant

1 point

4) A hyperbolic PDE must contain

(a) Dirichlet B.C

(b) Neumann B.C

(c) Robin-mixed B.C

(d) Cauchy B.C

1 point

5) Consider hyperbolic PDE: $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$; The BCs on x are homogeneous. The BCs on t cannot be:

(a) At t=0, $u = u_{01}$, $\frac{\partial u}{\partial t} = u_{02}$

(b) At t=0,u=0, $\frac{\partial u}{\partial t} = 0$

(c) At t=0,u=0, $\frac{\partial u}{\partial t} = u_{02}$

(d) At t=0, $u = u_{01}$, $\frac{\partial u}{\partial t} = 0$

3 points

6) Bessel functions are orthogonal to each w.r.t weight function

(a) r

(b) r^2

sin r

exp (r)

2 points

7) For one dimensional transient heat conduction in a solid cylinder, where wall temperature is kept at constant temperature, the boundary condition at centreline of cylinder at r=0 is an example of:

(a) Dirichlet B.C

(b) Neumann B.C

(c) Physical B.C

(d) None of the above

3 points

8) What is BC at r=0 in problem 7:

(a) T=infinite

(b) $T = T_{ambient}$

(c) $T = T_{wall}$

2 points

9) For Bessel function $J_0(x)$, it is

(a) An exponential function of x

(b) It is an oscillatory function about x axis with diminishing magnitude

(c) It is a linear function in x through origin

3 points

10) For Bessel function $Y_0(x)$ is

(a) 0 at x=0

(b) ∞ at x=0

(c) $-\infty$ at x=0

(d) 1 at x=0

3 points

11) m^{th} order Bessel function $J_m(\lambda x)$ are

(a) Orthogonal functions

(b) Non-Orthogonal functions

3 points

12) For 2 dimensional transient heat conduction problem in a cylinder without θ symmetry the BCs on θ are

(a) $T|_{\pi} = T|_{-\pi}$ & $\frac{\partial T}{\partial t}|_{\theta=\pi} = \frac{\partial T}{\partial t}|_{\theta=-\pi}$

(b) T=0 at $\theta = \pi$ & $\frac{\partial T}{\partial t}|_{\theta=\pi} = 0$ at $\theta = -\pi$

(c) T=1 at $\theta = \pi$ & $\frac{\partial T}{\partial t}|_{\theta=\pi} = 0$ at $\theta = -\pi$

(d) T=0 at $\theta = \pi$ & $\frac{\partial T}{\partial t}|_{\theta=\pi} = 1$ at $\theta = -\pi$

3 points