Program: **BE**

Biomedical (BMC301),
Electrical (EEC301),
Electronics and Computer(ECC301),
Electronics(ELC301),
Electronics and Teclecom. (ECC301),
Instrumentation (ISC301)

Curriculum Scheme: Rev 2019 'C' Scheme
Examination: SE Semester III
Course Name: **Engineering Mathematics III**

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Find the Laplace transform of $\int_0^t e^{7u}\, u\, du$
Option A:	$\frac{1}{s(s+7)^2}$
Option B:	$\frac{1}{s(s-7)^2}$
Option C:	$\frac{1}{(s-7)^2}$
Option D:	$\frac{1}{(s+7)^2}$
2.	Which of the following are the Cauchy-Riemann equations?
Option A:	$u_x = -v_y$ and $u_y = v_x$
Option B:	$u_x = v_y$ and $u_y = v_x$
Option C:	$u_x = v_y$ and $u_y = -v_x$
Option D:	$u_x = -v_x$ and $u_x = -v_x$
3.	Find the inverse Laplace transform of $\frac{6}{s(s-2)}$
Option A:	$-3(1-e^{2t})$
Option B:	$3(1-e^{2t})$
Option C:	$3(e^{-2t}-1)$
Option D:	$e^{-2t}+1$
4.	Find the eigen values of A^4, if $A = \begin{bmatrix} 7 & 1 \\ 0 & 1 \end{bmatrix}$
Option A:	2401 and 1
Option B:	-2401 and 1
Option C:	2401 and -1
Option D:	-2401 and -1
5.	Find the divergence of $\overline{F} = xi - xz\, j + z\, k$
Option A:	0
Option B:	2
Option C:	-2y

Option D:	$2x$
6.	For the Fourier series of $f(x) = x^2 - x^4$ in the interval$(-2, 2)$, find b_n
Option A:	-2π
Option B:	π
Option C:	2π
Option D:	0
7.	Find the inverse Laplace transform for $\frac{s+8}{s^2+6s+25}$
Option A:	$e^{-3t}(cos\,4\,t + sin4t)$
Option B:	$e^{-3t}\left(cos\,4\,t - \frac{5}{4}\,sin4t\right)$
Option C:	$e^{-3t}\left(cos\,4\,t + \frac{5}{4}\,sin4t\right)$
Option D:	$e^{-3t}\left(sin\,4\,t + \frac{5}{4}\,cos4t\right)$
8.	Using Cayley - Hamilton theorem find inverse of *A* if the characteristic polynomial is $\lambda^3 + 7\lambda^2 - 18\lambda + 4 = 0$
Option A:	$A^{-1} = \frac{1}{4}[A^2 + 7A - 18I]$
Option B:	$A^{-1} = -\frac{1}{4}[A^2 + 7A + 18I]$
Option C:	$A^{-1} = -\frac{1}{4}[A^2 - 7A - 18I]$
Option D:	$A^{-1} = -\frac{1}{4}[A^2 + 7A - 18I]$
9.	Find the Laplace transform of $\frac{d}{dt}\left(\frac{\sin 3t}{t}\right)$
Option A:	$s\cot^{-1}\left(\frac{s}{3}\right) - 3$
Option B:	$s\cot^{-1}\left(\frac{s}{3}\right) - 1$
Option C:	$s\cot^{-1}(s) - 1$
Option D:	$s\cot^{-1}(s) - 3$
10.	Find the curl of the vector function $\overline{F} = (x^2 + yz)i - (y^2 + zx)j - (z^2 + xy)k$
Option A:	$\nabla \times \overline{F} = i + 2yj - 2zk$
Option B:	$\nabla \times \overline{F} = 2yj - 2zk$
Option C:	$\nabla \times \overline{F} = 2xi + 2yj - 2zk$
Option D:	$\nabla \times \overline{F} = 2xi + 2yj + 2zk$

