University of Mumbai (Question Bank)
Examination First Half 2022

Program: BE Electronics and Telecommunication Engineering
Curriculum Scheme: Rev2016
Examination: SE Semester III
Course Code: ECC301and Course Name: Applied Mathematics-III

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Q1.	
1.	If $L[f(t)]=\frac{2}{s^3}e^{-s}$ then $L[f(2t)]=----$
Option A:	$-\frac{8}{s^3}e^{-\frac{s}{2}}$
Option B:	$\frac{4}{s^3}e^{-\frac{s}{2}}$
Option C:	$\frac{8}{s^3}e^{-\frac{s}{2}}$
Option D:	$\frac{8}{s^3}e^{\frac{s}{2}}$
2.	$\nabla \bullet \frac{\bar{r}}{r^n}=----$
Option A:	$\frac{(3+n)}{r^n}$
Option B:	$\frac{(3-n)}{r}$
Option C:	$\frac{(4-n)}{r^n}$
Option D:	$\frac{(3-n)}{r^n}$
3.	According to Stoke's theorem
Option A:	$\oint_c \bar{F}\bullet d\bar{r}=\iint_s \nabla\bullet\bar{F}\times\hat{n}\,ds$
Option B:	$\oint_c \bar{F}\bullet d\bar{r}=\iint_s \nabla\times\bar{F}\bullet\hat{n}\,ds$
Option C:	$\oint_c \bar{F}\bullet d\bar{r}=\iint_s \nabla\times\bar{F}\,ds$
Option D:	$\oint_c \bar{F}\bullet d\bar{r}=-\iint_s \nabla\times\bar{F}\bullet\hat{n}\,ds$
4.	If f(x) is an odd function in $(-\pi,\pi)$, then

Option A:	$a_0 = 0, a_n = 0$
Option B:	$a_0 = 0, b_n = 0$
Option C:	$a_0 = 0, a_n \neq 0$
Option D:	$a_0 \neq 0, a_n = 0$
5.	The Laplace transform of $\sin^3 t$
Option A:	$\frac{1}{4}[\frac{1}{(s^2+1)} - \frac{1}{(s^2+9)}]$
Option B:	$\frac{3}{4}[\frac{1}{(s^2+1)} + \frac{1}{(s^2+9)}]$
Option C:	$\frac{3}{4}[\frac{1}{(s^2+1)} - \frac{1}{(s^2+9)}]$
Option D:	$[\frac{1}{(s^2+1)} - \frac{1}{(s^2+9)}]$
6.	Which of the following is a Bessel's differential equation?
Option A:	$x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + (x^2 - n^2)y = 0$
Option B:	$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 + n^2)y = 0$
Option C:	$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$
Option D:	$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + n^2 y = 0$
7.	If $f(z) = r^2 \cos 2\theta + ir^2 \sin p\theta$ is an analytic then value of p is
Option A:	5
Option B:	-2
Option C:	4
Option D:	2
8.	The inverse Laplace transform of $\frac{(s+1)}{(s+1)^2+9}$
Option A:	$e^{-t}\cos 3t$
Option B:	$-e^{-t}\cos 3t$
Option C:	$e^{-t}\cos 9t$
Option D:	$e^{t}\cos 3t$
9.	The value of a_0 in the Fourier series of $f(x) = \|\sin x\|$ in $(-\pi, \pi)$
Option A:	$-\frac{2}{\pi}$
Option B:	$\frac{2}{\pi}$

Option C:	$\frac{4}{\pi}$
Option D:	$\frac{2}{\pi^2}$
10.	$L^{-1}(\cot^{-1} s) = ----$
Option A:	$-\frac{\sin t}{t}$
Option B:	$\frac{\cos t}{t}$
Option C:	$\frac{\sin t}{t^2}$
Option D:	$\frac{\sin t}{t}$
11.	$L\{sinh4t\} =$..................
A:	$\frac{s}{s^2 - 4^2}$
B:	$\frac{s}{s^2 + 4^2}$
C:	$\frac{4}{s^2 + 4^2}$
D:	$\frac{4}{s^2 - 4^2}$
12.	Which of the following function is not analytic
Option A:	z^3
Option B:	Coshz
Option C:	$z\|z\|$
Option D:	e^z
13.	$sin^{-1}x$ Cannot be expressed as a Fourier series because
Option A:	it is even
Option B:	it is not a single valued
Option C:	it is periodic
Option D:	it has finite discontinuities
14.	The value of constant m such that $\bar{F} = (x + 3y)\bar{i} + (y - 2z)\bar{j} + (x + mz)\bar{k}$ is

