DR.D.Y.PATIL INSTITUTE OF TECHNOLGY,
PIMPRI, PUNE-18
DEPARTMENT OF MATHEMATICS

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)=$e^{-\lvert x\rvert}$ $-\infty < x < \infty$ 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 $\frac{4}{\pi}\int_0^\infty \frac{sin\lambda-\lambda cos\lambda}{\lambda} cos\lambda x d\lambda = \begin{cases} 1-\mathrm{x}^2, & 0 \le x \le 1 \\ 0, & x > 1 \end{cases}$, 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 $f(x)=\begin{cases} 1, & \lvert x\rvert < a \\ 0, & \lvert x\rvert > a \end{cases}$ is	A

	a) $\frac{2\sin\lambda a}{\lambda}$ b) $\frac{e^{-i\lambda a}}{\lambda}$ c) $\frac{e^{i\lambda a}}{\lambda}$ d) $\frac{2\cos\lambda a}{\lambda}$	
6	The Fourier sine transform F_s(x) of $f(x) = \begin{cases} \frac{\pi}{2}, & 0 < x < \pi \\ 0 & , x > \pi \end{cases}$ is a)$\frac{\pi}{2}\left(\frac{1-sin\lambda\pi}{\lambda}\right)$ b)$\frac{\pi}{2}\left(\frac{cos\lambda\pi-1}{\lambda}\right)$ $c)\frac{\pi}{2}\left(\frac{1-cos\lambda\pi}{\lambda}\right)$ $d)\left(\frac{cos\lambda\pi}{\lambda}\right)$	**C**
7	The Fourier sine transform $F_s(\lambda)$ of f(x)=$e^{-x} + e^{-2x}$ a)$\frac{\lambda}{1+\lambda^2} + \frac{\lambda}{4+\lambda^2}$ b) $\frac{1}{1+\lambda^2} + \frac{1}{2+\lambda^2}$ c)$\frac{1}{1-\lambda^2} + \frac{1}{1+\lambda^2}$ d)$\frac{-1}{1+\lambda^2} + \frac{1}{4+\lambda^2}$	**A**
8	The Fourier cosine transform $F_c(\lambda)$ of f(x)=$e^{-\lvert x\rvert} - \infty < x < \infty$ 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**
9	The Fourier cosine transform $\int_0^\infty \frac{1-cosu}{u^2} cos\lambda udu = \begin{cases} \frac{\pi}{2}(1-\lambda), & 0 \le \lambda \le 1 \\ 0, & \lambda > 1 \end{cases}$ is, $\text{then the value of the integral } \int_0^\infty \frac{sin^2 zdz}{z^2}$ is a) 1 b)$\frac{\pi}{2}$ c)0 $d)\ \frac{\pi}{4}$	**B**
10	The Fourier Transform $F(\lambda)$of f(x)=$\begin{cases} e^{-x}, x > 0 \\ 0, x < 0 \end{cases}$ is a) $\frac{1-\lambda}{1+\lambda^2}$ b) $\frac{1-i\lambda}{1+\lambda^2}$ C) $\frac{1-i\lambda}{1-\lambda^2}$ d) $\frac{1}{1+\lambda^2}$	**B**
11	The Fourier sine transform of $f(x) = \begin{cases} 1, & \lvert x\rvert < a \\ 0, & \lvert x\rvert > a \end{cases}$ is a)$\frac{1-cos\lambda a}{\lambda}$ b) $\frac{sin\lambda a}{\lambda}$ c) $\frac{cos\lambda a-1}{\lambda}$ d) $\frac{sin\lambda a}{a}$	**A**

