

# University of Mumbai

Examinations Commencing from 10<sup>th</sup> April 2021 to 17<sup>th</sup> April 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.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. 2 marks each
1.	Laplace Transform of $\{t \sin 3t\}$ is
Option A:	$-\frac{6s}{(s^2+9)^2}$
Option B:	$-\frac{3}{(s^2+9)^2}$
Option C:	$\frac{6s}{(s^2+9)^2}$
Option D:	$-\frac{6}{(s^2+9)^2}$
2.	Laplace Transform of $\{\sin 2t \sin 3t\}$ is
Option A:	$\frac{1}{2} \left[ \frac{s}{s^2+1} - \frac{s}{s^2+25} \right]$
Option B:	$\frac{1}{2} \left[ \frac{s}{s^2+1} + \frac{s}{s^2+25} \right]$
Option C:	$\frac{1}{2} \left[ \frac{s}{s^2+25} - \frac{s}{s^2+1} \right]$
Option D:	$\left[ \frac{s}{s^2+1} - \frac{s}{s^2+25} \right]$
3.	Laplace Transform of $\{e^{2t}(1 + \sin t)\}$ is
Option A:	$\frac{1}{(s+2)} + \frac{1}{(s+2)^2+1}$
Option B:	$\frac{1}{(s-2)} + \frac{s}{(s-2)^2+1}$
Option C:	$\frac{1}{(s-2)} + \frac{1}{(s-2)^2+1}$
Option D:	$\frac{1}{(s-2)} + \frac{1}{(s-2)^2-1}$

4.	If $L\{f(t)\} = \frac{1}{s\sqrt{s+1}}$ , then $L\{f(2t)\}$ is
Option A:	$\frac{1}{2s}\sqrt{\frac{2}{(s+2)}}$
Option B:	$\frac{1}{s}\sqrt{\frac{2}{(s+2)}}$
Option C:	$\frac{1}{2}\sqrt{\frac{s}{(s+2)}}$
Option D:	$\sqrt{\frac{2}{(s+2)}}$
5.	Inverse Laplace Transform of $\frac{1}{s^4}$ is
Option A:	$\frac{1}{3!} t^4$
Option B:	$\frac{1}{2!} t^4$
Option C:	$\frac{1}{3!} t^3$
Option D:	$\frac{1}{4!} t^4$
6.	Inverse Laplace Transform of $\frac{1}{s} + \frac{1}{(s+2)^2}$ is
Option A:	$1 - te^{-2t}$
Option B:	$1 + te^{2t}$
Option C:	$1 + e^{-2t}$
Option D:	$1 + te^{-2t}$
7.	Inverse Laplace Transform of $\frac{1}{(s-2)^2-1}$ is
Option A:	$e^{-2t} \sin ht$
Option B:	$e^{2t} \sin t$
Option C:	$e^{2t} \sin ht$
Option D:	$e^{2t} \cos ht$
8.	Find Fourier coefficient $a_0$ for the function $f(x) = 2x - 3x^2$ , $0 \leq x \leq 2\pi$ ?
Option A:	$1 - 2\pi$
Option B:	$\pi(1 - 2\pi)$

Option C:	0
Option D:	$2\pi(1 - 2\pi)$
9.	Find Fourier coefficient $b_1$ in half range sine series for the function $f(x) = \sin x, 0 < x < \pi$ ?
Option A:	$\frac{\pi}{2}$
Option B:	0
Option C:	1
Option D:	-1
10.	Find Fourier coefficient $a_0$ for the function $f(x) = 1 - x^2, -1 \leq x \leq 1$
Option A:	$\frac{2}{3}$
Option B:	$\frac{1}{3}$
Option C:	0
Option D:	$-\frac{2}{3}$
11.	Which of the following is related to Cauchy-Riemann equations?
Option A:	$u_x = v_y, u_y = v_x$
Option B:	$u_x = -v_y, u_y = v_x$
Option C:	$u_x = v_y, u_y = -v_x$
Option D:	$u_x = u_y, v_y = v_x$
12.	If the eigenvalues of a 4x4 matrix A are given as 2, -3, -13 and 7, then determinant of A is
Option A:	19
Option B:	45
Option C:	546
Option D:	25
13.	What is the divergence of the vector field $f^{\vec{}} = 3x^2\hat{i} + 5xy^2\hat{j} + xyz^3\hat{k}$ at the point (1, 2, 3)?
Option A:	89
Option B:	80
Option C:	124
Option D:	100

