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QP CODE: (23MA205)

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SRI KRISHNA COLLEGE OF TECHNOLOGY

An Autonomous Institution, Approved by AICTE and affiliated to Anna University
Accredited by NAAC with "A" grade
Coimbatore, Tamil Nadu

Continuous Internal Assessment – MODEL

Programme(s)	Semester	Course Code(s)	Course Title
B.E. (EEE/ECE)	2	23MA205	DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES

Time: 3.00 Hours
Date: 05.04.2025

Max Marks: 100
No. of Pages:03

COURSE OUTCOMES:

CO1	Recall the concepts to solve second-order ordinary differential equations and partial differential equations	R
CO2	Interpret Fourier series solutions to the problems in engineering field.	U
CO3	Apply Fourier transform techniques to evaluate integrals and analyze continuous-time signals and systems.	AP
CO4	Apply Laplace transform techniques to solve differential equations and analyze linear systems.	AP
CO5	Apply Z transform techniques to analyze and solve discrete-time systems.	AP

	PART – A (10 X 2 = 20 MARKS)	RBT	CO	Marks
1.	Solve $(D^2 + n^2)y = 0$.	R	CO1	2
2.	Transform the equation $(2x+5)^2y'' - 6((2x+5)y'' + 8y = 0$ into a linear equation with constant coefficient.	R	CO1	2
3.	Solve$(D^2 - 7DD' + 6D'^2)z = 0$	R	CO1	2
4.	Infer Dirichlet's condition for f(x) to be expanded as Fourier series	U	CO2	2
5.	Find the constant term in the Fourier series corresponding to $f(x) = cos^2 x$ expressed in the interval $(-\pi, \pi)$.	U	CO2	2
6.	Obtain the Fourier cosine transform of $5e^{-2x} + 2e^{-5x}$	AP	CO3	2
7.	Evaluate the Laplace transform of $t \cos a\, t$	AP	CO4	2
8.	Derive the difference equation for $y_n = (A + Bn)(-3)^n$	AP	CO5	2
9.	Evaluate $Z[e^{-at} \sin b\, t]$.	AP	CO5	2
10.	Evaluate$Z[n(n-1)]$.	AP	CO5	2

		PART - B (5 X 16 = 80 MARKS)	RBT/CO/ MARKS
11.	i)	Solve $(x^2D^2 - xD + 4)y = x^2 \sin(\log x)$	RBT: R /CO: CO1 Marks: 8
	ii)	Solve $(D^2 - 5DD' + 6D'^2)z = y \sin x$	RBT: R /CO: CO1 Marks: 8
		(OR)	
12.	i)	Solve $(y - xz)p + (yz - x)q = (x + y)(x - y)$	RBT: R /CO:CO1 Marks: 6
	ii)	Solve the equation $\frac{d^2y}{dx^2} + a^2y = \tan ax$ by the method of variation of parameters	RBT: R/ CO:CO1 Marks: 10
13.	i)	Solve $x(y - z)p + y(z - x)q = z(x - y)$	RBT: R /CO:CO1 Marks:6
	ii)	A uniform string is stretched and fasted to two points 'l' apart. Motion is started by displacing the string into the form of the curve $y = k \sin \frac{\pi x}{l}$ from which it is released at time t=0. Find the displacement of the point of the string at a distance 'x' from one end at time t.	RBT: U /CO:CO2 Marks: 10
		(OR)	
14.	i)	Develop the Fourier cosine series for $f(x) = x$ in $0 < x < 1$ and deduce $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$.	RBT: U /CO:CO2 Marks: 8
	ii)	Find the Fourier series for $f(x) = \lvert x \rvert$ in $-l < x < l$ Hence find the value of $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots\ldots to\ \infty$.	RBT: U /CO:CO2 Marks: 8
15.	i)	Find the Fourier Transform of $f(x) = \begin{cases} 7 - \lvert x \rvert, \lvert x \rvert < 7 \\ 0, \lvert x \rvert > 7 \end{cases}$. Hence deduce (i) $\int_0^{\infty} \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$ (ii) $\int_0^{\infty} \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$	RBT: AP /CO:CO3 Marks: 12
	ii)	Find the Fourier cosine transform of e^{-ax}.hence deduce the value of $\int_0^{\infty} \frac{dx}{(x^2+1)(x^2+4)}$	RBT: AP /CO:CO3 Marks: 4
		(OR)	
16.	i)	A string is stretched between two fixed points at a distance 2l apart the points on the string are given initial velocity v where $v = \begin{cases} \frac{cx}{l}, 0 < x < l \\ \frac{c}{l}(2l - x), l < x < 2l \end{cases}$ Find the displacement.	RBT: AP /CO:CO3 Marks: 12
	ii)	Deduce that $\frac{1}{\sqrt{x}}$ is self-reciprocal under Cosine transformations if $F_c(x^{n-1}) = \sqrt{\frac{2}{\pi}} \cos\left(\frac{n\pi}{2}\right) \frac{\Gamma(n)}{s^n}$	RBT: AP /CO:CO3 Marks: 4

