Unit 4 - Week 02

Course outline

Assignment 2

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-08-21, 23:59 IST.

1) The solution of the diffusion problem $u_t = u_{xx} (0 < x < \pi, t > 0)$ with $u(0,t) = 0 = u(\pi,t)$, $u(x,0) = 3\sin(2x)$ is given by *1 point*

a. $3e^{-t}\sin(2x)$
b. $e^{-4t}\sin(x)$
c. $3e^{-2t}\sin(2x)$
d. $3e^{-4t}\sin(2x)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

2) The diffusion problem $u_t = u_{xx} (0 < x < \pi, t > 0)$, $u(0,t) = 0 = u(\pi,t)$, $u(x,0) = \sin(5x)\cos(x)$ admits the solution *1 point*

a. $\frac{e^{-36t}}{2}\left[\sin(5x) + e^{20t}\sin(x)\right]$
b. $\frac{e^{-20t}}{2}\left[\sin(x) + e^{20t}\sin(5x)\right]$
c. $\frac{e^{-36t}}{2}\left[\sin(6x) + e^{20t}\sin(4x)\right]$
d. $\frac{e^{-36t}}{2}\left[\sin(4x) + e^{20t}\sin(6x)\right]$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

3) The solution of the diffusion equation $u_t = u_{xx}, (0 < x < 1, t > 0)$, $u(0,t) = 1, u(1,t) = 1$, $u(x,0) = 0$ is given by *1 point*

a. $u(x,t) = 1 + \sum_{n=1}^{\infty} \frac{2}{n\pi}\left[(-1)^n - 1\right] e^{-n^2\pi^2 t}\sin(n\pi x)$
b. $u(x,t) = 1 + \sum_{n=1}^{\infty} \frac{2}{n\pi} e^{-n^2\pi^2 t}\sin(n\pi x)$
c. $u(x,t) = 1 + \sum_{n=1}^{\infty} \frac{2}{n\pi}\left[(-1)^n - 1\right] e^{-n^2\pi^2 t}\cos(n\pi x)$
d. $u(x,t) = 1 + \sum_{n=1}^{\infty} \frac{2}{n\pi} e^{-n^2\pi^2 t}\cos(n\pi x)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

4) The solution of the non-homogeneous diffusion equation $u_t = u_{xx} + e^{-t}\sin(3x), (0 < x < 1, t > 0)$, $u(0,t) = 0, u(\pi,t) = 1$, $u(x,0) = x$ is *1 point*

a. $\frac{x}{\pi} + \sin(3x) + \sum_{n=1}^{\infty} T_n(0) e^{-n^2 t}\sin(nx)$ where $T_n(0) = (-1)^{n+1}\frac{2}{n}\left(1 - \frac{1}{\pi}\right)$
b. $\frac{x}{\pi} + \frac{1}{8}\left[e^{-t} - e^{-9t}\right]\sin(3x) + \sum_{n=1}^{\infty} T_n(0) e^{-n^2 t}\cos(nx)$ where $T_n(0) = (-1)^{n+1}\frac{2}{n}\left(1 - \frac{1}{\pi}\right)$
c. $\frac{x}{\pi} + \frac{1}{8}\left[e^{-t} - e^{-9t}\right]\sin(3x) + \sum_{n=1}^{\infty} T_n(0) e^{-n^2 t}\sin(nx)$ where $T_n(0) = (-1)^{n+1}\frac{2}{n}\left(1 - \frac{1}{\pi}\right)$
d. $\frac{x}{\pi} + \left[e^{-t} - e^{-9t}\right] + \sum_{n=1}^{\infty} T_n(0) e^{-n^2 t}\sin(nx)$ where $T_n(0) = (-1)^{n+1}\frac{2}{n}\left(1 - \frac{1}{\pi}\right)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

5) The solution of the IVP $u_{tt} = u_{xx}; u(x,0) = \sin x; u_t(x,0) = 1$. Then, $u\left(\pi, \frac{\pi}{2}\right)$ is equal to *1 point*

a. $\frac{\pi}{2}$
b. $\pi - 1$
c. π
d. $1 - \frac{\pi}{2}$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

6) The solution of the wave equation $u_{tt} = 4u_{xx}; 0 < x < \pi; u(0,t) = u(\pi,t) = 0;$ $u(x,0) = \sin x; u_t(x,0) = 0$. Then $u\left(\frac{\pi}{2}, \frac{\pi}{2}\right)$ is equal to *1 point*

a. 0
b. 1
c. π
d. -1

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

7) Let $u(x,t)$ be the solution of the IVP $u_{tt} - u_{xx} = 1, x \in \mathbb{R}, t > 0$ with $u(x,0) = 0, u_t(x,0) = 0, x \in \mathbb{R}$. Then $u(1,1)$ is equal to *1 point*

a. $-\frac{1}{2}$
b. 1
c. $\frac{1}{2}$
d. -1

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

8) Let $u(x,t)$ be the D'Alembert's solution of the IVP for the wave equation $u_{tt} - c^2 u_{xx} = 0$, $u(x,0) = f(x), u_t(x,0) = g(x)$ where *c* is a positive real number, $f(x)$ and $g(x)$ are odd function, then $u(0,3)$ is equal to *1 point*

a. 1
b. 2
c. -1
d. 0

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

9) Any solution of the BVP $u_{xx} + u_{yy} = 0, x \in (0,\pi), y \in (0,\pi)$, $u(x,0) = u(x,\pi) = u(0,y) = 0$ is of the form *1 point*

a. $\sum_{n=1}^{\infty} k_n \sinh(nx)\cos(ny)$
b. $\sum_{n=1}^{\infty} k_n \sinh(nx)\sin(ny)$
c. $\sum_{n=1}^{\infty} k_n \cosh(nx)\sin(ny)$
d. $\sum_{n=1}^{\infty} k_n \cosh(nx)\cos(ny)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
b

