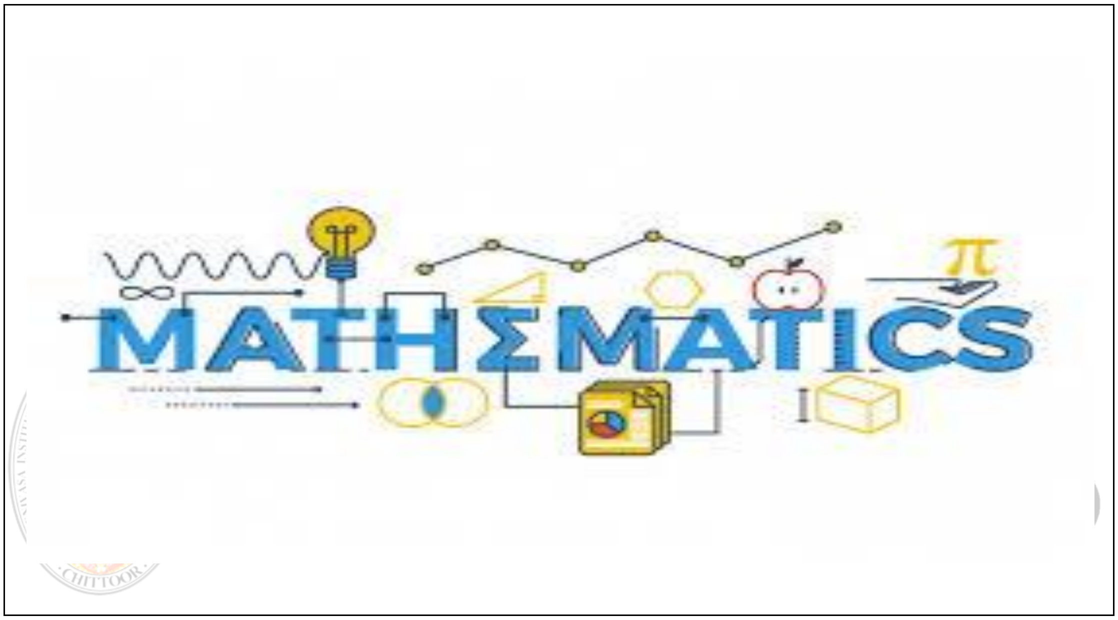
SREENIVASA INSTITUTE of TECHNOLOGY and MANAGEMENT STUDIES
(AUTONOMOUS)

(DIFFERENTIAL EQUATIONS & TRANSFORMATION TECHNIQUES)

QUESTION BANK

I- B.TECH / II - SEMESTER REGULATION: R20



COMPILED BY
DEPARTMENT OF MATHEMATICS

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES

(Autonomous)

DEPARTMENT of SCIENCE AND HUMANITIES

QUESTION BANK DIFFERENTIAL EQUATIONS &TRANSFORM TECHNIQUES (20BSC121)

Question No.	Questions	BLOOMS TAXONOMY
	UNIT – 1:ORDINARY DIFFERENTIAL EQUATIONS	
	PART-A (Two Marks Questions)	
	Short Answer Type Questions	
1.	*Find the differential equation of* $y = ax^2$, *where a is a parameter*	L2,L3
2.	*Find the differential equation of* $x^2 + y^2 = a^2$, *where a is a parameter*	L2,L3
3.	*Write the solution of* $\frac{dy}{dx} + P(x)y = Q(x)$	L1
4.	*Write the solution of* $\frac{dx}{dy} + P(y)x = Q(y)$	L1
5.	*Find the Integrating factor of* $\frac{dy}{dx} - \frac{y}{x} = \cos x$	L2,L3
6.	*Find the Integrating factor of* $\frac{dy}{dx} + xy = \sin x$	
7.	*Find the Integrating factor of* $(1-x^2)\frac{dy}{dx} + xy = ax$	L2,L3
8.	*Find the Integrating factor of* $(x+y+1)dy/dx = 1$	L2,L3
9.	Solve $\frac{d^2y}{dx^2} - a^2y = 0$	L2,L3
10.	Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$	L2,L3
11.	Solve $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$	L2,L3
12.	Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = 0$	L2,L3
13.	Find the general solution of $(4D^2 + 4D + 1)y = 0$.	L2,L3
14.	Solve $(D^3 - 1)y = 0$	L2,L3
15.	Solve $(D-1)^2(D+2)y = 0$	L2,L3
16.	Find the particular integral of $(D^2+6D+4)y=e^{3x}$	L2,L3
17.	Solve $(D-1)^2(D+2)y = 0$	L2,L3
18.	Find the particular integral of $(D^2+9)y = \cos 3x$	L2,L3
19.	Find the particular integral of $(4D^2+4D+1)y=100$	L2,L3
20.	Write the formulae for A and B in method of variation of parameters	L1

