SAMPLE QUESTION BANK

Program: BE (Electronics Engineering)

Curriculum Scheme: Rev2016

Examination: SE Semester III

Course Code: ELX301 and Course Name: APPLIED MATHEMATICS-III

Time: 2 hour 30 minutes Max. Marks: 80

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Q1.	**MCQs**
1.	$L[e^{-2t} - sin5t]$ is
Option A:	$\frac{1}{s-2} - \frac{s}{s^2+25}$
Option B:	$\frac{1}{s+2} - \frac{s}{s^2+25}$
Option C:	$\frac{1}{s+2} - \frac{5}{s^2+25}$
Option D:	$\frac{1}{s-2} - \frac{5}{s^2+25}$
2.	Inverse L.T. of $\frac{1}{s(s^2+1)}$ is
Option A:	$cost - 1$
Option B:	$sint$
Option C:	$cost$
Option D:	$1 - cost$
3.	In the Fourier series of $f(x) = \begin{cases} sinx, & 0 \le x \le \pi \\ 0, & \pi \le x \le 2\pi \end{cases}$ Value of the Fourier Coefficient a_1 is
Option A:	$\frac{1}{2}$
Option B:	$\frac{1}{2\pi}$
Option C:	$\frac{1}{\pi}$
Option D:	0
4.	$u = e^{bx}\cos(5y)$ is harmonic, then value of b is
Option A:	25
Option B:	± 5
Option C:	± 1
Option D:	$\pm\sqrt{5}$
5.	Find the value of a if $\bar{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ is solenoidal
Option A:	$a = 2$
Option B:	$a = -2$
Option C:	$a = -4$
Option D:	$a = 4$
6.	Using Stoke's theorem value of integral $\int_C [(2x - y)i + yz^2j - y^2zk).d\bar{r}$

	where C encloses the area bounded by $x^2 + y^2 + z^2 = 1$ and z=0 is
Option A:	$-\pi$
Option B:	$\frac{\pi}{4}$
Option C:	$\frac{\pi}{2}$
Option D:	π
7.	[I] $sin\left(\frac{\pi x}{3}\right)$ and $sin\left(\frac{5\pi x}{3}\right)$ $are\ orthogonal\ in$ (0,3) II] cos$\left(\frac{\pi x}{3}\right)$ and $sin\left(\frac{5\pi x}{3}\right)$ $are\ orthogonal\ in$ (0,3)
Option A:	$only\ I\ is\ correct$
Option B:	$Only\ II\ is\ correct$
Option C:	Both I and II are not correct
Option D:	$Both\ I\ and\ II\ are\ correct$
8.	$\frac{J_{\frac{1}{2}}(x)}{J_{-\frac{1}{2}}(x)}$ = p then p is
Option A:	sinx
Option B:	cosx
Option C:	tanx
Option D:	cotx
9.	Which of the following function cannot be the real or imaginary part of any analytic function of z?
Option A:	$3x^2y + 6xy - y^3$
Option B:	$3x^2y + 6xy + y^3$
Option C:	$x^3+3x^2 - 3y^2 - 3y^2x + 2$
Option D:	$x^2 - 2xy - y^2 - 2x + 3y$
10.	Value of $\int_0^\infty e^{-4t}t^2 cosh2tdt$ dt
Option A:	$\frac{7}{52}$
Option B:	$\frac{5}{54}$
Option C:	$\frac{7}{54}$
Option D:	$\frac{7}{44}$
11.	Find the Laplace transform of te^{at}
Option A:	$\frac{1}{s+a}$
Option B:	$\frac{s}{(s-a)^2}$
Option C:	$\frac{1}{(s-a)^2}$
Option D:	$\frac{a}{s^2-a^2}$
12.	Evaluate $L^{-1}\left[tan^{-1}\left(\frac{a}{s}\right)\right]$

