

University of Mumbai
Examination 2020

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

Program: ETRX

Curriculum Scheme: Rev2016

Examination: SE Semester III

Course Code: ELX 301 and Course Name: ENGINEERING MATHEMATICS

Time: 2 hour

Max. Marks: 80

For the students:- All the Questions are compulsory and carry equal marks .

Q1.	L[Sinat]
Option A:	$\frac{a}{s^2 + a^2}$
Option B:	$\frac{a}{s^2 - a^2}$
Option C:	$\frac{s}{s^2 - a^2}$
Option D:	$\frac{s}{s^2 + a^2}$
Q2.	Laplace Transform of $e^{2t}[\cos 3t + \frac{4}{3}\sin 3t]$
Option A:	$\frac{s + 2}{s^2 - 4s + 13}$
Option B:	$\frac{s + 3}{s^2 - 4s + 13}$
Option C:	$\frac{s + 4}{s^2 - 4s + 13}$
Option D:	$\frac{s - 2}{s^2 - 4s + 13}$
Q3.	Laplace Transform of $e^{2t} [t^4 \div 24 + \frac{t^5}{60}]$
Option A:	$\frac{s}{(s - 2)^6}$
Option B:	$\frac{s + 2}{s^2 - 4s + 7}$
Option C:	$\frac{s + 2}{s^2 - 4s + 1}$
Option D:	$\frac{s + 2}{s^2 - 4s - 13}$
Q4.	Laplace Transform of $[-1 - t - \frac{t^2}{2} + e^t]$
Option A:	$\frac{1}{s^3 (s + 1)}$
Option B:	$\frac{1}{s^3 (s - 4)}$

Option C:	$\frac{1}{s}$
Option D:	$\frac{1}{s^3(s-1)}$
Q5.	Inverse Laplace Transform of $\frac{s^2}{(s^2+a^2)(s^2+b^2)}$
Option A:	$\frac{1}{(a^2-b^2)}[a\sin at + b\sin bt]$
Option B:	$\frac{1}{(a^2-b^2)}[a\sin at - b\sin bt]$
Option C:	$\frac{1}{(a^2-b^2)}[a\sin at - b\cos bt]$
Option D:	$\frac{1}{(a^2-b^2)}[a\cos at - b\sin bt]$
Q6.	Inverse Laplace Transform of $\frac{s+4}{s(s-1)(s^2+4)}$
Option A:	$-1 + e^t - \frac{1}{2}\sin 2t$
Option B:	$-1 - e^t - \frac{1}{2}\sin 2t$
Option C:	$-1 + e^t + \frac{1}{2}\sin 2t$
Option D:	$1 + e^t - \frac{1}{2}\sin 2t$
Q7.	Inverse Laplace Transform of $\frac{2s}{s^4+4}$
Option A:	$\sin t \sinh t$
Option B:	$\csc t \sec t$
Option C:	$\cos t \cosh t$
Option D:	$\cot t \tan ht$
Q8.	Inverse Laplace Transform of $\frac{1}{(s+4)^2(s-3)}$
Option A:	$e^{3t}[\frac{1}{49} - \frac{1}{49}e^{-7t} - \frac{t}{7}e^{-7t}]$
Option B:	$e^{3t}[\frac{1}{49} + \frac{1}{49}e^{-7t} - \frac{t}{7}e^{-7t}]$
Option C:	$e^{3t}[\frac{1}{49} + \frac{1}{49}e^{-7t} + \frac{t}{7}e^{-7t}]$
Option D:	$e^{3t}[\frac{1}{49} - \frac{1}{49}e^{-7t} - \frac{2}{7}e^{-7t}]$
Q9.	Find a ,b ,c ,d if $f(z) = [x^2 + 2axy + by^2] + i[cx^2 + 2dxy + y^2]$ is analytic function
Option A:	$a = 1 \ b = -1 \ c = -1 \ d = -1$
Option B:	$a = 1 \ b = 1 \ c = -1 \ d = 1$
Option C:	$a = 1 \ b = -1 \ c = -1 \ d = 1$
Option D:	$a = -1 \ b = -1 \ c = -1 \ d = 1$
Q10.	Find Real Part of Analytic function whose Imaginary part $v = x^2 + \frac{x}{x^2+y^2} - y^2$