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Question No.	Questions	BLOOMS TAXONOMY
	UNIT – 1 ORDINARY DIFFERENTIAL EQUATIONS	
	PART-B (Ten Marks Questions)	
1.	a)Solve $\frac{dy}{dx} + \frac{y}{x\log x} = \frac{\sin 2x}{\log x}$	L2,L3
	b) Solve $(1+y^2)dx = (\tan^{-1} y - x)dy$	L2,L3
2.	a) Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$	L2,L3

	b) Solve $\left(x+2y^3\right)\frac{dy}{dx}=y$	L2,L3
3.	Solve $x\frac{dy}{dx}+y=x^3y^6$	L2,L3
4.	Solve $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$	L2,L3
5.	Solve $\frac{dy}{dx}-\frac{Tan\, y}{1+x}=(1+x)e^x\sec y$	L2,L3
6.	a) Solve $\frac{d^3y}{dx^3}-9\frac{d^2y}{dx^2}+23\frac{dy}{dx}-15y=0$	L2,L3
	b) Solve $\frac{d^3y}{dx^3}-6\frac{d^2y}{dx^2}+11\frac{dy}{dx}-6y=e^{-2x}+e^{-3x}$	L2,L3
7.	a) Solve $\left(D^2+4D+4\right)y=18\cosh x$	L2,L3
	b) Solve $\left(D^2+D+1\right)y=\sin 2x$	L2,L3
8.	a) Solve $\left(D^2-4D+3\right)y=\sin 3x\cos 2x$	L2,L3
	b) Solve $(D^3-1)y=e^x+\sin 3x+2$	L2,L3
9.	a) Solve $(D^2-2D-3)y=x^3$	L2,L3
	b) Solve $\left(\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y\right)=8e^{3x}\sin 2x$	L2,L3
10.	Solve $(D^2+3D+2)y=e^{-x}+x^2+\cos x$	L2,L3
11.	Solve $(D^3+2D^2+D)y=e^{2x}+x^2+x+\sin 2x$	L2,L3
12.	Solve $\left(D^2+1\right)y=x\sin x$	L2,L3
13.	Solve $\left(D^2-4D+4\right)y=8x^2e^{2x}\sin 2x$	L2,L3
14.	Solve $\frac{d^2y}{dx^2}+4y=\tan 2x$ by the Method of variation of Parameter	L2,L3
15.	If voltage of a battery in an L-R circuit is 10 sin t, Find the current I in the circuit under the initial condition I(0)=0.	L2,L3

QNo.	Questions	Blooms Taxonomy
	UNIT –2: PARTIAL DIFFERENTIAL EQUATIONS	
	PART-A (Two Marks Questions)	
1.	Define partial differential equation and give an example?	L1
2.	Define order and degree of a partial differential equation?	L1
3.	Give an example for first order and first-degree partial differential equation.	L1
4.	Form the partial differential equation by eliminating the arbitrary constants a and b from $z=ax+by+a^2+b^2$	L2,L3
5.	Form the partial differential equation by eliminating the arbitrary constants a and b from $z=axy+b$	L2,L3

