Question bank for In semester exam
Semester II (2021-2022)
SUB: ENGINEERING MATHEMATICS III
Unit II
Fourier Transform and Z Transform

SR.NO	QUESTIONS	OPTION
1	Given that $\int_0^\infty \frac{sint}{t}\,dt = \frac{\pi}{2}$ *then* Fourier sine transform $F_s(\lambda)$, f(x)=$\frac{1}{x}$,x> 0 , *is* given by a)π b)π c)$\frac{\pi}{4}$ $d)\frac{\pi}{2}$	D

2	If $f(x) = \begin{cases} x, & 0 < x < 1 \\ 0 & , \ x > 1 \end{cases}$ then Fourier sine transform $F_s(\lambda)$ of f(x) is given by
	
	   a)$\frac{\lambda cos\lambda+sin\lambda}{\lambda^2}$ b)$\frac{-\lambda cos\lambda-sin\lambda}{\lambda^2}$
	   c)$\frac{-\lambda cos\lambda+sin\lambda}{\lambda^2}$ d)$\frac{cos\lambda}{\lambda^2}$
		C

3	The Fourier cosine transform $F_c(\lambda)$ of f(x)=$e^{-\mid x \mid} - \infty < x < \infty$ is a)$\frac{\lambda}{1+\lambda^2}$ b) $\frac{1}{1+\lambda^2}$ c)$\frac{1}{1-\lambda^2}$ d)$\frac{-1}{1+\lambda^2}$	B
4	The Fourier cosine integral representation is $\frac{4}{\pi}\int_0^\infty \frac{sin\lambda-\lambda cos\lambda}{\lambda}\,cos\lambda x d\lambda = \begin{cases} 1 - x^2, & 0 \le x \le 1 \\ 0, & x > 1 \end{cases}$, Then the value of the integral $\int_0^\infty \frac{sin\lambda-\lambda cos\lambda}{\lambda}\,cos\frac{\lambda}{2}d\lambda$ is equal to, a)$\frac{-3\pi}{16}$ b)$\frac{3\pi}{16}$ c)$\frac{-3\pi}{8}$ $d)\frac{3\pi}{4}$	B
5	Find the Fourier Transform $F(\lambda)$ of $f(x) = \begin{cases} 1, & \mid x \mid < a \\ 0, & \mid x \mid > a \end{cases}$ is	A

a) $\dfrac{2\sin\lambda a}{\lambda}$	b) $\dfrac{e^{-i\lambda a}}{\lambda}$	c) $\dfrac{e^{i\lambda a}}{\lambda}$	d) $\dfrac{2\cos\lambda a}{\lambda}$	

6

The Fourier sine transform $F_s(x)$ of $f(x) = \begin{cases} \dfrac{\pi}{2}, & 0 < x < \pi \\ 0 & , \ x > \pi \end{cases}$

is

a)$\dfrac{\pi}{2}\left(\dfrac{1-sin\lambda\pi}{\lambda}\right)$ b)$\dfrac{\pi}{2}\left(\dfrac{cos\lambda\pi-1}{\lambda}\right)$

c)$\dfrac{\pi}{2}\left(\dfrac{1-cos\lambda\pi}{\lambda}\right)$ d)$\left(\dfrac{cos\lambda\pi}{\lambda}\right)$

C

7

The Fourier sine transform $F_s(\lambda)$ of f(x)=$e^{-x} + e^{-2x}$

a)$\dfrac{\lambda}{1+\lambda^2} + \dfrac{\lambda}{4+\lambda^2}$ b) $\dfrac{1}{1+\lambda^2} + \dfrac{1}{2+\lambda^2}$

c)$\dfrac{1}{1-\lambda^2} + \dfrac{1}{1+\lambda^2}$ d)$\dfrac{-1}{1+\lambda^2} + \dfrac{1}{4+\lambda^2}$

