University of Mumbai

Examinations Commencing from 7th January 2021 to 20th January 2021

Program: **BE Electronics Engineering**

Curriculum Scheme: Rev 2019 'C' Scheme

Examination: SE Semester III

Course Code: **ELC301** and Course Name: **Engineering Mathematics III**

Time: 2 hour Max. Marks: 80

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Note : Q1 carrying 40 marks. Q2 and Q3 are carrying 20 equal marks.

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Find Laplace transform of $f(t) = 1,\ 0 < t < 5;\quad f(t) = 0,\ t > 0$
Option A:	$\frac{1- e^{-5s}}{s}$
Option B:	$\frac{1}{s}e^{-5s}$
Option C:	$\frac{1}{s}$
Option D:	$\frac{1+ e^{-5s}}{s}$
2.	If $L[f(t)] = log\left(\frac{s+3}{s+1}\right)$, find $L[f(2t)]$
Option A:	$2\ log\left(\frac{s+3}{s+1}\right)$
Option B:	$2\ log\left(\frac{s+6}{s+2}\right)$
Option C:	$\frac{1}{2}log\left(\frac{s+3}{s+1}\right)$
Option D:	$\frac{1}{2}log\left(\frac{s+6}{s+1}\right)$
3.	Find $L[te^{-3t}sint]$
Option A:	$\frac{2s-6}{(s^2-6s+10)^2}$
Option B:	$\frac{2s+6}{(s^2+6s+10)^2}$
Option C:	$\frac{1}{(s+3)^2+1}$
Option D:	$\frac{1}{(s^2-6s+10)^2}$
4.	Find $L\left[\int_0^t u\ sin3u\ du\right]$
Option A:	$\frac{2}{(s^2+1)^2}$
Option B:	$\frac{2}{(s^2+3)^2}$
Option C:	$\frac{6}{(s^2+9)^2}$

Option D:	$\frac{2s}{(s^2+1)^2}$
5.	$L^{-1}\left[\frac{s+5}{s^2-25}\right]$ =?
Option A:	$cos5t + 5\, sin5t$
Option B:	$cosh5t + 5\, sinh5t$
Option C:	$cosh5t + sinh5t$
Option D:	$cosht + 5\, sinht$
6.	Find $L^{-1}\left[\frac{s-2}{s^2-4s+13}\right]$
Option A:	$e^{2t}\frac{sin3t}{3}$
Option B:	$e^{-2t}\frac{sin3t}{3}$
Option C:	$e^{2t}sin3t$
Option D:	$e^{2t}cos3t$
7.	In Fourier series of $f(x) = xcosx$ in $(-\pi, \pi)$. The value of a_n is
Option A:	0
Option B:	$\frac{-1}{2}$
Option C:	$\frac{(-1)^n}{n^2-1}$
Option D:	$\frac{1}{n^2-1}$
8.	$f(x) = \begin{cases} cosx, & -\pi < x < 0 \\ -cosx, & 0 < x < \pi \end{cases}$ is
Option A:	Both even and odd function
Option B:	neither even nor odd
Option C:	odd function
Option D:	Even function
9.	The Fourier series for f(x) in $(0,2\pi)$ is $\mathrm{f(x)} = \frac{\pi}{2} - \frac{1}{\pi}\sum_{\mathrm{n}=1}^{\infty}\frac{1}{\mathrm{n}^2}\mathrm{cosnx}$. Find the value of $\frac{1}{2\pi}\int_0^{2\pi}[f(x)]^2\ dx$
Option A:	$\frac{\pi^3}{4} + \frac{1}{\pi}\sum_{n=1}^{\infty}\frac{1}{n^4}$
Option B:	$\frac{\pi^2}{4} + \frac{1}{2\pi^2}\sum_{n=1}^{\infty}\frac{1}{n^4}$
Option C:	$\frac{\pi^3}{2} - \frac{1}{\pi}\sum_{n=1}^{\infty}\frac{1}{n^4}$
Option D:	0
10.	A function f(t) is periodic with period 2π if

