Total No. of Questions: 4

Enrolment No. EN21CS304019

Faculty of Engineering

Mid Sem I Examination April -2022

EN3BS12 Engineering Mathematics II

Programme: B.Tech. Branch/Specialisation: All

Duration: 2 Hrs. **Maximum Marks: 40**

Q.1 i. Laplace transforms of unit step function $L\{u(t-a)\}$ is denoted by 1

a. e^{-as} b. $e^{-as}s$

c. e^{-as}/s d. e^{-as}/a.

ii. The kernel of Laplace transform is 1

a. e^{-st} b. e^{st}

c. $e^{-st}f(t)$ d. $e^{st}f(t)$

iii. The value of $\int_0^\infty e^{-2t}cos3tdt$ =... 1

a. $\frac{2}{13}$ b. $\frac{-2}{5}$

c. $\frac{3}{13}$ d. $\frac{-3}{5}$

iv. If $F(t)$ is a periodic function with period T, then $L\{F(t)\}$ =... 1

a. $\int_0^T e^{-st}F(t)dt$ b. $\int_0^T e^{st}F(t)dt$

c. $\frac{\int_0^T e^{-st}F(t)dt}{(1-e^{-sT})}$ d. $\frac{\int_0^T e^{st}F(t)dt}{(1-e^{sT})}$

v. If $L^{-1}\{f(s)\} = F(T)$, then $L^{-1}\left\{\frac{f(s)}{s}\right\} = \cdots$ 1

a. $\int_0^\infty F(t)dt$ b. $\int_0^t F(t)dt$

c. $t.F(t)$ d. None of these.

vi. For the Half range cosine series which one condition is correct 1

a. $a_n = 0$ b. $b_n = 0$

c. $a_0 = b_n = 0$ d. $a_0 = a_n = 0$

vii. Fourier series of any odd function in interval $(-\pi, \pi)$ contains only 1

a. Cosine terms b. Sine terms

c. Cosine and sine terms d. None of these.

viii. Let $f(x)$, a periodic function with period 2π defined in the interval $(\alpha, \alpha + 2\pi)$, be the sum of a trigonometric series i.e., $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty}(a_n cosnx + b_n sinnx)$, then a_n is given by 1

a. $\int_\alpha^{\alpha+2\pi} f(x)dx$ b. $\frac{1}{\pi}\int_\alpha^{\alpha+2\pi} f(x)cosnxdx$

c. $\frac{1}{2\pi}\int_\alpha^{\alpha+2\pi} f(x)dx$ d. $\frac{1}{\pi}\int_\alpha^{\alpha+2\pi} f(x)sinnxdx$

ix. The function $f(x) = x \cdot \cos x$ in interval $(-\pi, \pi)$ is define as a 1

a. Odd function b. Even function

c. Doubtful d. Periodic function.

x. If $f(x)$ is an odd function then the Fourier series of $f(x)$ in the interval $(-l, l)$ is given by 1

a. $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\left(\frac{n\pi x}{l}\right) + \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi x}{l}\right)$

b. $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\left(\frac{n\pi x}{l}\right)$

c. $f(x) = \sum_{n=1}^{\infty} b_n \sin\left(\frac{n\pi x}{l}\right)$

d. None of these.

Q.2 i. Find the Laplace Transform of $\int_0^t e^{-t} \cos t \, dt$ 4

ii. Apply convolution theorem to evaluate $L^{-1}\left\{\frac{1}{(s^2+9)(s+3)}\right\}$. 6

OR iii. Solve $(D^2 + 9)y = \cos 2t$, if $y(0) = 1, y\left(\frac{\pi}{2}\right) = -1$ 6

Q.3 i. Write the Dirichlet's conditions for the uniform convergence of a Fourier series. 3

ii. Find the Fourier series of the function $f(x) = x \cdot \sin x, -\pi < x < \pi$. 7

OR iii. Find a Fourier series to represent $x + x^2$ in the interval $(-\pi, \pi)$. 7

Hence Show that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \cdots = \frac{\pi^2}{12}$

Q.4 i. State the change of scale property of Laplace Transform. 2

ii. Find the inverse Laplace transform of $\tan^{-1}\left(\frac{1}{s}\right)$. 3

iii. Find the Half range sine series for the function $f(x) = \pi - x^2, 0 < x < \pi$. 5

OR iv. Find the Fourier series to represent the function 5

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 0 & 1 < x < 2. \end{cases}$$

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