10) If $\delta^{(n)}(x)$ is the n^{th} derivative of the Dirac delta function, then the value of $\int_{-\infty}^{\infty} f(x)\delta^{(n)}(x-a)\,dx$ is equal to *1 point*

a. $(-1)^n f^{(n)}(0)$
b. $f^{(n)}(0)$
c. $f^{(n)}(a)$
d. $(-1)^n f^{(n)}(a)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

11) The Green's function of the BVP $y'' = 0, y(0) = y'(1), y'(0) = y(1)$ is equal to *1 point*

a. $G(x,t) = \begin{cases} (2-t)x + 1 - t, & 0 \le x < t \\ (1-t)x + 1, & t < x \le 1 \end{cases}$
b. $G(x,t) = \begin{cases} x + 1 - t, & 0 \le x < t \\ (1-t)x + 1, & t < x \le 1 \end{cases}$
c. $G(x,t) = \begin{cases} (1-t)x + t, & 0 \le x < t \\ (2-t)x + 1, & t < x \le 1 \end{cases}$
d. $G(x,t) = \begin{cases} (1-x)t + x - 1, & 0 \le x < t \\ (1-t)x + t - 2, & t < x \le 1 \end{cases}$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

12) Using Green's function, the solution of the BVP $y'' + y = x, y(0) = 0 = y\left(\frac{\pi}{2}\right)$ is given by *1 point*

a. $y(x) = x + \frac{\pi}{2}\sin x$
b. $y(x) = x^2 + \frac{\pi}{2}\sin x$
c. $y(x) = x - \frac{\pi}{2}\sin x$
d. $y(x) = x^2 - \frac{\pi}{2}\sin x$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
c

13) Using Green's function, the solution of the BVP $y'' - y = x, y(0) = 0 = y(1)$ is given by *1 point*

a. $y(x) = \frac{\cosh(x)}{\cosh(1)} + x$
b. $y(x) = \frac{\cosh(x)}{\cosh(1)} - x$
c. $y(x) = \frac{\sinh(x)}{\sinh(1)} + x$
d. $y(x) = \frac{\sinh(x)}{\sinh(1)} - x$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d

14) Transform the BVP $y'' + y = x, y(0) = 0, y'(1) = 0$ to a Fredholm integral equation $y(x) = \phi(x) + \int_0^1 G(x,t)y(t)\,dt$ then, the value of $\phi(x)$ and $G(x,t)$ are equal to *1 point*

a. $G(x,t) = \begin{cases} x, & 0 \le x < t \\ t, & t < x \le 1 \end{cases}$ $\phi(x) = -\frac{1}{6}(3x - x^3)$
b. $G(x,t) = \begin{cases} x^2, & 0 \le x < t \\ t^2, & t < x \le 1 \end{cases}$ $\phi(x) = \frac{1}{6}(3x - x^3)$
c. $G(x,t) = \begin{cases} x^2, & 0 \le x < t \\ t^2, & t < x \le 1 \end{cases}$ $\phi(x) = (x - x^3)$
d. $G(x,t) = \begin{cases} x, & 0 \le x < t \\ t, & t < x \le 1 \end{cases}$ $\phi(x) = (x - x^3)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
a

15) Reduce the BVP $y'' + xy = 1, y(0) = y(1) = 0$ to the integral equation $y(x) = \phi(x) + \int_0^1 G(x,t)\,ty(t)\,dt$, then the value of $\phi(x)$ and $G(x,t)$ are equal to *1 point*

a. $G(x,t) = \begin{cases} x(1-t), & 0 \le x < t \\ t(1-x), & t < x \le 1 \end{cases}$ $\phi(x) = x(1-x)$
b. $G(x,t) = \begin{cases} t(1-x), & 0 \le x < t \\ x(1-t), & t < x \le 1 \end{cases}$ $\phi(x) = \frac{1}{2}x(1-x)$
c. $G(x,t) = \begin{cases} x^2(1-t^2), & 0 \le x < t \\ t^2(1-x^2), & t < x \le 1 \end{cases}$ $\phi(x) = \frac{1}{2}x(1-x)$
d. $G(x,t) = \begin{cases} x(1-t), & 0 \le x < t \\ t(1-x), & t < x \le 1 \end{cases}$ $\phi(x) = -\frac{1}{2}x(1-x)$

a
b
c
d

No, the answer is incorrect.
Score: 0
Accepted Answers:
d