11.	Laplace Transform of $\{e^{2t} + 4t^3 - 2sin3t + 3cos3t\}$ is
Option A:	$\frac{1}{s-2} + \frac{6}{s^4} + \frac{3s-2}{s^2+9}$
Option B:	$\frac{1}{s-2} + \frac{6}{s^3} + \frac{-2+3s}{s^2+9}$
Option C:	$\frac{1}{s-2} + \frac{24}{s^4} + \frac{s-2}{s^2+9}$
Option D:	$\frac{1}{s-2} + \frac{24}{s^4} + \frac{3(s-2)}{s^2+9}$
12.	If $L\{f(t)\} = \frac{s-3}{(s^2-6s+25)^2}$, then $L\{f(2t)\}$ is
Option A:	$\frac{4(s-6)}{(s^2-12s+100)^2}$
Option B:	$\frac{s-6}{(s^2-6s+100)^2}$
Option C:	$\frac{2(s-3)}{(s^2-12s+100)^2}$
Option D:	$\frac{4(s-3)}{(s^2-12s+100)^2}$
13.	Inverse Laplace Transform of $\frac{s}{4s^2-25}$ is
Option A:	$\frac{1}{4}cosh\frac{5}{2}$t
Option B:	$cosh\frac{5}{2}$t
Option C:	$\frac{1}{4}sinh\frac{5}{2}$t
Option D:	$sinh\frac{5}{2}$t
14.	Inverse Laplace Transform of $log\left(\frac{s^2+1}{s^2}\right)$ is
Option A:	$\frac{2}{t}(1+cost)$
Option B:	$\frac{2}{t}(1-sint)$
Option C:	$\frac{2}{t}(1-cost)$
Option D:	$\frac{2}{t}(1+sint)$
15.	If $f(z) = x^2 - y^2 + i2xy$ find $f^1(z)$
Option A:	z
Option B:	2z
Option C:	$2z^2$
Option D:	z^2
16.	The value of m so that $2x - x^2 + my^2$ may be harmonic

Option A:	0
Option B:	1
Option C:	2
Option D:	3
17.	The matrix $A = \begin{bmatrix} 1 & 0 \\ 2 & 4 \end{bmatrix}$ is given. Find the eigenvalues of $4A^{-1} + 3A + 2I$
Option A:	9, 15
Option B:	6, 15
Option C:	9, 12
Option D:	7, 15
18.	The matrix $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 1 & 2 & p \end{bmatrix}$ has one eigenvalue equal to 3. The sum of the other two eigen values is
Option A:	p
Option B:	$p-1$
Option C:	$p-2$
Option D:	$p-3$
19.	The Fourier series to represent x^2 for $0 \leq x \leq 2\pi$ $is\ given\ by$ $x^2 = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n\, cosnx + \sum_{n=1}^{\infty} b_n\, sinnx$. The value of a_0 is
Option A:	$\frac{4\pi^2}{3}$
Option B:	$\frac{2\pi^3}{3}$
Option C:	$\frac{\pi^2}{3}$
Option D:	$\frac{8\pi^2}{3}$
20.	The value of $\boldsymbol{\lambda}$ so that the vector $\vec{u} = (x+3y)\hat{\imath} + (y-2z)\hat{\jmath} + (x+\boldsymbol{\lambda}z)\hat{k}$ is solenoidal vector is
Option A:	-2
Option B:	3
Option C:	1
Option D:	2
21.	L$[e^{-t}.sin3t]$=?
Option A:	$\frac{3}{s^2-2s+10}$
Option B:	$\frac{3}{s^2+2s+10}$
Option C:	$\frac{s}{s^2-2s+10}$
Option D:	$\frac{s}{s^2+2s+10}$
22.	$L\left[t^{3/2}+1\right]$ =?
Option A:	$\frac{\sqrt{\pi}}{2s^{5/2}} + \frac{1}{s}$
Option B:	$\frac{3\sqrt{\pi}}{2s^{5/2}} + \frac{1}{s}$