14.	The Eigen values of the following matrix are $A = \begin{bmatrix} -2 & 5 & 4 & 0 & 7 & 5 & 0 & 0 & 2 \end{bmatrix}$
Option A:	-3 , 12, -6
Option B:	2,4 , 5
Option C:	1, 2 ,3
Option D:	-2,2,7
15.	If $u = 2x + kx^3 + 3xy^2$ is harmonic then the value of the constant k is
Option A:	3
Option B:	-1
Option C:	2
Option D:	0
16.	A vector field which has a vanishing divergence is called as
Option A:	Solenoidal field
Option B:	Rotational field
Option C:	Hemispheroidal field
Option D:	Irrotational field
17.	If all Eigen values are distinct then the matrix is
Option A:	Non-diagonalizable
Option B:	Diagonalizable
Option C:	Symmetric
Option D:	Singular
18.	If $f(z) = ze^z$ then it's real part $u$ is given by
Option A:	$e^x \{ x \sin y + y \cos y \}$
Option B:	$e^x \{ y \sin y + x \cos y \}$
Option C:	$e^x \{ x \cos y - y \sin y \}$
Option D:	$e^x \{ y \sin y - x \cos y \}$
19.	If the Eigenvalues of a matrix A are 1,-2,-1 then the Eigenvalues of $A^2 - A - 2I$ are
Option A:	-4,4,0
Option B:	2,4,1
Option C:	2,4,0
Option D:	-2,4,0
20.	Determine the constants $a, b, c$ if $\bar{F}$ is irrotational where $\bar{F} = (axy + bz^3)i + (3x^2 - cz)j$
Option A:	-6,0,1
Option B:	6,0,0
Option C:	0,6,0

<b>Q2. (20 Marks)</b>	<b>Solve any Four out of Six.</b>	<b>5 marks each</b>
A	Find $L[(t + \sin t)^2]$	
B	Find $L^{-1}\left[\frac{4s+12}{s^2+8s+12}\right]$	
C	Obtain the Fourier series for $f(x) = x$ in $(0, 2\pi)$ .	
D	Find the analytic function $f(z)$ in terms of $z$ whose real part is $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ .	
E	Find the Eigenvalues of matrix $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ -1 & 4 & 3 & 1 \\ -1 & & & \end{bmatrix}$ and Show that matrix satisfies the characteristic equation .	
F	Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz)$ is both irrotational and solenoidal.	

<b>Q3. (20 Marks)</b>	<b>Solve any Four out of Six.</b>	<b>5 marks each</b>
A	Evaluate $\int_0^t \frac{\sin \sin u}{u} du$	
B	Find $L^{-1}\left[\frac{1}{s(s^2+9)}\right]$	
C	Obtain half range Fourier sine series for $f(x) = x(\pi - x)$ in $(0, \pi)$ .	
D	Find the constants $a, b, c, d, e$ if $f(z) = (ax^3 + bxy^2 + 3x^2 + cy^2 + x) + i(dx^2y - 2y^3 + ex)$ is analytic.	
E	Find Eigenvalues & Eigenvectors for the matrix $A = \begin{bmatrix} 3 & -4 & 2 & -3 \end{bmatrix}$	
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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<b>Question Number</b>	<b>Correct Option (Enter either 'A' or 'B' or 'C' or 'D')</b>
Q1.	A
Q2.	A
Q3.	C
Q4	B
Q5	C
Q6	D
Q7	C
Q8.	D
Q9.	C
Q10.	A
Q11.	C
Q12.	C
Q13.	B
Q14.	D
Q15.	B
Q16.	A
Q17.	B
Q18.	C
Q19.	D
Q20.	B