

University of Mumbai
Examination 2021 under cluster __ (Lead College: _____)
Examinations Commencing from 15th June 2021 to 24th June 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

Note: All Questions are compulsory.

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 e^{-10t}
Option A:	$\frac{1}{s-10}$
Option B:	$\frac{1}{s+10t}$
Option C:	$\frac{10}{s+10t}$
Option D:	$\frac{1}{s+10}$
2.	If $L[f(t)] = \frac{4s}{s^2-9}$, find $L[f(2t)]$
Option A:	$\frac{s}{s^2-36}$
Option B:	$\frac{4s}{s^2-36}$
Option C:	$\frac{4s}{s^2-9}$
Option D:	$\frac{4s}{s^2-18}$
3.	Find $L\left[\frac{\sin t}{t}\right]$
Option A:	$\cot^{-1}(s)$
Option B:	$\tan^{-1}(s)$
Option C:	$\cot^{-1}\left(\frac{s}{a}\right)$
Option D:	Does not exists
4.	Find $L\left[\int_0^t \cos 2u \, du\right]$

Option A:	$\frac{s}{s^2+4}$
Option B:	$\frac{s}{s^2+1}$
Option C:	$\frac{1}{s^2+4}$
Option D:	$\frac{1}{s^2+1}$
5.	$L^{-1}\left[\frac{4s-3}{s^2+9}\right]=?$
Option A:	$4\cos 3t - \sin 3t$
Option B:	$4\cos 3t + \sin 3t$
Option C:	$4\cos 3t - 3 \sin 3t$
Option D:	$4\sin 3t - \cos 3t$
6.	Find $L^{-1}\left[\frac{s+2}{s^2+4s+13}\right]$
Option A:	$e^{2t} \cos 3t$
Option B:	$e^{-2t} \cos 3t$
Option C:	$e^{2t} \sin 3t$
Option D:	$e^{-2t} \sin 3t$
7.	In Fourier series of $f(x) = x + x^3$ in $(-\pi, \pi)$. The coefficient of $\cos 2x$ is
Option A:	-1
Option B:	$\frac{-1}{2}$
Option C:	1
Option D:	0
8.	$f(x) = x^2 + \sin x$ is
Option A:	Even as well as odd function
Option B:	neither even nor odd function
Option C:	odd function
Option D:	Even function
9.	In the half range sine Series of $f(x) = x - x^2$ in $(0, 1)$ coefficient b_2 is
Option A:	0
Option B:	$\frac{1}{\pi^2}$
Option C:	$\frac{8}{\pi^3}$
Option D:	$\frac{4}{\pi^3}$

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.	Find the corresponding analytic function for harmonic function $v = 3x^2y + 6xy - y^3$ is
Option A:	$z^3 - z^2 + c$
Option B:	$z^2 + 3z^3 + c$
Option C:	$z^3 + 3z^2 + c$
Option D:	$z^3 - 3z^2 + c$
12.	Which of the following statement is true
Option A:	A bilinear transformation is a combination of basic transformations translation, rotation and inversion
Option B:	A bilinear transformation is known as Mobius Transformation
Option C:	Every Bilinear transformation is conformal
Option D:	All options are TRUE
13.	If u and v are the harmonic functions then which of the following function is not harmonic function
Option A:	uv
Option B:	$u + v$
Option C:	$\frac{u}{v}$
Option D:	$u - v$
14.	Find the eigen values of matrix A , Where $A = \begin{bmatrix} 7 & 4 & -1 & 4 \\ 7 & -1 & -4 & -4 \end{bmatrix}$
Option A:	$\lambda = 3, 3, 12$
Option B:	$\lambda = 12, -3, -3$
Option C:	$\lambda = 7, 7, 4$
Option D:	$\lambda = -12, 3, 3$
15.	If $A = \begin{bmatrix} 1 & 2 & 2 & -1 \end{bmatrix}$ find A^4 .
Option A:	$5I$
Option B:	$25I$
Option C:	$125I$

Option D:	625I
16.	If $A = \begin{bmatrix} 2 & 0 & 0 & 3 \\ -1 & 0 & -4 & 5 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ Find Eigen Values of $A^2 + 2A + I$
Option A:	9,0,0
Option B:	9,0,1
Option C:	3,0,0
Option D:	9,4,1
17.	If the matrix A has eigen value -1,-1,2 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 $\vec{a} = 3i - j + 2k$ 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.	If the vector $\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is irrotational; find the constants a, b, c.
Option A:	a=1, b=2, c=4
Option B:	a=-1, b=4, c=2
Option C:	a=4, b=2, c=1
Option D:	a=4, b=2, c=-1
20.	Evaluate $\int_c y dx + x dy$ along $y = x$ from A(0,0) to B(1,1)
Option A:	1
Option B:	2xy
Option C:	-1
Option D:	0

Q2. (20 Marks Each)	Solve any Four out of Six	5 marks each
A	Find $L \int_0^t e^{2u} \cos^2 u du$	

B	$L^{-1}\left[\tan^{-1}\left(\frac{2}{s^2}\right)\right]$
C	Obtain the Fourier series for $f(x) = x$ in $(0, 2\pi)$
D	Find the analytic function $f(z)$ whose real part is $\frac{1}{2}\log(x^2 + y^2)$
E	Show that $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ -1 & 4 & 3 & 1 \\ -1 & & & \end{bmatrix}$ satisfies Cayley-Hamilton theorem. Hence find A^{-1}
F	Evaluate by using Green's theorem $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the closed region bounded by $y = \sqrt{x}$ and $y = x^2$

Q3. (20 Marks Each)	Solve any Four out of Six	5 marks each
A	Evaluate $\int_0^{\infty} e^{-t} \left(\frac{\cos 3t - \cos t}{t} \right) dt$	
B	Find the inverse Laplace transform by using convolution theorem $\frac{s+3}{(s^2+6s+13)^2}$	
C	Obtain the half range Fourier cosine series expansion for $f(x) = x(2 - x)$ in $(0, 2)$	
D	Obtain the orthogonal trajectories for the family of curves $e^{-x} \cos y = C$.	
E	Find the eigen values and eigen vector for $A = \begin{bmatrix} -2 & 2 & -3 & 2 & 1 \\ -6 & -1 & -2 & 0 \end{bmatrix}$	
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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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	D
Q2.	B
Q3.	A
Q4	C
Q5	A
Q6	B
Q7	D
Q8.	B
Q9.	A
Q10.	D
Q11.	C
Q12.	D
Q13.	C
Q14.	A
Q15.	B
Q16.	B
Q17.	D
Q18.	D
Q19.	D
Q20.	A