17.	i)	Find $L^{-1}\left[\frac{s}{(s^2+a^2)(s^2+b^2)}\right]$ using convolution theorem	RBT: AP/ CO:CO4 Marks: 6
	ii)	Solve the differential equation $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = e^{-t}$ with $y(0) = 1$and $y'(0) = 0$ using Laplace transform	RBT: AP /CO:CO4 Marks: 10
		(OR)	
18.	i)	Solve the initial value problem $y'' - 3y' + 2y = 4t, y'(0) = -1, y(0) = 1.$	RBT: AP /CO:CO4 Marks: 10
	ii)	Find $L\left(\int_0^t t\, e^{-t} \sin t \; dt\right)$	RBT: AP /CO:CO4 Marks: 6

19.	i)	Using Convolution theorem find $Z^{-1}\left[\frac{z^2}{(z+2)^2}\right]$	RBT: AP/ CO:CO5 Marks: 6
	ii)	Solve $y_{n+2} - 7y_{n+1} + 12y_n = 2^n$ given that $y_0 = y_1 = 0$	RBT: AP /CO:CO5 Marks: 10
		(OR)	
20.	i)	Apply Partial fraction method to find $Z^{-1}\left[\frac{4z^3}{(2z-1)^2(z-1)}\right]$	RBT: AP /CO:CO5 Marks: 6
	ii)	Solve the difference equation $y(n+3) - 3y(n+1) + 2y(n) = 0$ given that y(0)=4, y(1)=0,y(2)=8 using Z-transform.	RBT: AP/ CO:CO5 Marks: 10

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Continuous Internal Assessment – I

Programme(s)	Semester	Course Code(s)	Course Title
B.E-ECE & EEE	2	23MA205	DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES

Time: 1.5 Hours
Date: 13.02.2025

Max Marks: 50
No. of Pages:02

COURSE OUTCOMES:

CO1	Recall the concepts to solve second -order ordinary differential equations and partial differential equations	R
CO2	Interpret Fourier series solutions to the problems in engineering field	U
CO3	Apply Fourier transform techniques to evaluate integrals and analyze continuous time signals and systems	AP
CO4	Apply Laplace transform techniques to solve differential equations and analyze linear systems	AP
CO5	Apply Z transform techniques to analyze and solve discrete -time systems	AP

