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SARDAR PATEL UNIVERSITY
B.Sc.- III Semester
Course Code: US03CELC01
Electronics and Communication
Date: 13/06/2022, Time: 12.00 to 2.00 pm

TOTAL MARKS 70

Q. 1 Multiple Choice Questions: 10

1. Gradient is
   - (i) A vector normal to the surface
   - (ii) A vector parallel to surface
   - (iii) A vector away from the surface
   - (iv) None of above

2. Divergence is del operated on
   - (i) Scaler quantity
   - (ii) Vector quantity
   - (iii) Tensor quantity
   - (iv) Optimum quantity

3. A function f(x) is said to be odd if f(-x)
   - (i) = f(x)
   - (ii) = -f(x)
   - (iii) = 0
   - (v) = -1

4. The fourier series for f(x) in the interval $\alpha < x < \alpha + 2\pi$ is given by

   (i) $f(x) = \dfrac{a_o}{2} + \sum_{n=0}^{\infty} a_n \cos nx + \sum_{n=0}^{\infty} b_n \sin nx$

   (ii) $f(x) = a_0 + \sum_{n=0}^{\infty} a_n \cos nx + \sum_{n=0}^{\infty} b_n \sin nx$

   (iii) $f(x) = \dfrac{a_o}{2} + \sum_{n=0}^{\infty} a_n \sin nx + \sum_{n=0}^{\infty} b_n \cos nx$

   (iv) None of the above.

5. $\cos n\pi =$
   - (i) $-n$
   - (ii) $(-1)^n$
   - (iii) 0
   - (iv) 1

6. The laplace transform of e^{at}
   - (i) 1/s-a
   - (ii) a/s-a
   - (iii) s/s+a
   - (iv) As/s+a

7. The numerical value of $\Gamma 3/2$ is
   - (i) $\sqrt{\pi}$
   - (ii) $\sqrt{\pi}/2$
   - (iii) 1
   - (iv) 0

8. The Laplace transform of $e^{at} t^n$ is given by

   (i) $\dfrac{n!}{S^{n+1}}$

   (ii) $\dfrac{n!}{(S-a)^{n+1}}$

   (iii) $\dfrac{\Gamma(n+1)}{S^{n+1}}$

   (iv)   None of the above

9. $F(s) = \int\limits_{-\infty}^{+\infty} f(t)e^{ist} dt$ is called

   (i)   Fourier transform
   (ii)   Laplace's transform
   (iii)   Integral transform
   (iv)   None of above

10. $e^{i\Theta} - e^{-i\Theta} =$

   (i) $2i\cos\Theta$
   (ii) $2i\sin\Theta$
   (iii) $2i\tan\Theta$
   (iv) $2i\cot\Theta$

Q2: True or False

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1. A vector is specified by both magnitude and direction.
2. Gradient is del operated on scalar quantity.
3. Even function is symmetrical about X-axis.
4. A function f(x) is even if f(-x) = -f(x).
5. $\sin n\pi = 0$
6. The numerical value of $\Gamma 1/2$ is $\sqrt{\pi}$.
7. The Laplace transform of coshat is $s/s^2 + a^2$.
8. $F(s) = \dfrac{1}{2\pi} \int\limits_{-\infty}^{+\infty} f(s)e^{-isx} ds$ is called inverse Fourier transform.

Q3: Answer any 10 questions out of 12 questions briefly.

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1. Give geometrical interpretation of DOT product.
2. Give physical interpretation of Divergence
3. Define Incompressible fluid and Compressible Fluid
4. Give expressions for a_0, a_n and b_n.
5. Find a_0 for the Fourier series to represent x^2 in the interval ($-\pi$ to π)
6. Define even function giving example.
7. Find Laplace transform of $1 + 2\sqrt{t} + \dfrac{3}{\sqrt{t}}$.
8. Find Laplace transform of $(\sin t - \cos t)^2$
9. Find Laplace transform of $\cos^2 2t$.
10. Complete this equation, $e^{i\Theta} - e^{-i\Theta} = ?$
11. Give definition of Fourier Transform.
12. Give definition of Inverse Fourier Transform.

Q4: Answer any 4 questions out of 8 questions elaborately.

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1. A particle moves along the curve, $x = t^3 + 1, y = t^2, z = 2t + 3$ where t denotes time. Find the component of velocity and acceleration at t=1 in the direction i-3j+2k.
2. Evaluate div $\vec{F}$ and curl $\vec{F}$ at a point (1, 2, 3) if $\vec{F} = grad[x^3 y + y^3 z + z^3 x - x^2 y^2 z^2]$
3. Find the fourier series expansion of $f(x) = e^{-ax}$ in the interval $-\pi < x < \pi$.

4. Prove that $x^2 = \dfrac{\pi^3}{3} + 4\sum_{n=1}^{4}(-1)^n \dfrac{Cosnx}{n^2}$ $-\pi < x < \pi.$
    where

5. Find Laplace transform of (i) e^{4t} Sin 2t Cos t (ii) t^2cosat

6. Find Laplace transform of (i) $t^2 e^{-3t}$ Sin 2t (ii) $\dfrac{Cos2t - Cos3t}{t}$

7. Find Fourier transform of
$$f(x) = \begin{cases} 1 - x^2 & for \quad |x| \le 1 \\ 0 & for \quad |x| > 1 \end{cases}$$

    Hence evaluate $\displaystyle\int_0^\infty \dfrac{Sinx}{x}dx$.

8. Find fourier transform of
$$f(x) = \begin{cases} 1 - x^2 & for \quad |x| \le 1 \\ 0 & for \quad |x| > 1 \end{cases}$$

$$\int_0^\infty \dfrac{xCosx - Sinx}{x^3} Cos\dfrac{x}{2}dx$$

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