

SAMPLE QUESTIONS SET

Subject: Applied Mathematics III

Course: CBCGS/CBGS

SE: ELEX Branch

Q.1 If $f(t)$ be a function, $t \geq 0$, then $L[f(t)]$ defined as

(a) $\int_{-\infty}^{\infty} e^{st} f(t) dt$

(b) $\int_{-\infty}^{\infty} e^{st} f(t) dt$

(c) $\int_0^{\infty} e^{st} f(t) dt$

(d) $\int_0^{\infty} e^{-st} f(t) dt$

Q.2 Find $L[1 + e^{-2t} + \sin 2t]$

(a) $\frac{1}{s} + \frac{1}{s-2} + \frac{1}{s^2-2^2}$

(b) $\frac{1}{s} + \frac{1}{s+2} + \frac{s}{s^2-2^2}$

(c) $\frac{1}{s} + \frac{1}{s-2} + \frac{2}{(s^2+2^2)}$

(d) $\frac{1}{s} + \frac{1}{s+2} + \frac{2}{s^2+2^2}$

Q.3 If $L\{f(t)\} = F(s)$, then $L\{f(at)\} = \frac{1}{a} F\left(\frac{s}{a}\right)$ known as

(a) First shifting theorem

(b) Second shifting theorem

(c) Change of scale property

(d) Multiplication theorem

Q.4 If $f(t)$ be a periodic function with period $T > 0$, then $L(f(t))$ is

(a) $\int_0^T e^{-st} f(t) dt$

(b) $\frac{\int_0^T e^{-st} f(t) dt}{1 + e^{sT}}$

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

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

Q.5 . If $L^{-1}[F(s)] = f(t)$ and $L^{-1}[G(s)] = g(t)$ then $L^{-1}[F(s).G(s)]$ is

$$(a) \int_0^t f(x)g(t+x)dx$$

$$(b) \int_0^x f(x)g(t-x)dt$$

$$(c) \int_0^t f(x)g(t-x)dx$$

$$(d) \int_0^x f(x)g(t+x)dt$$

Q.6. What is the maximum directional derivative of $\phi = x^2yz^3$ at $(2,1,-1)$?

- (a) $\sqrt{171}$ (b) $\sqrt{176}$ (c) $\sqrt{129}$ (d) None

Q.7. Find $\nabla\phi$ if $\phi = xyz$ at $(1,2,3)$

- (a) $6i - 3j + 2k$ (b) $6i + 3j - 2k$ (c) $6i + 3j + 2k$ (d) None

Q.8. If $\vec{F}$ is irrotational vector field ; then

- (a) $\text{Curl } \vec{F} = 0$ (b) $\text{Div. } \vec{F} = 0$ (c) $\text{Grad. } \vec{F} = 0$ (d) None

Q.9. If from the function $f(t)$ one forms of the function $\psi(t) = f(t) + f(-t)$ then $\psi(t)$ is

- (a) Even (b) Odd
(c) Neither even nor odd (d) Both even and odd.

Q.10. The trigonometric Fourier series of an even function does not have

- (a) Constant (b) Cosine terms
(c) Sine terms (d) Odd.

Q.11. The function $f_3(x) = -1 + ax + bx^2$ is orthogonal to functions $f_1(x) = 1$ and $f_2(x) = x$ in the interval $(-1, 1)$. The value of b will be

- (a) 3 (b) -3
(c) 0 (d) None of these.

Q.12. Fourier series of odd function only have

- (a) Constant (b) Cosine terms
(c) Sine terms (d) Odd.

Q.13. For standard Fourier series $\frac{1}{2l} \int_c^{c+2l} f(x) dx =$

- (a) a_0 (b) a_n
 (c) b_n (d) None of these.

Q.14. In Fourier expansion of $f(x)=x^2$ for the interval $(0, 2\pi)$ find $b_n =$

- (a) $2\pi/n$ (b) $4\pi^2/3$
 (c) $4\pi/n$ (d) $4/n^2$

Q.15 Function cannot be expressed as Fourier series if it is

- (a) Single valued (b) multiple valued
 (c) Positive valued (d) negative valued

Q.16. Find a_0 the Fourier series for $f(x) = 0, -\pi < x < 0$
 $= \sin x, 0 < x < \pi$.

- (a) $1/\pi$ (b) 0
 (c) $\pi/n(n+1)$ (d) $\frac{1}{4n^2}$

Q.17 Find b_n (for n is even) half range sine series of $f(x) = 2x - x^2$ in the interval $0 < x < 2$

- (a) $32/n^3\pi^3$ (b) 0
 (c) $\frac{16}{n^3\pi^3} [1 - \cos n\pi]$ (d) $\frac{-16}{n^3\pi^3} [1 - \cos n\pi]$

Q.18. Bessel's equation of order n is

- a) $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + (x^2 - n^2)y = 0$
 b) $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$
 c) $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - (n^2 + x^2)y = 0$

d) $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (n^2 - x^2)y = 0$

Q19. Modified Bessel's equation of order n is

a) $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - (i^2 x^2 - n^2)y = 0$

b) $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (i^2 n^2 + x^2)y = 0$

c) $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - (i^2 x^2 + n^2)y = 0$

d) $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (i^2 x^2 - n^2)y = 0$

Q20. For positive integer n, a function is called the Generating function of Bessel's coefficients.

