



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
<b>UNIT – 1: ORDINARY DIFFERENTIAL EQUATIONS</b>		
<b>PART-A (Two Marks Questions)</b>		
<i>Short Answer Type Questions</i>		
1.	Find the differential equation of $y = a x^2$ , where $a$ is a parameter	L2,L3
2.	Write the solution of a) $\frac{dy}{dx} + P(x)y = Q(x)$ b) $\frac{dx}{dy} + P(y)x = Q(y)$	L1
3.	Find the Integrating factor of $\frac{dy}{dx} - \frac{y}{x} = \cos x$	L2,L3
4.	Find the Integrating factor of $(1-x^2) \frac{dy}{dx} + xy = ax$	L2,L3
5.	Find the Integrating factor of $(x+y+1)dy/dx = 1$	L2,L3
6.	Solve $\frac{d^2 y}{dx^2} - a^2 y = 0$	L2,L3
7.	Solve $\frac{d^2 y}{dx^2} + \frac{dy}{dx} + y = 0$	L2,L3
8.	Find the general solution of $(4D^2 + 4D + 1)y = 0$ .	L2,L3
9.	Solve $(D^3 - 1)y = 0$	L2,L3
10.	Solve $(D-1)^2(D+2)y = 0$	L2,L3
11.	Find the particular integral of $(D^2+6D+4)y=e^{3x}$	L2,L3
12.	Solve $(D-1)^2(D+2)y = 0$	L2,L3
13.	Find the particular integral of $(D^2 + 9)y = \cos 3x$	L2,L3
14.	Find the particular integral of $(4D^2+4D+1)y=100$	L2,L3
15.	Write the formulae for A and B in method of variation of parameters	L1

Question No.	Questions	BLOOMS TAXONOMY
<b>UNIT – 1 ORDINARY DIFFERENTIAL EQUATIONS</b>		
<b>PART-B (Ten Marks Questions)</b>		
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 $(x+2y^3) \frac{dy}{dx} = y$	L2,L3
3.	Solve $x \frac{dy}{dx} + y = x^3 y^6$	L2,L3
4.	Solve $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$	L2,L3



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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 $(D^2 + 4D + 4)y = 18 \cosh x$	L2,L3
	b) Solve $(D^2 + D + 1)y = \sin 2x$	L2,L3
8.	a) Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$	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 $(D^2 + 1)y = x \sin x$	L2,L3
13.	Solve $(D^2 - 4D + 4)y = 8x^2 e^{2x} \sin 2x$	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
<b>UNIT -2: PARTIAL DIFFERENTIAL EQUATIONS</b>		
<b>PART-A (Two Marks Questions)</b>		
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



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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.	Solve $xp + yq = z$	L2,L3
12.	What are the multipliers to solve $(y-z)p + (z-x)q = x-y$ by method of multipliers	L2,L3
13.	Solve $p+q=k$	L2,L3
14.	Solve $z = px + qy + (p^3 + q^3)$	L2,L3
15.	What is the process in method of separation of variables	L1

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<b>UNIT -2: PARTIAL DIFFERENTIAL EQUATIONS</b>		
<b>PART-A (Two Marks Questions)</b>		
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.	Solve $xp + yq = z$	L2,L3
12.	What are the multipliers to solve $(y-z)p + (z-x)q = x-y$ by method of multipliers	L2,L3
13.	Solve $p+q=k$	L2,L3
14.	Solve $z = px + qy + (p^3 + q^3)$	L2,L3
15.	What is the process in method of separation of variables	L1

Question No.	Questions	Blooms Taxonomy
<b>UNIT - 3: LAPLACE TRANSFORM</b>		
<b>PART-A (Two Marks Questions)</b>		
1.	Find i) $L(\cos 4t)$ ii) $L(\sinh 2t)$ iii) $L(t^3)$ iv) $L(\cosh 5t)$	L1
2.	Find $L\{\sin^2 2t\}$	L1,L2
3.	Find $L\{\sin 2t \sin 3t\}$	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