A

8

The Fourier cosine transform $F_c(\lambda)$ of f(x)=$e^{-|x|} - \infty < x < \infty$
is

a)$\dfrac{\lambda}{1+\lambda^2}$ b) $\dfrac{1}{1+\lambda^2}$ c)$\dfrac{1}{1-\lambda^2}$ d)$\dfrac{-1}{1+\lambda^2}$

B

9

The Fourier cosine transform

$\int_0^\infty \dfrac{1-cosu}{u^2} cos\lambda u\, du = \begin{cases} \dfrac{\pi}{2}(1-\lambda), & 0 \le \lambda \le 1 \\ 0, & \lambda > 1 \end{cases}$ is,

then the value of the integral $\int_0^\infty \dfrac{sin^2 z\, dz}{z^2}$ is

a) 1   b)$\dfrac{\pi}{2}$ c)0   d)$\dfrac{\pi}{4}$

B

10

The Fourier Transform $F(\lambda)$ of f(x)=$\begin{cases} e^{-x}, x > 0 \\ 0, x < 0 \end{cases}$ is

a) $\dfrac{1-\lambda}{1+\lambda^2}$ b) $\dfrac{1-i\lambda}{1+\lambda^2}$ C) $\dfrac{1-i\lambda}{1-\lambda^2}$ d) $\dfrac{1}{1+\lambda^2}$

B

11

The Fourier sine transform of $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ is

a)$\dfrac{1-cos\lambda a}{\lambda}$ b) $\dfrac{sin\lambda a}{\lambda}$ c) $\dfrac{cos\lambda a-1}{\lambda}$ d) $\dfrac{sin\lambda a}{a}$

A

12	If the Fourier integral representation of $f(x)$ is $$\frac{2}{\pi}\int\limits_{0}^{\infty}\frac{\sin\lambda\cos\lambda x]}{\lambda}d\lambda = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$$ then value of the integral $\int\limits_{0}^{\infty}\frac{\sin\lambda}{\lambda}d\lambda$ is a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) 0 d) 1	B
13	The Fourier sine representation, $$e^{-x}\cos x = \frac{2}{\pi}\int\limits_{0}^{\infty}\frac{\lambda^3}{\lambda^4 + 4}\sin\lambda x d\lambda, \quad F_s(\lambda) \text{ is,}$$ a)$\frac{\lambda^2}{\lambda^4+4}$ b)$\frac{\lambda^3}{\lambda^4+4}$ c) $\frac{\lambda^4+4}{\lambda^3}$ d)$\frac{1}{\lambda^4+4}$	B
14	Given that $F_c(\lambda) = \int\limits_{0}^{\infty} u^{m-1}\cos\lambda u \, du = \frac{\Gamma(m)}{\lambda^m}\cos\frac{\pi m}{2}$ is, Then the Fourier cosine transform $F_c(\lambda)$ of $$f(x) = x^3, x > 0 \text{ is given by,}$$ a) $\frac{6}{\lambda^4}$ b)$\frac{3}{\lambda^3}$ c) $\frac{4}{\lambda^2}$ d)$\frac{1}{\lambda^2}$	A
15	The solution of f(x) of the integral equation, $\int_0^\infty f(x)\cos\lambda x dx = e^{-\lambda}, \lambda > 0$ is a)$\frac{2}{\pi}[\frac{e^{-x}}{(1+x^2)}]$ b)$\frac{2}{\pi}[\frac{x}{(1+x^2)}]$ c)$\frac{2}{\pi}[\frac{1}{(1-x^2)}]$ d)$\frac{2}{\pi}[\frac{1}{(1+x^2)}]$	d
16	The solution of f(x) of the integral equation $$\int\limits_{0}^{\infty} f(x)\sin\lambda x dx = \begin{cases} 1, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases} \text{ is,}$$ a)$\frac{2}{\pi}[\frac{\cos x}{x}]$ b)$\frac{2}{\pi}[\frac{1-\cos x}{x}]$ c)$\frac{2}{\pi}[\frac{1+\sin x}{x}]$ d)$\frac{2}{\pi}[\frac{\sin x}{x}]$	b
17	The solution of f(x) of the integral equation	

$$\int_0^\infty f(x)\,sin\lambda x\,dx = \begin{cases} 1-\lambda, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases} \text{ is,}$$