Option C:	$\frac{3\sqrt{\pi}}{4s^{5/2}} + \frac{1}{s}$
Option D:	$\frac{\sqrt{\pi}}{4s^{5/2}} + \frac{1}{s}$
23.	Find $L^{-1}\left[\frac{s-1}{s^2-2s+2}\right]$
Option A:	e^t
Option B:	$e^{-t}sint$
Option C:	$e^t sint$
Option D:	$e^t cost$
24.	Find $L^{-1}\left(\frac{1}{s(s^2+1)}\right)$
Option A:	$1 - sint$
Option B:	$1 + \cos t$
Option C:	$1 - cost$
Option D:	$1 + sint$
25.	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:	$\frac{1}{n^2-1}$
26.	In Fourier series expansion for $f(x) = x + cosx$ in $(0,2\pi)$, the value of a_0 is
Option A:	π
Option B:	-2π
Option C:	2π
Option D:	0
27.	The Cauchy-Riemann equation is
Option A:	$u_x = -v_y$ and $u_y = v_x$
Option B:	$u_x = v_y$ and $u_y = v_x$
Option C:	$u_x = v_y$ and $u_y = -v_x$
Option D:	$u_x = -v_x$ and $u_x = -v_x$
28.	If A = $\begin{bmatrix} 1 & 0 & 0 \\ 3 & -1 & 0 \\ -5 & 0 & 2 \end{bmatrix}$ Find Eigen Values of $A^2 - 2A^{-1} + I$
Option A:	4,4,4
Option B:	0,4,4
Option C:	1,4,4
Option D:	0,4,3

29.	The characteristic equation of the matrix $\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ is
Option A:	$(x-1)(x-2)(x+2)=0$
Option B:	$(x+2)(x+2)(x+1)=0$
Option C:	$(x-2)(x-2)(x-1)=0$
Option D:	$(x-1)(x-1)(x-2)=0$
30.	If $\bar{F}=(x+2y+az)\bar{i}+(bx-3y-z)\bar{j}+(4x+cy+2z)\bar{k}$ is irrotational then
Option A:	$a=-4, b=2, c=-1$
Option B:	$a=4, b=2, c=1$
Option C:	$a=4, b=2, c=-1$
Option D:	$a=-4, b=-2, c=-1$

	Subjective Questions
1	Find the Laplace transform of $f'(t)$, where $f(t)=t, 0\leq t\ \leq 4, f(t)=5, t>4$.
2	Find the inverse Laplace transform of $\frac{(s+7)^2}{(s^2+14s+53)^2}$ using convolution theorem.
3	Find the half range cosine series of $f(x)=\frac{1}{2}(\pi-x)sinx$ in $(0,\ \pi)$.
4	Find the harmonic conjugate function *v* where $u=\ x^2-\ y^2-2xy-2x+3y$. Also prove that *u* is harmonic.
5	Find 7^A, if $A=\begin{bmatrix}3 & 1\\ 1 & 3\end{bmatrix}$
6	Find the values of $a, b\ c$ such that $\bar{F}=\ (axy+bz^3)\ i+\ (3x^2-cz)\ j+\ (3xz^2-y)\ k$ is irrotational.
7	Find the Laplace transform of $e^{-3t}\ cosh5t\ sin4t$
8	Using the convolution theorem, Find $L^{-1}\left(\frac{1}{(s^2+9)^2}\right)$.
9	Find the Fourier series of $\boldsymbol{f(x)=\frac{\pi^2}{12}-\frac{x^2}{4}}$ in the interval $(-\pi,\pi)$
10	Find the constants a,b,c,d and e if the function $f(z)=(ax^4+bx^2y^2+cy^4+dx^2-2y^2)+i(4x^3y-exy^3+4xy)$ is analytic.

11	Show that the matrix A=$\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ is diagonalisable
12	Show that $\overrightarrow{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ is a conservative force. Find the work done by the force $\overrightarrow{F}$ on the particle from (1,1,0) to (2,0,1) .
13	Evaluate $\int_0^\infty \frac{\cos 4t - \cos 3t}{t}\, dt$ by using Laplace transform.
14	Find $L^{-1}\left[\frac{s-1}{s^2+4s+29}\right]$
15	Find the Fourier Series for $f(x) = 4 - x^2$, in (-4, 4)
16	Show that the matrix A=$\begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ is diagonalisable
17	Find the orthogonal trajectory of the family of curves given by $e^x \cos y - xy = c$.
18	Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both irrotational and solenoidal.
19	Find the Laplace transform of $t\sqrt{1 + sin4t}$.
20	Find the inverse Laplace transform of $\frac{s^2}{(s^2 - 36)^2}$
21	Find the half range sine series for $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \end{cases}$
22	Find the orthogonal trajectories for the curve $e^x cosy - xy = c$.
23	If A=$\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$, by using Cayley-Hamilton theorem find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 + 2A + I$.
24	Using Green's theorem to evaluate $\oint (x^2 + xy)dx + (x^2 + y^2)dy$ around the boundary of the square formed by the line $x = \pm 2,\ y = \pm 2$.
25	Find the Laplace transform of $e^{-4t} \int_0^t u\ sin3u\ du$
26	Obtain the inverse Laplace transform of $\frac{78}{s^3\,(s-3)}$
27	Find the half - range cosine series of the function $f(x) = -\frac{x}{l} + 1$,$0 \le x \le l$,
28	Construct an analytic function whose imaginary part is $e^{2x}(xcos2y - ysin2y)$.