Option A:	$\frac{1}{t}sinat$
Option B:	$\frac{a}{t}sinat$
Option C:	$\frac{1}{t}sint$
Option D:	$sinat$
13.	The value of the integral $\int_0^\infty e^{-3t}(tcost)dt$ is
Option A:	$\frac{2}{5}$
Option B:	$\frac{2}{25}$
Option C:	$\frac{5}{2}$
Option D:	$\frac{25}{2}$
14.	If the Fourier series of $f(x) = x^2$ for $-\pi \le x \le \pi$ is $f(x) = x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}\left[\frac{(-1)^n}{n^2}\right]cosnx$, then the value of $\sum_{n=1}^{\infty}\left[\frac{1}{n^2}\right]$ is
Option A:	$\frac{\pi^2}{2}$
Option B:	$\frac{\pi^2}{8}$
Option C:	$\frac{\pi^2}{6}$
Option D:	$\frac{\pi^2}{3}$
15.	Find Fourier coefficient b_1 for the function $f(x) = xsinx$ in the interval $(0, 2\pi)$
Option A:	$-\pi$
Option B:	π
Option C:	0
Option D:	-2π
16.	If $\vec{a} = 3\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$, $\vec{b} = 6\hat{\imath} + 4\hat{\jmath} - 2\hat{k}$, $\vec{c} = 3\hat{\imath} + 2\hat{\jmath} + 4\hat{k}$ Find $\vec{a} \times (\vec{b} \times \vec{c})$.
Option A:	$10(6\hat{\imath} + 4\hat{\jmath} + 5\hat{k})$
Option B:	$20(6\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$
Option C:	$10(6\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$
Option D:	$20(6\hat{\imath} + 4\hat{\jmath} + 5\hat{k})$
17.	By Green's theorem, what is the area bounded by a simple closed curve *C* that resides in the *xy*-plane?
Option A:	$\frac{1}{2}\int(xdy - ydx)$
Option B:	$\frac{1}{2}\int(xdy + ydx)$
Option C:	$\int(xdy - ydx)$
Option D:	$\int(xdy + ydx)$
18.	When *n* is an integer, what is the value of $J_{-n}(x)$?
Option A:	$J_n(x)$
Option B:	$(-1)^n J_n(x)$

Option C:	$(-1)^n J_{-n}(x)$
Option D:	$J_{-n}(x)$
19.	Find the bilinear transformation which maps the points $z = 0, 1, \infty$ onto the points w = -5, -1, 3.
Option A:	$\frac{1-z}{z+2}$
Option B:	$\frac{3z+5}{z-1}$
Option C:	$\frac{1-2z}{z+4}$
Option D:	$\frac{3z-5}{z+1}$
20.	What are C.R. equations in polar coordinates?
Option A:	$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial u}{\partial \theta} = r\frac{\partial v}{\partial r}$
Option B:	$\frac{\partial u}{\partial r} = -\frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial u}{\partial \theta} = r\frac{\partial v}{\partial r}$
Option C:	$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial u}{\partial \theta} = -r\frac{\partial v}{\partial r}$
Option D:	$\frac{\partial u}{\partial r} = -\frac{1}{r}\frac{\partial v}{\partial \theta}$, $\frac{\partial u}{\partial \theta} = \frac{\partial v}{\partial r}$

Q2	**Descriptive Questions**
1	Using L.T. Solve the D.E. $y''(t) + 3y'(t) + 2y(t) = t \; ; y(0) = 1, \; y'(0) = -1$
2	Using Green's theorem evaluate $\int_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by $y = \sqrt{x}, y = x^2$
3	Find the Bilinear Transformation which maps $z = 0, 1, \infty$ *onto the points* $w = -5, -1, 3$ respectively.
4	Find the Fourier series of $f(x) = \begin{cases} -sin\pi x, & -1 < x < 0 \\ sin\pi x, & 1 \geq x \geq 0 \end{cases}$
5	Find the Laplace transform of $f(t) = \begin{cases} t^2 - t, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases}$
6	Prove that $[\sqrt{x}\, J_{\frac{1}{2}}(x)]^2 + [\sqrt{x}\, J_{\frac{-1}{2}}(x)]^2 = \frac{2}{\pi}$
7	Find the Laplace transform of $tcos^2 t$
8	Find the inverse Laplace transform of $L^{-1}\left[\frac{3s+7}{s^2-2s-3}\right]$
9	Find the Fourier expansion of $f(x) = \lvert x \rvert$ in the interval $(-2 \leq x \leq 2)$.
10	Find the directional derivative of $\emptyset = x^2 ycosz$ at $(1, 2, \frac{\pi}{2})$ in the direction of $(2i+3j+2k)$.
11	Using Green's theorem evaluate $\int_c \vec{F}.\overrightarrow{dr}$, where c is the curve enclosing the region bounded by $y^2 = 4ax, x = a$ in the plane $z = 0$ and $\vec{F} = (2x^2y + 3z^2)\hat{\imath} + (x^2 + 4yz)\hat{\jmath} + (2y^2 + 6xz)\hat{k}$
12	Determine the constants a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + y^2)$ is analytic.