a) $e^{\frac{x}{2}(t-\frac{1}{t})}$ b) $e^{\frac{x}{2}(t+\frac{1}{t})}$ c) $e^{x(t-\frac{1}{t})}$ d) $e^{\frac{x}{2}(t-\frac{1}{t})}$

Q21. $\frac{1}{\pi} \int_0^\pi \cos(x \sin \theta - n\theta) d\theta = \dots\dots\dots$

a) $J_{n+1}(x)$ b) $J_n(x)$ c) $2J_n(x)$ d) $J_{n-1}(x)$

2. If $\bar{a} = 2i + 3j - 4k$; $\bar{b} = 4i + 6j - 8k$ then $\bar{a} \times \bar{b} = ?$

(a) 58 (b) 48 (c) 0 (d) None

Q.22. If $\bar{a}, \bar{b}, \bar{c}$ are coplanar then $\begin{bmatrix} \bar{a} & \bar{b} & \bar{c} \end{bmatrix} = ?$

(a) 0 (b) 1 (c) -1 (d) None

Q.23. What is the value of $(\bar{a} \times \bar{b}) \times (\bar{c} \times \bar{d}) = ?$

(a) $\begin{bmatrix} \bar{a} & \bar{b} & \bar{d} \end{bmatrix} \bar{c} - \begin{bmatrix} \bar{a} & \bar{b} & \bar{c} \end{bmatrix} \bar{d}$ (b) $\begin{bmatrix} \bar{a} & \bar{b} & \bar{c} \end{bmatrix} \bar{d} - \begin{bmatrix} \bar{a} & \bar{b} & \bar{d} \end{bmatrix} \bar{c}$

(c) $\begin{bmatrix} \bar{b} & \bar{c} & \bar{d} \end{bmatrix} \bar{a} - \begin{bmatrix} \bar{a} & \bar{c} & \bar{d} \end{bmatrix} \bar{b}$ (d) $\begin{bmatrix} \bar{a} & \bar{c} & \bar{d} \end{bmatrix} \bar{b} - \begin{bmatrix} \bar{a} & \bar{b} & \bar{d} \end{bmatrix} \bar{c}$

Q.24. By Greens theorem

(a) $\int_c Pdx + Qdy = \iint_R \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y} \right) dx dy$ (b) $\int_c Pdx - Qdy = \iint_R \left(\frac{\partial P}{\partial x} - \frac{\partial Q}{\partial y} \right) dx dy$

(c) $\iint_R Pdx - Qdy = \int_c \left(\frac{\partial P}{\partial x} - \frac{\partial Q}{\partial y} \right) dx dy$ (d) None

Q.25. By stokes theorem

(a) $\int_c \vec{F} \cdot d\vec{r} = \iint_s (\nabla \times \vec{F}) \cdot d\vec{s}$

(b) $\int_c \vec{F} \times d\vec{r} = \iint_s (\nabla \cdot \vec{F}) \cdot d\vec{s}$

(c) $\int_c \vec{F} \times d\vec{s} = \iint_s (\nabla \cdot \vec{F}) \cdot d\vec{r}$

(d) None

Q.26. According to Greens theorem formula for the area is

(a) $\frac{1}{2} \int_c (ydx - xdy)$

(b) $\frac{1}{2} \int_c (xdx + ydy)$

(c) $\frac{1}{2} \int_c xydx dy$

(d) None

Q.27. Evaluate $\int_c (2ydx + 3xdy)$ where $c: x^2 + y^2 = 4$

(a) 2π (b) 5π (c) 4π (d) None

Q.28. Find L(y) of differential Equation $(D^2 + 2D + 5)y = e^{-t} \sin t$, with $y(0) = 0, y'(0) = 1$

(a) $\frac{(s^2 + 2s + 3)}{(s^2 + 2s + 5)(s^2 + 2s + 2)}$

(b) $\frac{(s^2 - 2s + 5)}{(s^2 + 2s + 3)(s^2 + 2s + 2)}$

(c) $\frac{(s^2 - 2s + 3)}{(s^2 - 2s + 5)(s^2 - 2s + 2)}$

(d) $\frac{(s^2 + 2s + 3)}{(s^2 + 5)(s^2 + 2)}$

Q.29. Find $L^{-1} \left[\frac{s+2}{s^2 - 4s + 13} \right]$

(a) $e^{2t} \cos 3t + 4 e^{2t} \sin 3t$

(b) $3 e^{2t} \cos 3t + 4 e^{2t} \sin 3t$

(c) $e^{2t} \cos 3t + \frac{4}{3} e^{2t} \sin 3t$

(d) $e^{-2t} \cos 3t + \frac{4}{3} e^{-2t} \sin 3t$

Q.30. Find $L[te^{3t} \sin 4t]$

(a) $\frac{8(s-3)}{(s^2-6s+25)^2}$

(b) $\frac{(2s-6)}{(s^2-6s+10)^2}$

(c) $\frac{2(s+3)}{(s^2-6s+25)^2}$

(d) $\frac{8(s-3)}{(s^2-6s+10)^2}$