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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 tranform	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 $L^{-1}\left\{\frac{1}{(s+1)^2}\right\}$	L1,L2
20.	State Convolution Theorem	L1
<b>PART-B (Ten Marks Questions)</b>		
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) $\cos 2t \cdot \cos 3t$	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 $L\{F(3t)\}$ ii) Find $L\left[\int_0^t \frac{e^{-t} \sin t}{t} dt\right]$	L1,L2
4.	Find i) $L\{t^2 \cos 3t\}$ 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 $2\pi$ and it is given by $F(t) = \begin{cases} \sin t, & 0 < t < \pi \\ 0 & \pi < t < 2\pi \end{cases}$	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 $x'(0) = -2$ by using laplace transform	L1,L2,L3



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13.	Using Laplace transform solve $(D^2 + 2D - 3)y = \sin x$ if $y(0) = y'(0) = 0$ .	L1,L2,L3
14.	Solve $\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = e^{-t}$ , Given that $x(0) = 0$ and $x'(0) = 1$	L1,L2,L3
15.	Solve $y'' - 3y' + 2y = 4t + e^{3t}$ , Given that $y(0) = 1$ and $y'(0) = -1$	L1,L2,L3

Question No.	Questions	Blooms Taxonomy
<b>UNIT – 4: FOURIER SERIES</b>		
<b>PART-A (Two Marks Questions)</b>		
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 $f(x) = \begin{cases} -\pi, & -\pi \leq x \leq 0 \\ x, & 0 < x < \pi \end{cases}$ , then the find the value of $a_0$ .	L1,L2
10	If $f(x)$ is defined in $0 \leq x \leq 2\pi$ write the formulae for $a_0, a_n$ and $b_n$ .	L1,L2
11	If $f(x)$ is defined in $-\pi \leq x \leq \pi$ 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 $f(x) = \begin{cases} -\pi, & -\pi \leq x \leq 0 \\ x, & 0 < x < \pi \end{cases}$ , then the find the value of $a_0$ .	L1,L2

<b>PART-B (Ten Marks Questions)</b>		
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 $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$ .	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 $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$ .	L1,L2



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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 $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ .	L1,L2
5.	Expand the function $f(x) = x^2$ as a Fourier series in $[-\pi, \pi]$ and hence deduce that (a) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$ (b) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots = \frac{\pi^2}{6}$	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 $f(x) = e^x, (0, 2\pi)$	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 $f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi \leq x \leq 0 \\ 1 - \frac{2x}{\pi}, & 0 \leq x \leq \pi \end{cases}$	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 $\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \frac{1}{7^3} + \dots = \frac{\pi^3}{32}$ .	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 $f(x) = \begin{cases} x^2, & 0 \leq x \leq 2 \\ 4, & 2 \leq x \leq 4 \end{cases}$	L1,L2

Question No.	Questions	Blooms Taxonomy
<b>UNIT – 5: FOURIER TRANSFORMS</b>		
<b>PART-A (Two Marks Questions)</b>		
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





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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 $f(x) = \begin{cases} 1, &  x  < a \\ 0, &  x  > a \end{cases}$ 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 $f(x) = \begin{cases} 1 - x^2, &  x  \leq 1 \\ 0, &  x  > 1 \end{cases}$ and hence evaluate (a) $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$ (b) $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} dx$	L1,L2
6.	Show that Fourier transform of $f(x) = \begin{cases} a -  x , &  x  < a \\ 0, &  x  > a \end{cases}$ is $\frac{2}{s^2} [1 - \cos as]$	L1,L2
7.	Find the Fourier transform of $f(x)$ defined by $f(x) = \begin{cases} \sin x, & 0 < x < \pi \\ 0, & \text{otherwise} \end{cases}$	L1,L2
8.	Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, &  x  < a \\ 0, &  x  > a \end{cases}$ 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 $f(x) = \begin{cases} 1, & 0 \leq x \leq \pi/2 \\ -1, & \pi/2 \leq x \leq \pi \end{cases}$	
15.	Find finite fourier cosine transform of $f(x) = \frac{x^2}{2\pi} - \frac{\pi}{6}, 0 < x < \pi$	