6.	Form the partial differential equation by eliminating the arbitrary constants a and b from $z = ax^2 + by^2$	L2,L3
7.	Form the partial differential equation by eliminating the arbitrary constants a and b from $z = (x + a)(y + b)$	L2,L3
8.	Form the partial differential equation by eliminating the arbitrary function from $z = f(x^2 - y^2)$	L2,L3
9.	Form the partial differential equation by eliminating the arbitrary function from $z = \phi(y/x)$	L2,L3
10.	Form the partial differential equation by eliminating the arbitrary function from $z = f(x + y)$	L2,L3
11.	Define Linear partial differential equation with an example	L1
12.	Define Non-linear partial differential equation with an example	L1
13.	Solve xp+yq=z	L2,L3
14.	What are the multiplies to solve (y-z)p+(z-x)q=x-y by method of multiplies	L2,L3
15.	Solve p+q=k	L2,L3
16.	Solve pq=k	
17.	Solve $p^2+q^2=1$	
18.	Solve $z=px+qy+(p^3+q^3)$	L2,L3
19.	Solve z-px-qy = pq	
20.	What is the process in method of separation of variables	L1

PART-B (Ten Marks Questions)

1.	a) Form the partial differential equation by eliminating the arbitrary constants a & b from $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$	L2,L3
	b) Form the partial differential equation by eliminating the arbitrary constants a & b from $z = (x - a)^2 + (y - b)^2$	L2,L3
2.	a)Form the partial differential equation by eliminating the arbitrary constants h & k from $(x-h)^2 + (y-k)^2 + z^2 = a^2$ b)Form the partial differential equation by eliminating the arbitrary constants h & k from $x^2+y^2+(z-c)^2= r^2$	L2,L3
3.	Form the partial differential equation by eliminating the arbitrary constants a, b from $\log(az - 1) = x + ay + b$	L2,L3
4.	Form the partial differential equation by eliminating the arbitrary constants a, b & c from $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	L2,L3
5.	Form the partial differential equation by eliminating the arbitrary function from $lx + my + nz = \emptyset(x^2 + y^2 + z^2)$	L2,L3
6.	Form the partial differential equation by eliminating the arbitrary function $z = (x + y)f(x^2 - y^2)$	L2,L3
7.	Form the partial differential equation by eliminating the arbitrary function $\emptyset(x^2 + y^2 + z^2, z^2 - 2xy) = 0$	L2,L3
8.	Form the partial differential equation by eliminating the arbitrary functions f and g	L2,L3

	from $z = f(x+ct) + g(x-ct)$	
9.	a) Solve yzp+zxq=xy b) Solve $(y^2 z/x)p+zxq=y^2$	**L2,L3**
10.	*a) Solve (mz-ny)p+(nx-lz)q=ly-mx* *b) Solve* $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$	**L2,L3**
11.	Solve $z^2(p^2+q^2+1)=c^2$	**L2,L3**
12.	*Solve* $z^2(p^2+q^2)=x^2+y^2$	**L2,L3**
13.	Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ and $u(x,0) = 6e^{-3x}$, by the method of separation of variables	**L2,L3**
14.	Solve $4u_x + u_y = 3u$ and $u(0,y) = e^{-5y}$, by the method of separation of variables	**L2,L3**
15.	Solve $u_x - 4u_y = 0$ and $u(0,y) = 8\,e^{-3y}$, by the method of separation of variables	**L2,L3**