Option A:	$f(t+2\pi)=0$
Option B:	$f(t+2\pi)=2\pi$
Option C:	$f(t+2\pi)=f(2\pi)$
Option D:	$f(t+2\pi)=f(t)$
11.	Which of the following functions is NOT analytic
Option A:	Sinhz
Option B:	Cosz
Option C:	$\bar{z}$
Option D:	z^2+z
12.	For f(z) $=$ u $+$ iv analytic, which of the following statement is correct
Option A:	f(z) may satisfy Cauchy-Riemann equation.
Option B:	f(z) is constant function
Option C:	f(z) =0
Option D:	u, v both are harmonic
13.	Find k such that $f(z)=\frac{1}{2}\log(x^2+y^2)+itan^{-1}\frac{kx}{y}$ is analytic
Option A:	K=1
Option B:	K=-1
Option C:	K=0
Option D:	K=2
14.	Find the characteristic roots of matrix A , Where $A=\begin{bmatrix}3 & -1 & 1\\ -1 & 5 & -1\\ 1 & -1 & 3\end{bmatrix}$
Option A:	$\lambda=1,\ 2,\ \ 3$
Option B:	$\lambda=1,\ 1,\ \ -2$
Option C:	$\lambda=2,\ 3,6$
Option D:	$\lambda=-2,-3,-6$
15.	$\lambda=5$ is one of the eigenvalues of $A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$. Find the eigenvector corresponding to eigenvalue $\lambda=5$ is
Option A:	$[1\ -1\ \ 0]$’
Option B:	$[1\ \ 1\ \ 1]$’
Option C:	$[1\ -1\ -1]$’
Option D:	$[1\ 0\ -1]$’

16.	If A = $\begin{bmatrix} 1 & 2 & 8 \\ 0 & -1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$ Find Eigen Values of $A^2 + 3A + 2A^{-1} + I$
Option A:	7,-3,12
Option B:	6,-4,11
Option C:	1,-1,2
Option D:	7,-3,15
17.	If the matrix A has eigen value 1,1,5 then algebraic multiplicity of A for $\lambda = 1$ is
Option A:	-1
Option B:	0
Option C:	1
Option D:	2
18.	The divergence and curl of $\bar{a} = 2i - 3j + k$ is
Option A:	div $\bar{a}$=0 , curl $\bar{a}$=5
Option B:	div $\bar{a}$=2 , curl $\bar{a}$=0
Option C:	div $\bar{a}$=3 , curl $\bar{a}$=3
Option D:	div $\bar{a}$=0 , curl $\bar{a}$=0
19.	Find the value of a if $\bar{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ is solenoidal
Option A:	$a = 2$
Option B:	$a = -2$
Option C:	$a = -4$
Option D:	$a = 4$
20.	Evaluate $\int_C ydx + x\,dy$ along $y = x^2$ from A(0,0) to B(1,1)
Option A:	0
Option B:	2xy
Option C:	-1
Option D:	1

Q2. **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	*Find* $L\left[e^{-t}\int_0^t e^u \cosh u\, du\right]$
B	$L^{-1}\left[\log\left(1+\frac{4}{s^2}\right)\right]$ s
C	*Obtain the Fourier series for* e^{-x} *in* $(0,2\pi)$
D	*Find the analytic function* $f(z)$ *whose imaginary part is* $e^{-x}(y\sin y + x\cos y)$
E	*Show that* $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ *satisfies Cayley-Hamilton theorem.* *Hence find* A^{-1}

F	Evaluate by using Green's theorem $\int_C (x^2 - y)dx + (2y^2 + x)dy$, *where* C is the closed region bounded *by* $y = 4$ and $y = x^2$

Q3. **(20 Marks Each)**	**Solve any Four out of Six** **5 marks each**
A	*Evaluate* $\int_0^\infty e^{-3t}\left(\frac{\sinh t \sin t}{t}\right) dt$
B	*Find* $L^{-1}\left[\frac{s}{(s^2+4s+13)^2}\right]$
C	*Obtain the half range Fourier sine series expansion for* $f(x) = (x - x^2)$ *in* $(0,2)$
D	*Obtain the orthogonal trajectories for the family of curves* $e^{-x} \cos y = C$.
E	*Check whether the matrix* $A = \begin{bmatrix} 2 & 3 & 4 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$ *is diagonalizable*
F	Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both irrotational and solenoidal.

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Question Number	Correct Option (Enter either ‘A’ or ‘B’ or ‘C’ or ‘D’)
Q1.	A
Q2.	D
Q3.	B
Q4	C
Q5	B
Q6	A
Q7	A
Q8.	C
Q9.	B
Q10.	D
Q11.	C
Q12.	D
Q13.	B
Q14.	C
Q15.	B
Q16.	A
Q17.	D
Q18.	D
Q19.	B
Q20.	D