	solenoidal is
Option A:	3
Option B:	4
Option C:	6
Option D:	-2
15.	If $L\{f(t)\} = \varphi(s)$ then $L\{f(2t)\} =$.................
Option A:	$\frac{1}{2}\emptyset\left(\frac{s}{2}\right)$
Option B:	$\frac{1}{s}\emptyset\left(\frac{2}{e}\right)$
Option C:	$\frac{1}{2a}\emptyset\left(\frac{t}{2}\right)$
Option D:	$\frac{1}{t}\emptyset\left(\frac{s}{2}\right)$
16.	Which of the following is a Bessel's differential equation?
Option A:	$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$
Option B:	$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 + n^2)y = 0$
Option C:	$x^2\frac{d^2y}{dx^2} + (x^2 + n^2)y = 0$
Option D:	$\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 + n^2)y = 0$
17.	The Inverse Laplace transform of $\emptyset(s) = \frac{s}{(s+2)^2+1}$
Option A:	$2e^{-2t}\cos t + e^{-2t}\sin t$
Option B:	$e^{-2t}\cos t + 2e^{-2t}\sin t$
Option C:	$2e^{-2t}\cos t - e^{-2t}\sin t$
Option D:	$e^{-2t}\cos t - 2e^{-2t}\sin t$
18.	In Parseval's relation of Half range Fourier cosine series expansion, which of the following terms doesn't appear?
Option A:	a_0
Option B:	a_n
Option C:	b_n

Option D:	All terms appear
19.	Half range cosine series of f(x) in $(-l, l)$ is f(x) = ……
Option A:	$a_0 + \sum a_n \cos(\frac{n\pi x}{l})$
Option B:	$\sum a_n \cos(\frac{n\pi x}{l})$
Option C:	$a_0 + \sum a_n \sin(\frac{n\pi x}{l})$
Option D:	$a_0 + \sum a_n \cos n\pi x$
20	The maximum value of the directional derivative of the function $\phi = 2x^2 + 3y^2 + 5z^2$, at $(1,1,-1)$
Option A:	5
Option B:	152
Option C:	√152
Option D:	-10
Q2	
1	Evaluate by Stoke's theorem $\int(xydx + xy^2dy)$ over c where c is the square in the xy-plane with vertices (1,0) , (0,1), (-1,0), and (0,-1)
2	Show that the functions $f_1(x) = 1$, and $f_2(x) = x$ are orthogonal in the interval (-1,1) and determine the constants a and b so that the function $f_3(x) = 1 + ax + bx^2$ is orthogonal to both $f_1(x)$ and $f_2(x)$ in that interval.
3	Find the directional derivative of $\phi = xy + yz + xz$ at the point $(1,2,0)$ in the direction of vector $\bar{u} = \bar{\imath} + 2\bar{\jmath} + 2\bar{k}$
4	Find Laplace Transform of $e^{-2t} cosh5tsin4t$
5	Obtain the complex form of fourier series for f(x) = cosax in (-π , π)
6	Find the orthogonal trajectory of family of the curves $(x^3y - xy^3) = c$