13	Using convolution theorem find inverse Laplace transform of $\frac{s^2}{(s^2+25)^2}$
14	Find the analytic function $f(z)=u+iv$ in terms of z whose real part is $u=r^2cos2\theta - rsin\theta$
15	If S is any closed surface enclosing a volume V and $\vec{F} = 2xi + 3yj + zk$,then using Gauss Divergent theorem evaluate $\iint_S \vec{F}.\hat{n}ds$
16	Find a and b such that $\vec{F} = (axy + z^3)i + x^2j + bz^2xk$ is irrotational. Also find the work done in moving a particle under this force field(conservative) from $(1,-2,1)$ to $(3,1,4)$
17	Find Laplace transform $L[\frac{sintsinh2t}{t}]$
18	Is the set of functions $\left\{e^{-\frac{x}{2}} \ , \ e^{-\frac{x}{2}}(1-x) \ , \ \frac{1}{2}e^{-\frac{x}{2}}(x^2-4x+2)\right\}$ orthogonal over $(0,\infty)$.Justify your answer
19	If $L\,f(t) = \frac{s}{s^2+s+4}$, find $L\,[e^{-3t}f(2t)]$.
20	Find inverse Laplace transform by using convolution theorem $\frac{1}{(s-2)^4(s+3)}$.
21	Obtain the complex form of Fourier series for $f(x) = e^{ax}$ in $(0,\ a)$.
22	Prove that $\nabla f(r) = f'(r)\frac{\vec{r}}{r}$ and hence, find $f(r)$ if $\nabla f(r) = 2r^4\vec{r}$.
23	Use Gauss's divergence theorem to evaluate $\iint \overline{N}.\,\overline{F}\ ds$ over a surface S; where $\vec{F} = x^2\hat{\imath} + z\hat{\jmath} + yz\hat{k}$ and the surface S of the cube is bounded by $x = 0, x = 1;\ y = 0, y = 1;\ z = 0, z = 1.$
24	Prove that $\int x^4 J_1(x)dx = x^4J_2(x) - 2x^3J_3(x).$
25	Find L.T. of the following function $te^{-4t}sin3t$
26	Find the inverse Laplace Transform of the following functions $cot^{-1}(s+1)$
27	Find the Fourier series of $f(x) = \begin{cases} -1, & -\pi < x < 0 \\ 1 \ , & 0 < x < \pi \end{cases}$ Hence deduce: $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots \ldots = \frac{\pi}{4}$
28	Given:The imaginary part $v(x,y) = tan^{-1}\left(\frac{y}{x}\right)$, construct the analytic function $f(z) = u+iv$ in terms of z.
29	Evaluate by Green's theorem for the field $\vec{F} = x^2\hat{i} + xy\hat{j}$ over the region R enclosed by $y=x^2$ and line $y=x$
30	Prove that $J_{(3/2)}(x) = \sqrt{\frac{2}{\pi x}}\ .(\frac{sinx}{x} - cosx)$
31	Find Laplace transform of $\int_0^t ucos^2udu.$
32	Solve by using Laplace transform. $\frac{d^2y}{dt^2} + y = t,\ \text{with}\ y(0) = 1,\ y'(0) = 0$
33	Obtain half-range sine series in $(0,\ \pi)$ for $x(\pi - x)$.
34	Prove that the vector field $\vec{F} = (y^2cosx + z^3)\hat{\imath} + (2ysinx - 4)\hat{\jmath} + (3xz^2 + 2)\hat{k}$ is irrotational.

	Also find the scalar potential for $\vec{F}$.
35	Find the total work done in moving a particle in the force field $\vec{F} = 3xy\hat{\imath} - 5z\hat{\jmath} + 10x\hat{k}$ along $x = t^2 + 1, y = 2t^2, z = t^3$ from $t = 1$ and $t = 2$.
36	Find the orthogonal trajectories of the family of curves $x^4 + y^4 - 6x^2y^2 = \text{constant}$.