Question No.	Questions	Blooms Taxonomy
	UNIT – 3: LAPLACE TRANSFORM	
	PART-A (Two Marks Questions)	
1.	Find $i) L(\cos 4t)$ $ii) L(sihh\ 2t)$ $iii) L(t^3)$ $iv) L(\cosh 5t)$	**L1**
2.	Find $L\{\ sin^2 2t\}$	**L1,L2**
3.	Find $L\{sin2t\ sin3t\}$	**L1,L2**
4.	Find $L\{e^{2t}\cos 3t\}$	**L1,L2**
5.	Find $L\{e^{-5t}\sinh 2t\}$	**L1,L2**
6.	Find $L\{t^2 e^{-3t}\}$	**L1,L2**
7.	State First shifting property of Laplace transform	**L1**
8.	State Change of scale property of Laplace transform	**L1**
9.	State multiplication by t property of Laplace transform	**L1**
10.	State division by t property of Laplace transform	**L1**
11.	State Laplace transform of second order derivate	**L1**
12.	State Laplace transform of integral	**L1**
13.	State second shifting property of Laplace trasnform	**L1**
14.	If $f(t) = \begin{cases} Cos(t - \frac{2\pi}{3}) & ;\ t < 2\pi/3 \\ 0\ ; & t > 2\pi/3 \end{cases}$ then find L{f(t)}	**L1,L2**
15.	Define Unit step function and derive Laplace Transform of Unit Step Function	**L1**
16.	Define Period function and Laplace transform of period function	**L1**
17.	Define Unit impulse function and Laplace Transform of unit impulse function	**L1**
18.	Find $L^{-1}\left\{\frac{1}{s(s+1)}\right\}$	**L1,L2**
19.	Find $L^{-1}\{\frac{1}{(s+1)^2}\}$	**L1,L2**
20.	State Convolution Theorem	**L1**
	PART-B (Ten Marks Questions)	
1.	i) Evaluate $L\{e^{2t} + 4t^3 - 2\sin 3t + 3\cos 3t\}$ ii) Find the Laplace Transforms of a) $\cos^2 2t$ b) cos 2t.cos 3t	**L1,L2**
2.	i) Evaluate $L\{e^{-3t}(2\cos 5t - 3\sin 5t)\}$ ii) Find $L[sin\ t\ sinh\ t]$	**L1,L2**
3.	i) If $L\{F(t)\} = \frac{9s^2 - 12s + 15}{(s-1)^3}$, Find $L\{F(3t)\}$	**L1,L2**

	ii) Find $L\left[\int_0^t \frac{e^{-t}\sin t}{t}dt\right]$	
4.	Find i) L {t^2cos 3t} ii) L {t e^{-2t}cos t}	**L1,L2**
5.	Find the Laplace Transform of $\frac{\cos 2t - \cos 3t}{t}$	**L1,L2**
6.	Find $L\{F(t)\}$, where $F(t)$ is a periodic function of period 2π and it is given by $F(t) = \begin{cases} \sin t, & o < t < \pi \\ 0 & \pi < t < 2\pi \end{cases}$	**L1,L2**
7.	i) Find $L^{-1}\left\{\frac{s+2}{s^2+6s+7}\right\}$ ii) Find $L^{-1}\left\{\frac{s}{(s+6)^5}\right\}$	**L1,L2**
8.	Find the Inverse Laplace Transform of $\frac{4}{(s+1)(s+2)}$	**L1,L2**
9.	Find the Inverse Laplace Transform of $\frac{s^2+s-2}{s(s+3)(s-2)}$	**L1,L2**
10.	Find the Inverse Laplace Transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$	**L1,L2**
11.	Using the Convolution Theorem find $L^{-1}\left\{\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right\}$	**L1,L2**
12.	Solve the differential equation $\frac{d^2x}{dt^2} - 4\frac{dx}{dt} - 12x = e^{3t}$ given that x(0) = 1 and $x^1(0)$ = -2 by using laplace transform	**L1,L2,L3**
13.	Using Laplace transform solve (D^2 + 2D – 3)y = sinx if y(0) = $y^1(0)$ = 0.	**L1,L2,L3**
14.	Solve $\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = e^{-t}$, Given that $x(0) = 0$ and $x^1(0) = 1$	**L1,L2,L3**
15.	Solve $y'' - 3y' + 2y = 4t + e^{3t}$, Given that $y(0) = 1$ and $y^1(0) = -1$	**L1,L2,L3**

Question No.	Questions	Blooms Taxonomy
	UNIT – 4: FOURIER SERIES	
	PART-A (Two Marks Questions)	
1	Write the Fourier series expansion of f(x) in [0,2L]	L1
2	Write the Fourier series expansion of $f(x)$ in $(0, 2\pi)$	L1
3	Write the Fourier series expansion of $f(x)$ in $(-\pi, \pi)$	L1
4	Define periodic function.	L1
5	Define even and odd functions with suitable examples	L1
6	Write the Dirichlet's conditions.	L1
7	If $f(x) = x - x^2$ in $(-\pi, \pi)$, then find the value of the Fourier coefficient a_0.	L1,L2
8	Find a_n in the expansion of $f(x) = \|x\|$ in $(-\pi, \pi)$.	L1,L2