$f(x){=}\frac{2}{\pi}\int_0^1 (1-\lambda)\,sin\lambda x\,d\lambda$ then the value of f(x) is

a)$\frac{2}{\pi}[\frac{1}{x}-\frac{sinx}{x^2}]$ 　　　　　　b)$\frac{2}{\pi}[\frac{1}{x}-\frac{cosx}{x^2}]$

c)$\frac{2}{\pi}[\frac{1}{x}+\frac{sinx}{x^2}]$ 　　　　　　d)$\frac{2}{\pi}[-\frac{1}{x}+\frac{sinx}{x^2}]$

18	The solution of f(x) of the integral equation, $$\int_0^\infty f(x)\,sin\lambda x\,dx = e^{-\lambda}, \lambda > 0 \text{ is}$$ a)$\frac{2}{\pi}[\frac{e^{-x}}{(1+x^2)}]$ 　　b)$\frac{2}{\pi}[\frac{x}{(1+x^2)}]$ 　c)$\frac{2}{\pi}[\frac{1}{(1-x^2)}]$ 　d)$\frac{2}{\pi}[\frac{1}{(1+x^2)}]$	b
19	For the Fourier sine representation $$\frac{12}{\pi}\int_0^\infty \frac{\lambda sin\lambda x}{(4+\lambda^2)(16+\lambda^2)}\,d\lambda = e^{-3x}sinhx,$$ $$x > 0, \quad F_s(\lambda)\text{is}$$ a) $\frac{6\lambda}{(4+\lambda^2)(16+\lambda^2)}$ 　　　b) $\frac{\lambda}{(4+\lambda^2)(16+\lambda^2)}$ c)$\frac{6cos\lambda x}{(4+\lambda^2)(16+\lambda^2)}$ 　　　d) $\frac{1}{(4+\lambda^2)(16+\lambda^2)}$	A
20	In the Fourier integral representation of $$\frac{1}{2\pi}\int_{-\infty}^\infty \left(\frac{e^{-i\lambda\pi}+1}{1-\lambda^2}\right)e^{i\lambda x}\,d\lambda = \begin{cases} sinx, 0 < x < \pi \\ 0, x < 0\,and\,x > \pi \end{cases}, F(\lambda)\text{is}$$ a)$\frac{1+\lambda^2}{1-i\lambda}$ 　　b)$\frac{e^{-i\lambda}}{1-\lambda^2}$ 　　　c)$\frac{e^{-i\lambda\pi}+1}{1-\lambda^2}$ 　　　d)$\frac{sin\,\lambda}{1-\lambda^2}$	C
	Z- TRANSFORM	
1	If f(k)$= sin\frac{\pi}{2}K, k \ge 0,$ then Z transform of $\{sin\frac{\pi}{2}k\}$ is given by　　　　a) $\frac{z}{Z^2-1}, |z| < 1$ 　　　　　　　　b) $\frac{z^2}{Z^2+1}, |z| > 1$ 　　　C) $\frac{z}{Z^2+1}, |z| > 1$ 　　　　　　　　D_$\frac{z}{Z^2-1}, |z| > 1$	C

