

University of Mumbai

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

Program: BE Electronics and Telecommunication Engineering

Curriculum Scheme: Rev 2019 'C' Scheme

Examination: SE Semester III

Course Code: ECC301 and Course Name: Engineering Mathematics III

Time: 2 hour

Max. Marks: 80

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 $f(t) = 1, 0 < t < 5; f(t) = 0, t > 0$
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 $L[te^{-3t} \sin t]$
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 $L\left[\int_0^t u \sin 3u du\right]$
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:	$\cos 5t + 5 \sin 5t$
Option B:	$\cosh 5t + 5 \sinh 5t$
Option C:	$\cosh 5t + \sinh 5t$
Option D:	$\cos ht + 5 \sin ht$
6.	Find $L^{-1} \left[\frac{s-2}{s^2-4s+13} \right]$
Option A:	$e^{2t} \frac{\sin 3t}{3}$
Option B:	$e^{-2t} \frac{\sin 3t}{3}$
Option C:	$e^{2t} \sin 3t$
Option D:	$e^{2t} \cos 3t$
7.	In Fourier series of $f(x) = x \cos x$ 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.	$f(x) = \begin{cases} \cos x, & -\pi < x < 0 \\ -\cos x, & 0 < x < \pi \end{cases}$ 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 $f(x) = \frac{\pi}{2} - \frac{1}{\pi} \sum_{n=1}^{\infty} \frac{1}{n^2} \cos nx$. 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 $\vec{a} = 2i - 3j + k$ is
Option A:	$\text{div } \vec{a}=0$, $\text{curl } \vec{a}=5$
Option B:	$\text{div } \vec{a}=2$, $\text{curl } \vec{a}=0$
Option C:	$\text{div } \vec{a}=3$, $\text{curl } \vec{a}=3$
Option D:	$\text{div } \vec{a}=0$, $\text{curl } \vec{a}=0$
19.	Find the value of a if $\vec{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ 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 $y = x^2$
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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 $\vec{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both irrotational and solenoidal.	

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Max. Marks: 80

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