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

	$$\int_0^{\infty} f(x)\, sin\lambda x dx = \begin{cases} 1-\lambda, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases}$$ 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, $\int_0^{\infty} f(x)\, sin\lambda x dx = e^{-\lambda}, \lambda > 0$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 $$\frac{12}{\pi}\int_0^{\infty} \frac{\lambda sin\lambda x}{(4+\lambda^2)(16+\lambda^2)} d\lambda = \mathrm{e}^{-3x}\mathrm{sinhx},$$ $x > 0,\ \ F_S(\lambda)$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 $\frac{1}{2\pi}\int_{-\infty}^{\infty}\left(\frac{e^{-i\lambda\pi}+1}{1-\lambda^2}\right)e^{i\lambda x}d\lambda = \begin{cases} sinx, 0 < x < \pi \\ 0, x < 0 and x > \pi \end{cases}, F(\lambda)$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)$\frac{z}{Z^2-1}, \lvert z\rvert < 1$ b)$\frac{z^2}{Z^2+1}, \lvert z\rvert > 1$ C)$\frac{z}{Z^2+1}, \lvert z\rvert > 1$ D_$\frac{z}{Z^2-1}, \lvert z\rvert > 1$	**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) $\frac{2z}{z^2-4}, \|z\|>2$ b) $\frac{2z}{z^2-4}, \|z\|<2$ c) $\frac{2z}{z^2+4}, \|z\|>2$ d) $\frac{2z}{z^2+4}, \|z\|<2$	C
3	If f(k)=$k, k \geq 0,$ then Z transform of $\{k\}$ is given by a) $\frac{z}{(Z-1)^2}, \|z\|>1$ b) $\frac{(z-1)^2}{z^2}, \|z\|>1$ c) $\frac{(z+1)^2}{z^2}, \|z\|>1$ d) $\frac{z^2}{(Z+1)^2}, \|z\|>1$	A
4	If $\|z\|>2,$, $Z^{-1}\left[\frac{z}{(z-1)(z-2)}\right]$ is given by a) $2^k-1, k \geq 0$ b) $2^{k+1}-1, k>1$ c) $\frac{1^k}{2}-1, k \geq 0$ 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) $\frac{1}{\left(z-\frac{1}{3}\right)\left(z+\frac{1}{3}\right)}$ b) $\frac{z}{\left(z-\frac{1}{3}\right)\left(z+\frac{1}{3}\right)}$ c) $\frac{z}{\left(z+\frac{1}{3}\right)\left(z+\frac{1}{2}\right)}$ d) $\frac{z}{\left(z-\frac{1}{3}\right)^2}$	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) $\frac{(z-5)^2}{5z}, \lvert z\rvert > 5$ b) $\frac{(z-5)^2}{z}, \lvert z\rvert > 5$ C) $\frac{5z}{(z-5)^2}, \lvert z\rvert > 5$ d) $\frac{5z}{(Z+5)^2}, \lvert z\rvert > 5$	**c**
8	Z-transform of $\{ 3^k e^{-2k}, k \geq 0 \}$ is given by a) $\frac{z}{z-3e^2}$ b) $\frac{z}{z-3e^{-2}}$ c) $\frac{z}{z-2e^3}$ d) $\frac{z}{z+3e^2}$	**b**
9	For finding inverse Z-transform by inversion integral method of F(z)= $\frac{z}{(z-2)(z-3)}$ 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)= $\frac{10z}{(z-1)(z-2)}$ 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) $\left(\frac{z}{z-2}\right)\left(\frac{z}{z-3}\right), \lvert z\rvert > 3$ b) $\left(\frac{z}{z-2}\right)\left(\frac{z}{z-3}\right), \lvert z\rvert < 3$ c) $\left(\frac{z}{z-2}\right)\left(\frac{z}{z-3}\right), \lvert z\rvert < 2$ d) $\left(\frac{z}{z-2}\right)\left(\frac{z}{z-3}\right), \lvert z\rvert > 2$	**A**
12	If $\lvert z\rvert < 1,$, $Z^{-1}\left[\frac{z}{(z-1)(z-2)}\right]$ is given by a) $2^k - 1, k \geq 0$ b) $2^{k+1} - 1, k > 1$ c) $1-2^k, k < 0$ 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) $\frac{z}{(z-1)(z^2-3)}$ b) $\frac{1}{(1-3z^2)}$ c) $\frac{z}{(z-1)(1-3z^2)}$ d) $\frac{z^3}{(z-1)(z^2-3)}$	
14	For finding inverse Z-transform by inversion integral method of F(z)= $\frac{z}{\left(z-\frac{1}{2}\right)\left(z-\frac{1}{5}\right)}$ the residue of $z^{k-1}F(z)$ at the pole $z=\frac{1}{2}$ is a) $\frac{10}{3}\left(\frac{1}{2}\right)^k$ b) $10\left(\frac{1}{2}\right)^k$ c) $-10\left(\frac{1}{2}\right)^k$ d) $\frac{1}{10}\left(\frac{1}{2}\right)^k$	**A**
15	If f(k)= $\frac{\sin ak}{k}, k \geq 0,$ then Z transform of $\{\frac{\sin ak}{k}, k \geq 0,$ is given by a) $\cot^{-1}(z+\cos a)$ b) $\cot^{-1}\left(\frac{z+\cos a}{\sin a}\right)$ c) $\cot^{-1}(z-\cos a)$ d) $\cot^{-1}\left(\frac{z-\cos a}{\sin a}\right)$	**D**
16	If $2<\|z\|<4,,$ $Z^{-1}\left[\frac{1}{(z-4)(z-2)}\right]$ is given by a) $-2^{k-1}-4^{k-1}, k \leq 0, k \geq 1$ b) $2^{k-1}+4^{k-1}, k \leq 0, k \geq 2$ c) $-2^{k-1}+4^{k-1}, k \leq 0, k \leq 0$ d) $\frac{1}{2}\left[-(4)^{k-1}-(2)^{k-1}\right], k \leq 0, k \geq 1$	**D**
17	. For finding inverse Z-transform by inversion integral method of F(z)= $\frac{z}{\left(z-\frac{1}{4}\right)\left(z-\frac{1}{3}\right)}$ the residue of $z^{k-1}F(z)$ at the pole $z=\frac{1}{4}$ is a) $-\frac{1}{4}\left(\frac{1}{4}\right)^k$ b) $-12\left(\frac{1}{4}\right)^k$ c) $-3\left(\frac{1}{4}\right)^k$ d) $20\left(\frac{1}{4}\right)^k$	**B**
18	If $\|z\|>2, k \geq 0$,inverse Z-transform of $\frac{z^2}{(z-2)^2}$ 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)=$\left(\frac{\pi}{2}\right)^k \cos\frac{\pi}{2}K, k \geq 0,$ then Z transform of$\{\left(\frac{\pi}{2}\right)^k \cos\frac{\pi}{2}k\}$ is given by a) $\frac{z^2}{Z^2+\frac{\pi^2}{4}}, \lvert z\rvert > \frac{\pi}{2}$ b) $\frac{z^2}{Z^2-\frac{\pi^2}{4}}, \lvert z\rvert < \frac{\pi}{2}$ c) $\frac{z}{Z^2+\frac{\pi^2}{4}}, \lvert z\rvert > \frac{\pi}{2}$ d) $\frac{z}{Z^2-\frac{\pi^2}{4}}, \lvert z\rvert > \frac{\pi}{2}$	**A**
20	. If $1<\lvert z\rvert<3$, $Z^{-1}\left[\frac{z}{(z-1)(z-3)}\right]$ is given by a) $1+3^k, k>0$ b) $1+3^k, k<0$ c) $3^k-1, k<0$ d) $\frac{1}{2}\left(-3^k-1\right), k<0, k\geq 0$	**D**