2	. If $f(k) = 2^k \sin\frac{\pi}{2} K, k \geq 0$, then Z transform of $\{2^k \sin\frac{\pi}{2} k\}$ is given by a) $\frac{2z}{z^2 - 4}, \lvert z \rvert > 2$ b) $\frac{2z}{z^2 - 4}, \lvert z \rvert < 2$ c) $\frac{2z}{z^2 + 4}, \lvert z \rvert > 2$ d) $\frac{2z}{z^2 + 4}, \lvert z \rvert < 2$	D
3	If $f(k) = k, k \geq 0$, then Z transform of $\{k\}$ is given by a) $\frac{z}{(Z-1)^2}, \lvert z \rvert > 1$ b) $\frac{(z-1)^2}{z^2}, \lvert z \rvert > 1$ c) $\frac{(z+1)^2}{z^2}, \lvert z \rvert > 1$ d) $\frac{z^2}{(Z+1)^2}, \lvert z \rvert > 1$	A
4	If $\lvert z \rvert > 2$,, $Z^{-1}\left[\frac{z}{(z-1)(z-2)}\right]$ is given by a) $2^k - 1, k \geq 0$ b) $2^{k+1} - 1, k > 1$ c) $\frac{1}{2}^k - 1, k \geq 0$ d) $k - 1, k \geq 0$	A
5	For the difference equation $f(k+1) + \frac{1}{3} f(k) = \left(\frac{1}{3}\right)^k, k \geq 0. f(0) = 0$ F(z) is given by a) $\dfrac{1}{\left(z - \frac{1}{3}\right)\left(z + \frac{1}{3}\right)}$ b) $\dfrac{z}{\left(z - \frac{1}{3}\right)\left(z + \frac{1}{3}\right)}$ c) $\dfrac{z}{\left(z + \frac{1}{3}\right)\left(z + \frac{1}{2}\right)}$ d) $\dfrac{z}{\left(z - \frac{1}{3}\right)^2}$	B
6	If $f(k) = \frac{2^k}{k}, k \geq 1$, then Z transform of $\{\frac{2^k}{k}\}, k \geq 1$, is given by a) $-\log(1 - 2z^{-1})$ b) $\log(1 - 2z^{-1})$ c) $-\log(1 + 2z^{-1})$ d) $\log(1 + 2z^{-1})$	A

7	If $f(k)=k5^k, k \geq 0,$ then Z transform of $\{k5^k\}$ is given by a) $\dfrac{(z-5)^2}{5z}, \|z\|>5$ b) $\dfrac{(z-5)^2}{z}, \|z\|>5$ C) $\dfrac{5z}{(z-5)^2}, \|z\|>5$ d) $\dfrac{5z}{(Z+5)^2}, \|z\|>5$	**c**
8	Z-transform of $\{ 3^k e^{-2k}, k \geq 0 \}$ is given by a) $\dfrac{z}{z-3e^2}$ b) $\dfrac{z}{z-3e^{-2}}$ c) $\dfrac{z}{z-2e^3}$ d) $\dfrac{z}{z+3e^2}$	**b**
9	For finding inverse Z-transform by inversion integral method of F(z)= $\dfrac{z}{(z-2)(z-3)}$ the residue of $z^{k-1}F(z)$ at the pole $z=2$ is a) $-(2)^k$ b) $(2)^k$ c) $-(3)^k$ d) $(3)^k$	**A**
10	For finding inverse Z-transform by inversion integral method of F(z)= $\dfrac{10z}{(z-1)(z-2)}$ the residue of $z^{k-1}F(z)$ at the pole $z=1$ is a)-10 b)10^{k-1} c)10 d)10^k	**A**
11	If $\{X(k)\}=\{2^k\}*\{3^k\}$ k≥0 then $Z\{X(k)\}$ is given by a) $\left(\dfrac{z}{z-2}\right)\left(\dfrac{z}{z-3}\right), \|z\|>3$ b) $\left(\dfrac{z}{z-2}\right)\left(\dfrac{z}{z-3}\right), \|z\|<3$ c) $\left(\dfrac{z}{z-2}\right)\left(\dfrac{z}{z-3}\right), \|z\|<2$ d) $\left(\dfrac{z}{z-2}\right)\left(\dfrac{z}{z-3}\right), \|z\|>2$	**A**
12	If $\|z\|<1,$ $Z^{-1}\left[\dfrac{z}{(z-1)(z-2)}\right]$ is given by a) $2^k - 1, k \geq 0$ b) $2^{k+1} - 1, k > 1$ c) $1 - 2^k, k < 0$ d) $2 - 3^k, k < 0$	**C**
13	For the difference equation $y_k - 3y_{k-2} = 1, k \geq 0, Y(z)$ is given by	**D**