9	If $f(x)=\begin{cases}-\pi, & -\pi\le x\le 0\\ x, & 0<x<\pi\end{cases}$, then the find the value of a_0.	L1,L2
10	If $f(x)$ is defined in $0\le x\le 2\pi$ write the formulae for a_0, a_n and b_n.	L1,L2
11	If $f(x)$ is defined in $-\pi\le x\le \pi$ write the formulae for a_0, a_n and b_n.	L1,L2
12	Is f(x) = x cos x is even or odd with explanation	L1,L2
13	Is f(x)= x- x^2 is even or odd with explanation	L1,L2
14	Express $f(x)=x$ as a Fourier series in $(-\pi,\pi)$	L1,L2
15	Write the Half range sine series expansion of $f(x)$	L1
16	Find b_n in the half range sine series for $f(x)=1$ in $(0,\pi)$.	L1,L2
17	Find a_0 in the half range cosine series for $f(x)=1$ in $(0,\pi)$.	L1,L2
18	Find a_n in the expansion of $f(x)=\|x\|$ in $(-\pi,\pi)$.	L1,L2
19	Find a_0 in the expansion of $f(x)=\sin x$ in $(0,\pi)$.	L1,L2
20	If $f(x)=\begin{cases}-\pi, & -\pi\le x\le 0\\ x, & 0<x<\pi\end{cases}$, then the find the value of a_0.	L1,L2

PART-B (Ten Marks Questions)		
1.	Find the Fourier series representing $f(x)=x,\ \ 0<x<2\pi$.	L1,L2
2.	Obtain the Fourier series for $f(x)=x-x^2$ in the interval $[-\pi,\pi]$. Hence show that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+.....=\frac{\pi^2}{12}$.	L1,L2
3.	Obtain the Fourier series expansion of $f(x)$ given that $f(x)=(\pi-x)^2$ in $0<x<2\pi$ and hence deduce the value of $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+.....=\frac{\pi^2}{6}$.	L1,L2
4.	Find the Fourier series of the periodic function defined as $f(x)=\begin{cases}-\pi, & -\pi<x<0\\ x, & 0<x<\pi\end{cases}$ and hence deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.....=\frac{\pi^2}{8}$.	L1,L2
5.	Expand the function $f(x)=x^2$ as a Fourier series in $[-\pi,\pi]$ and hence deduce that (a) $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+.....=\frac{\pi^2}{12}$ (b) $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+.....=\frac{\pi^2}{6}$	L1,L2
6.	Find the Fourier expansion of $f(x)=x\cos x,\ \ 0<x<2\pi$.	L1,L2
7.	Find the Fourier expansion of $f(x)=e^x,\ (o,2\pi)$	L1,L2
8.	Find a half-range cosine series of $f(x)=e^x,\ 0<x<l$	L1,L2
9.	Find a half-range cosine series of $f(x)=1,\ 0<x<2$	L1,L2
10.	Find a Fourier-series expansion for the function f(x) defined by $f(x)=\begin{cases}1+\frac{2x}{\pi}, & -\pi\le x\le 0\\ 1-\frac{2x}{\pi}, & 0\le x\le\pi\end{cases}$	L1,L2

11.	Find the half range cosine for the function $f(x)=x$ in the range $0<x<\pi$	L1,L2
12.	Find the half range sine series for the function $f(x)=x$ in the range $0<x<\pi$	L1,L2
13.	Find the half range sine series for $f(x)=x(\pi-x)$ in $0<x<\pi$ and deduce that $\frac{1}{1^3}-\frac{1}{3^3}+\frac{1}{5^3}-\frac{1}{7^3}+.....=\frac{\pi^3}{32}$.	L1,L2
14.	Find the Fourier sine series of the function $f(x)=x^2, 0<x<3$	L1,L2
15.	Find the Fourier cosine series of the function $f(x)=\begin{cases}x^2, 0\le x\le 2\\ 4, 2\le x\le 4\end{cases}$	L1,L2

