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NPTEL

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Courses » Integral Equations,calculus of variations and its applications

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Unit 3 - Week 2

Course outline

How to access the portal

Week-1

Week 2

- Fredholm integral equation with separable kernel: Theory
- Fredholm integral equation with separable kernel: Examples
- Solution of integral equations by successive substitutions
- Solution of integral equations by successive approximations
- Solution of integral equations by successive approximations: Resolvent kernel

Assignment 2

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

Due on 2018-08-15, 23:59 IST.

1) *For what values of a and b, the function* $(a+bx)e^{-x}$ *is a solution of* $y(x) = 4\int_0^\infty e^{-(x+t)}y(t)dt + (x-1)e^{-x}$ **1 point**

- $a=1,\ b=-1$
- $a=-1,\ b=1$
- $a=0,\ b=-1$
- $a=0,\ b=1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$a=0,\ b=1$

2) *For what values of a and b, the function* $a+bx$ *is a solution of* $y(x) = -\int_0^1 x^2e^{xt}y(t)dt + (x+1) + (x-1)e^x$ **1 point**

- $a=0,\ b=1$
- $a=1,\ b=0$
- $a=1,\ b=-1$

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$no\ eigenvalue$

$an\ eigenvalue\ \lambda = 3/2$

$an\ eigenvalue\ \lambda = -1$

$an\ eigenvalue\ \lambda = 1.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$no\ eigenvalue$

4) $The\ Fredholm\ integral\ equation\ y(x) = \lambda \int_{-1}^{1} (5xt^3 + 4x^2 t) y(t) dt\ has\ an\ eigenvalue$ ***1 point***

$\lambda = -1/2$

$\lambda = 1/2$

$\lambda = 2$

$\lambda = -2.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\lambda = 1/2$

5) $The\ eigenvalues\ and\ respective\ eigenfunctions\ for\ the\ Fredholm\ integral\ equation$ ***1 point***

$y(x) = \lambda \int_0^1 K(x,t) y(t) dt,\ where\ the\ kernel\ is\ of\ the\ form$

$$K(x,t) = \begin{cases} t(x+1), & 0 \le x \le t; \\ x(t+1), & t \le x \le 1. \end{cases}$$

$are\ given\ by$

$\lambda_0 = 1, y_0(x) = e^{-x}$

$\lambda_0 = -1, y_0(x) = e^{x}$

$\lambda_n = -n^2\pi^2, y_n(x) = \sin n\pi x,\ n = 1, 2, 3, \ldots$

$\lambda_n = -n^2\pi^2, y_n(x) = \sin n\pi x + n\pi \cos n\pi x,\ n = 1, 2, 3, \ldots$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\lambda_n = -n^2\pi^2, y_n(x) = \sin n\pi x + n\pi \cos n\pi x,\ n = 1, 2, 3, \ldots$

6) ***1 point***

The Fredholm integral equation $y(x) = x + \lambda \int_0^{2\pi} |\pi - t| \sin xy(t)dt$ *has a solution of the form*

- For $\lambda = \frac{1}{\pi^3}$, $y(x) = \sin x + x$
- For $\lambda = \frac{1}{\pi}$, $y(x) = \cos x + x$
- For $\lambda = \pi^3$, $y(x) = -\sin x + x$
- For $\lambda = -\frac{1}{\pi}$, $y(x) = \cos x - x.$

No, the answer is incorrect.
Score: 0

Accepted Answers:
For $\lambda = \frac{1}{\pi^3}$, $y(x) = \sin x + x$

7) **1 point**

Consider the Fredholm integral equation $y(x) = x + \lambda \int_{-1}^{1} (xt + x^2t^2)y(t)dt.$ *Then the successive substitution method, the unique solution of given equation exists at least for*

- $|\lambda| < 1$
- $|\lambda| < \frac{1}{2}$
- $|\lambda| < \frac{1}{3}$
- $|\lambda| < \frac{1}{4}$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$|\lambda| < \frac{1}{4}$.

8) *Let the iterated kernels for the Fredholm integral equation* $y(x) = \int_0^{\pi} K(x,t)y(t)dt,$ *with* $K(x,t) = e^x \cos t$ *be denoted by* $K_i, i = 1, 2, 3....$ *Then* **1 point**

- $K_2(x,t) = (\frac{e^\pi + 1}{2})e^x \cos t$
- $K_3(x,t) = \frac{1}{4}(e^\pi + 1)^2 e^x \cos t$
- $K_2(x,t) = (\frac{e^\pi - 1}{2})e^x \sin t$
- $K_3(x,t) = \frac{1}{4}(e^\pi - 1)^2 e^x \cos t.$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$K_3(x,t) = \frac{1}{4}\left(e^{\pi}+1\right)^2 e^x \cos t$

9) **1 point**

The resolvent kernel $\Gamma(x,t;\lambda)$ *corresponding to the Fredholm integral equation* $y(x) = f(x) + \lambda \int_{-1}^{1} x^2 t^2 y(t)dt$ *is given by*

- $\frac{x^2t^2}{5-2\lambda}$; $|\lambda| < \frac{2}{5}$
- $\frac{5x^2t^2}{5-2\lambda}$; $|\lambda| < \frac{5}{2}$
- $\frac{x^2t^2}{2\lambda-3}$; $|\lambda| < \frac{2}{3}$
- $\frac{3x^2t^2}{2\lambda-3}$; $|\lambda| < \frac{3}{2}$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\frac{5x^2t^2}{5-2\lambda}$; $|\lambda| < \frac{5}{2}$

10) *For the Fredholm integral equation* $y(x) = x + \lambda \int_0^1 (2x-t)y(t)dt$, *the solution, by the iterative method, exists provided* $|\lambda| < \lambda_1$. *Then* **1 point**

- $\lambda_1 = \sqrt{\frac{3}{2}}$
- $\lambda_1 = 2$
- $\lambda_1 = 3$
- $\lambda_1 = \sqrt{\frac{5}{2}}$.

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\lambda_1 = \sqrt{\frac{3}{2}}$

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