29	Verify Cayley – Hamilton theorem for the matrix A=$\begin{bmatrix}1 & 2 & -2\\ 1 & 1 & 1\\ 1 & 3 & -1\end{bmatrix}$
30	Find the directional derivative of the scalar function $\emptyset(x,y,z) = xy + zy + zx$ at the point $(1,2,3)$ in the direction of $3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$.
31	Find $L[e^{-4t}\int_0^t u\ sin3u\ du]$
32	Find the inverse Laplace transform of $\frac{s}{(s^2+1)(s^2+4)}$ by using convolution
33	Find the Fourier series expansion of $f(x) = x^2,\ -1 < x < 1$.
34	Verify Cayley – Hamilton theorem for the matrix A=$\begin{bmatrix}1 & 2 & -2\\ 1 & 1 & 1\\ 1 & 3 & -1\end{bmatrix}$ and find A^{-1}
35	Find the analytic function f(z)=u+iv in terms of z where u=$x^2 - y^2 - 2xy + 2x - 3y$
36	Evaluate by using Stoke's theorem $\int_C \bar{F}.\overline{dr}$ where $\bar{F} = x^2 i + xy\, j$ and C is the boundary of the rectangle x=0,y=0, x=1, y=1
37	Evaluate $\int_0^\infty \frac{\cos 8t\ -\ cos11t}{t}\ dt$ by using Laplace transform.
38	Find the inverse Laplace transform of $log\left[\frac{s^2\ -\ 9}{s(s\ +7\ )}\right]$
39	Find the Fourier series for the function $f(x) = \begin{cases} 0, & -7 < x < 0 \\ 5, & 0 < x < 7 \end{cases}$
40	Find the analytic function $f(z) = u + iv$ where $u + v = \frac{x}{x^2+y^2}$.
41	Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix}1 & 2 & 3\\ 0 & -1 & 1\\ 0 & 0 & 2\end{bmatrix}$.
42	Evaluate $\int_A^B (3x^2y - 2xy)dx + (x^3 - x^2)\,dy$ along $y^2 = x^3$ from A$(0,0)$ and B$(2,\ 4)$.
43	Find the Laplace transform of f(t) where $f(t) = \begin{cases} \frac{t}{k}, & 0 < t < k \\ 1, & t > k \end{cases}$
44	Find $L^{-1}\left(\frac{s^2}{(s^2+5)(s^2+4)}\right)$
45	Obtain the Fourier series for the function $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi}, & 0 \le x \le \pi \end{cases}$
46	If $u = x^2 - y^2$, $v = \frac{-y}{x^2+y^2}$ Show that both u and v are harmonic functions.
47	If A=$\begin{bmatrix}\frac{\pi}{2} & \pi\\ 0 & \frac{3\pi}{2}\end{bmatrix}$, find sinA
48	Using Green s theorem evaluate $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square bounded by the lines $x = 0, x = 1, y = 0\ and\ y = 1$.
49	Find L[e^{-t}cos2tcost]
50	Find the inverse Laplace transform of $\frac{1}{(s+1)(s-5)(s+2)}$
51	Find the half range cosine series of $f(x) = \frac{1}{2}(\pi - x)sinx$ in $(0,\ \pi)$.

52	If $A = \begin{bmatrix} \pi & \frac{\pi}{4} \\ 0 & \frac{\pi}{2} \end{bmatrix}$, find $\cos A$.
53	Find the directional derivative of the scalar function $\emptyset(x, y, z) = xy + zy + \mathrm{zx}$ at the point $(1,2,3)$ in the direction of $3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$.
54	Evaluate by using Green's theorem $\int_C (\mathrm{x}^2 - \mathrm{y})\mathrm{dx} + (2\mathrm{y}^2 + \mathrm{x})\mathrm{dy}$, where C is the closed region bounded by $\mathrm{y} = 4$ and $\mathrm{y} = \mathrm{x}^2$.