Question No.	Questions	Blooms Taxonomy
	UNIT – 5: FOURIER TRANSFORMS	
	PART-A (Two Marks Questions)	
1.	State Fourier integral theorem.	L1
2.	Write the formulae for Fourier Sine integrals.	L1
3.	Write the formulae for Fourier Cosine integrals	L1
4.	Write the formulae for Complex Fourier integral	L1
5.	Define Fourier transform.	L1
6.	Define Fourier Sine transform	L1
7.	Define Fourier Cosine transform	L1
8.	Define inverse Fourier Sine transform	L1
9.	Define inverse Fourier Cosine transform	L1
10.	State linear property of Fourier transforms.	L1
11.	State shifting property of Fourier transforms.	L1
12.	Define Finite Fourier cosine transform	L1
13.	Define Inverse finite Fourier cosine transform	L1
14.	Define finite Fourier sine transform	L1
15.	Define Inverse finite Fourier cosine transform	L1
	PART-B (Ten Marks Questions)	
1.	Using Fourier integral, show that $\int_0^\infty \frac{\lambda\sin\lambda x}{(\lambda^2+a^2)(\lambda^2+b^2)}d\lambda=\frac{\pi(e^{-ax}-e^{-bx})}{2(b^2-a^2)}; a,b>0$	L1,L2
2.	Using Fourier integral, show that $\int_0^\infty \frac{1-\cos\pi\lambda}{\lambda}\sin x\lambda\, d\lambda=\begin{cases}\frac{\pi}{2}, & 0<x<\pi\\ 0, & x>\pi\end{cases}$	L1,L2
3.	Using Fourier integral, show that $\int_0^\infty \frac{\lambda^2+2}{(\lambda^4+4)}\cos\lambda x\, d\lambda=\frac{\pi}{2}e^{-x}\cos x$	L1,L2
4.	Find the Fourier transform of $f(x)$ defined by $f(x)=\begin{cases}1, & \lvert x\rvert<a\\ 0, & \lvert x\rvert>a\end{cases}$ and hence evaluate (a) $\int_0^\infty \frac{\sin p}{p}dp$ (b) $\int_{-\infty}^{\infty}\frac{\sin ap\cos px}{p}dp$	L1,L2
5.	Find the Fourier transform of $f(x)$ defined by $f(x)=\begin{cases}1-x^2, & \lvert x\rvert\le 1\\ 0, & \lvert x\rvert>1\end{cases}$ and hence evaluate	L1,L2

	(a) $\int_0^\infty \frac{x\cos x-\sin x}{x^3}\cos\frac{x}{2}dx$ (b) $\int_0^\infty \frac{x\cos x-\sin x}{x^3}dx$	
6.	Show that Fourier transform of $f(x)=\begin{cases} a-\lvert x\rvert, & \lvert x\rvert<a \\ 0, & \lvert x\rvert>a \end{cases}$ is $\frac{2}{s^2}[1-\cos as]$	L1,L2
7.	Find the Fourier transform of $f(x)$ defined by $f(x)=\begin{cases} \sin x, & o<x<\pi \\ 0, & otherwise \end{cases}$	L1,L2
8.	Find the Fourier transform of $f(x)=\begin{cases} a^2-x^2, & \lvert x\rvert<a \\ 0, & \lvert x\rvert>a \end{cases}$ and hence show that $\int_0^\infty \frac{x\cos x-\sin x}{x^3}dx=\frac{\pi}{4}$	L1,L2
9.	Find the Fourier sine transform of $f(x)=e^{-ax}$ and deduce that $\int_0^\infty \frac{s\sin xs}{a^2+s^2}\,ds$	L1,L2
10.	Find the Finite Fourier sine and cosine transforms of f(x) = x, 0<x<4	L1,L2
11.	Find the Fourier transform of $f(x)=e^{-x^2}, -\infty<x<\infty$	
12.	Find the Fourier sine transform of $f(x)=\frac{e^{-ax}}{x}$	
13.	Find f(x), if its Fourier sine transform is e^{-as}	
14.	Find finite fourier cosine transform of $f(x)=\begin{cases} 1, & 0\le x\le \pi/2 \\ -1, & \pi/2\le x\le\pi \end{cases}$	
15.	Find finite fourier cosine transform of $f(x)=\frac{x^2}{2\pi}-\frac{\pi}{6}, 0<x<\pi$	