7	Find the Laplace transform of $\cos^4 t$
8	Find $\phi(r)$ such that $\nabla\phi = \frac{\bar{r}}{r^5}$ and $\phi(1) = 0$
9	Determine constants a, b, c so that the vector $F = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$ is conservative. Also, find scalar potential ϕ.
10	If $f(z) = u + iv$ is an analytic function of $z = x + iy$ and $u+v=\cos x \cdot \cosh y - \sin x \cdot \sinh y$, find $f(z)$ in terms of z .
11	Using Laplace transform , solve the following differential equation $\left(D^2 + 2D + 5\right)y = e^{-t}\sin t$ where $D = \frac{d}{dt}$ and $y(0) = 0,\ y'(0) = 1$
12	Obtain Fourier series for, $f(x) = -\pi,\ -\pi < x < 0$ $= x,\ 0 < x < \pi$
13	Obtain the expansion of $f(x) = x(\pi - x)$ for $0 < x < \pi$ as a half range cosine series.
14	Evaluate $\int_c \bar{F} \cdot d\bar{r}$ along the arc of the curve from the point (1, 0) to $(e^{2\pi}, 0)$ where $\bar{F} = \frac{x\hat{i} + y\hat{j}}{\left(x^2 + y^2\right)^{3/2}}$ and the vector equation of the curve is $\bar{r} = e^t \cos t\ \hat{i} + e^t \sin t\ \hat{j}$.
15	Find the Laplace transform of $\int_0^t e^{-2u} u^3\, du$
16	If $f(z)$ is an analytic function of z, then prove that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right]\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$
17	Find directional derivative of $\phi = x^4 + y^4 + z^4$ at the point $A(1, -2, 1)$ in the direction of line AB where $B = (2, 6, -1)$.
18	Using convolution theorem find $L^{-1}\left[\frac{1}{\left(s^2 + 4s + 13\right)^2}\right]$
19	Find $L^{-1}\left[\frac{(s+2)}{\left(s^2 - 4s + 7\right)}\right]$
20	Find the value of 'n' for which the vector $r^n\bar{r}$ is solenoidal, where $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$.
21	Show that the map of the real axis of the z-plane on the w-plane

	by the transformation $W = \frac{1}{(z+i)}$ is a circle. Find its radius and centre.
22	Evaluate $\oint_C \left[\left(x^2+2y\right)dx + \left(4x+y^2\right)dy\right]$ by Green's theorem where C is the boundary of the region bounded by $y = 0$, $y = 2x$ and $x + y = 3$.
23	Evaluate $\int_0^\infty \frac{(\cos 6t - \cos 4t)}{t} dt$
24	Express the function $f(x) = 1, \ \lvert x\rvert \le 1$ $= 0, \ \lvert x\rvert > 1$ as a Fourier integral and hence evaluate $\int_0^\infty \frac{\sin\omega \cos\omega x}{\omega} d\omega$
25	Evaluate by Stoke's theorem $\int(xydx + xy^2dy)$ over c where c is the square in the xy-plane with vertices (1,0) , (0,1), (-1,0), and (0,-1)
26	Show that the functions$f_1(x) = 1$, and $f_2(x) = x$ are orthogonal in the interval (-1,1) and determine the constants a and b so that the function $f_3(x) = 1 + ax + bx^2$ is orthogonal to both $f_1(x)$ and $f_2(x)$ in that interval.
27	Find the directional derivative of $\phi = xy + yz + xz$ at the point (1,2,0) in the direction of vector $\bar{u} = \bar{\imath} + 2\bar{\jmath} + 2\bar{k}$
28	Find Laplace Transform of $e^{-2t}cosh5tsin4t$
29	Obtain the complex form of fourier series for f(x) = cosax in (-π , π)
30	Find the orthogonal trajectory of family of the curves $(x^3y - xy^3) = c$
31	Evaluate using Green's theorem $\oint(x^2y)\,dx + (y^3)dy$ over C , where C is closed path formed by $y = x, y = x^2$
32	Find the Laplace transform of $f(t) = t$,0<t<1 =0, 1<t<2 ,if $f(t) = f(t+T)$
33	Find Fourier expansion of $f(x) = x^3, -\pi \le x \le \pi$.
34	Find work done in moving a partical in the force field $\bar{F} = (3x^2)\bar{\imath} + (2xz - y)\bar{\jmath} + z\bar{k}$ along the curve $x^2 = 4y$ and $3x^3 = 8z$ from x=0 to x=2.
35	Find the half range sine series for $f(x) = lx - x^2$ in $(0, l)$ and

	deduce that $\frac{\pi^3}{32} = 1 - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \cdots$
36	Using Convolution theorem find Inverse Laplace Transform of $\frac{1}{(s-2)^3(s+3)}$
37	Find Inverse Laplace transform of $\frac{2s+2}{s^2+2s+10}$
38	Obtain Fourier series expansion of $f(x) = 2x - x^2$ in $0 \leq x \leq 3$ whose period is 3.
39	Evaluate using Gauss Divergence theorem $\iint (lx + my + nz)\, ds$ where l, m, n are the direction cosines of the outer normal to the surface whose radius is 2.
40	Evaluate $\int_0^\infty e^{-2t} t^2 sin3tdt$
41	Find the Generating function for $J_n(x)$.
42	Find the image of the circle $(x-3)^2 + y^2 = 2$ under the transformation 1/z.