Option A:	$2xy - \frac{y}{x^2+y^2}$
Option B:	$-2xy + \frac{y}{x^2+y^2}$
Option C:	$2xy + \frac{y}{x^2+y^2}$
Option D:	$-xy + \frac{y}{x^2+y^2}$
Q11.	If $v = e^x \sin y$ then its Harmonic Conjugate is
Option A:	$e^x \sin y$
Option B:	$-e^x \sin y$
Option C:	$e^x \cos y$
Option D:	$e^x \sin x$
Q12.	$\nabla \frac{1}{r}$
Option A:	$-\frac{\vec{r}}{r^3}$
Option B:	$-\vec{r}$
Option C:	$-\frac{\vec{r}}{r}$
Option D:	$\frac{\vec{r}}{r^3}$
Q13.	∇r^3
Option A:	$nr^{n-2} \vec{r}$
Option B:	$-nr^{n-2} \vec{r}$
Option C:	$-r^{n-2} \vec{r}$
Option D:	$r^{n-8} \vec{r}$
Q14.	Find a ,b ,c if $\vec{f} = [axy + bz^3]i^{\wedge} + [3x^2 - cz]j^{\wedge} + [3xz^2 - y]k^{\wedge}$ is irrotational.
Option A:	a=6 , b=1, c = 1
Option B:	a=4 , b=1, c = 1
Option C:	a=6 , b=3, c = 1
Option D:	a=6 , b=1, c = 2
Q15.	if $\vec{F} = (x^2 - yz)i^{\wedge} + (y^2 - zx)j^{\wedge} + (z^2 - xy)k^{\wedge}$ is
Option A:	Solenoidal
Option B:	Irrotational
Option C:	Both a and b
Option D:	Neither a nor b
Q16.	In fourier series of x^2 in $[-\pi \pi]$ a_0 is
Option A:	$-\frac{\pi^2}{3}$

Option B:	$\frac{\pi^2}{9}$
Option C:	$\frac{\pi^2}{3}$
Option D:	$\frac{\pi^2}{4}$
Q17.	In Fourier series of x^2 $[0, 3]$ what is b_1
Option A:	$12\left[\frac{\pi^2-4}{\pi^3}\right]$
Option B:	$18\left[\frac{\pi^2-4}{\pi^3}\right]$
Option C:	$14\left[\frac{\pi^2-4}{\pi^3}\right]$
Option D:	$17\left[\frac{\pi^2-4}{\pi^3}\right]$
Q18.	In fourier series of $f(x) = x$ what is $a_0 =$
Option A:	1
Option B:	2
Option C:	3
Option D:	6
Q19.	Eigen values of $\begin{bmatrix} 3 & 1 & 1 \\ 2 & 4 & 2 \\ 1 & 1 & 3 \end{bmatrix}$ are
Option A:	6,2,2
Option B:	1,2,3
Option C:	4,3,2
Option D:	0, 2, 7
Q20.	The Eigen values of $\begin{bmatrix} -1 & 4 \\ 2 & 1 \end{bmatrix}$
Option A:	3, -3
Option B:	2,1
Option C:	-1, -1
Option D:	3, 3

Q2. (20 Marks)	Solve any Four out of Six 5 marks each
A	Find e^A and 4^A where $A = \frac{1}{2} \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$
B	Find Eigen values and vector of $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$
C	Find half range sine series for $f(x) = x^2$ in $[0,3]$
D	Obtain Fourier series of $f(x) = 0 \quad -\pi \leq x \leq 0$ $x^2 \quad 0 \leq x \leq \pi$
E	show that $\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ is conservative field . find its scalar potential.
F	Evaluate by Greens theorem $\oint (x^2y \, dx + y^3)dy$ where c is the closed path formed by $y = x$ and $y = x^2$

Q3. (20 Marks)	Solve any Four out of Six 5 marks each
A	Show that $v = e^x[x\sin y + y \cos y]$ satisfied Laplace equation and find its corresponding analytic function.
B	If $f(z) = u + iv$ is analytic function and $u - v = e^x(\cos y - \sin y)$ find $f(z)$
C	Find inverse Laplace of the following $\frac{s}{(2s+1)^2}$
D	If $\int_0^\infty e^{-2t} \sin(t + \alpha) \cos(t - \alpha) \, dt = \frac{3}{8}$ then find α
E	Find Laplace transform of $\frac{\sin t \cos 2t}{e^t}$
F	Find inverse Laplace of the following $\frac{1}{(s^4 - s^3)}$