a) $\dfrac{z}{(z-1)(z^2-3)}$ b) $\dfrac{1}{(1-3z^2)}$

c) $\dfrac{z}{(z-1)(1-3z^2)}$ d) $\dfrac{z^3}{(z-1)(z^2-3)}$

14	For finding inverse Z-transform by inversion integral method of $F(z)= \dfrac{z}{\left(z-\dfrac{1}{2}\right)\left(z-\dfrac{1}{5}\right)}$ the residue of $z^{k-1}F(z)$ at the pole $z=\dfrac{1}{2}$ is a) $\dfrac{10}{3}\left(\dfrac{1}{2}\right)^k$ b) $10\left(\dfrac{1}{2}\right)^k$ c) $-10\left(\dfrac{1}{2}\right)^k$ d) $\dfrac{1}{10}\left(\dfrac{1}{2}\right)^k$	A
15	If $f(k)=\dfrac{\sin ak}{k}, k\ge 0,$ then Z transform of $\{\dfrac{\sin ak}{k}, k\ge 0,$ is given by a) $\cot^{-1}(z+\cos a)$ b) $\cot^{-1}\left(\dfrac{z+\cos a}{\sin a}\right)$ c) $\cot^{-1}(z-\cos a)$ d) $\cot^{-1}\left(\dfrac{z-\cos a}{\sin a}\right)$	D
16	If $2<|z|<4,,$ $Z^{-1}\left[\dfrac{1}{(z-4)(z-2)}\right]$ is given by a) $-2^{k-1}-4^{k-1}, k\le 0, k\ge 1$ b) $2^{k-1}+4^{k-1}, k\le 0, k\ge 2$ c) $-2^{k-1}+4^{k-1}, k\le 0, k\le 0$ d) $\dfrac{1}{2}\left[-(4)^{k-1}-(2)^{k-1}\right], k\le 0, k\ge 1$	D
17	. For finding inverse Z-transform by inversion integral method of $F(z)= \dfrac{z}{\left(z-\dfrac{1}{4}\right)\left(z-\dfrac{1}{3}\right)}$ the residue of $z^{k-1}F(z)$ at the pole $z=\dfrac{1}{4}$ is a) $-\dfrac{1}{4}\left(\dfrac{1}{4}\right)^k$ b) $-12\left(\dfrac{1}{4}\right)^k$ c) $-3\left(\dfrac{1}{4}\right)^k$ d) $20\left(\dfrac{1}{4}\right)^k$	B
18	If $|z|>2, k\ge 0,$ inverse Z-transform of $\dfrac{z^2}{(z-2)^2}$ is given by a) $-(k+1)2^k$ b) $(k+1)2^k$ c) $(k+1)2^{-k}$ d) $(k-1)2^k$	B

19	If f(k)=$\left(\dfrac{\pi}{2}\right)^k \cos\dfrac{\pi}{2}K, k \geq 0,$ then Z transform of $\{\left(\dfrac{\pi}{2}\right)^k \cos\dfrac{\pi}{2}k\}$ is given by	A
	a) $\dfrac{z^2}{Z^2+\dfrac{\pi^2}{4}}, |z|>\dfrac{\pi}{2}$ b) $\dfrac{z^2}{Z^2-\dfrac{\pi^2}{4}}, |z|<\dfrac{\pi}{2}$ c) $\dfrac{z}{Z^2+\dfrac{\pi^2}{4}}, |z|>\dfrac{\pi}{2}$ d) $\dfrac{z}{Z^2-\dfrac{\pi^2}{4}}, |z|>\dfrac{\pi}{2}$	

20	. If $1<|z|<3$, $Z^{-1}\left[\dfrac{z}{(z-1)(z-3)}\right]$ is given by
	
	     a) $1+3^k, k>0$ b) $1+3^k, k<0$
	
	     c) $3^k-1, k<0$ d) $\dfrac{1}{2}\left(-3^k-1\right), k<0, k\geq 0$
		D