	PART - A (9 X 2 = 18 MARKS)	RBT	CO	Marks
1.	Solve $(D^2 - D + 1)y = 0$	R	CO1	2
2.	Compute the complementary function of $(D^2 + 2D + 1)y = sin2x$	R	CO1	2
3.	Construct the particular integral of $(D-3)^2 y = e^{-2x}$	R	CO1	2
4.	Compute the particular integral of $(D+1)^2 y = e^{-x}\cos x$	R	CO1	2
5.	Construct the particular integral of $(D^2 + 1)y = \sin x$	R	CO1	2
6.	Express the equation $xy'' + y' + 1 = 0$ into a linear equation with constant coefficients	R	CO1	2
7.	Convert the equation $(2x-1)^2 y'' - 4(2x-1)y' + 8y = 8x$ into a linear equation with constant coefficients	R	CO1	2
8.	Use PDE concepts to compute the general solution of $(D^2 - 5DD' + 6D'^2)z = 0$.	R	CO1	2

9.	Predict the general solution of the partial differential equation $(D^2 - 2DD' + D'^2)z = 0.$	R	CO1	2

		PART – B (2 X 16 = 32 MARKS)	RBT/CO/ MARKS
10.	i)	Solve: $(D^2 + 4D + 3)y = e^{-x}\sin x + xe^{3x}$	RBT: R CO:CO1 Marks: 10
	ii)	Compute the solution of $(D^2 + a^2)y = \sec ax$	RBT: R CO:CO1 Marks:6
		(OR)	
11.	i)	Solve: $(x^2D^2 - 4xD + 2)y = x\log x$	RBT: R CO:CO1 Marks: 8
	ii)	Construct the complementary function and Particular integral of $(D^2 + 4)y = \cos^2 x$	RBT: R CO:CO1 Marks: 8
12.	i)	Solve: $(3x+2)^2\frac{d^2y}{dx^2} - 3(3x+2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1$	RBT: R CO:CO1 Marks: 8
	ii)	Use method of multipliers to solve the partial differential equation $(mz - ny)p + (nx - lz)q = ly - mx$	RBT: R CO:CO1 Marks: 8
		(OR)	
13.	i)	Predict the solution of the Lagrange's linear equation $(x - y)p + (y - x - z)q = z$	RBT: R CO:CO1 Marks: 8
	ii)	Solve $(D^2 - 4DD' + 4D'^2)z = e^{2x+y}$	RBT: R CO:CO1 Marks: 8

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Continuous Internal Assessment – II

Programme(s)	Semester	Course Code(s)	Course Title
B.E-ECE & EEE	2	23MA205	DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES

Time: 1.5 Hours
Date: 13.03.2025_FN

Max Marks: 50
No. of Pages:02

COURSE OUTCOMES:

CO1	Recall the concepts to solve second -order ordinary differential equations and partial differential equations	R
CO2	Interpret Fourier series solutions to the problems in engineering field	U
CO3	Apply Fourier transform techniques to evaluate integrals and analyze continuous time signals and systems	AP
CO4	Apply Laplace transform techniques to solve differential equations and analyze linear systems	AP
CO5	Apply Z transform techniques to analyze and solve discrete -time systems	AP

	PART – A (9 X 2 = 18 MARKS)	RBT	CO	Marks
1.	Explain Dirichlet's conditions for Fourier series	R	2	2
2.	Find a_0 for the function $f(x)=\begin{cases}0 & ; 0<x<\pi \\ \sin x; & \pi<x<2\pi\end{cases}$	U	2	2
3.	In the Fourier series expansion of $f(x)=\begin{cases}1+\frac{2x}{\pi} & ; -\pi<x<0 \\ 1-\frac{2x}{\pi} & ; 0<x<\pi\end{cases}$ in $(-\pi,\pi)$ find the value of b_n, the coefficient of sin x	U	2	2
4.	To which value the half range sine series corresponding to $f(x)=x^2$ expressed in the interval (0,2) converges at x=2?	U	2	2
5.	Express the possible solutions of one dimensional wave equation	R	2	2
6.	Write the formula for complex Fourier Transform of f(x)	R	3	2
7.	Find the Fourier transform of $f(x)=\begin{cases}e^{iwx} & ; a<x<b \\ 0 & ; x<a, a>b\end{cases}$	AP	3	2
8.	Predict the Fourier Sine Transform of $f(x)=\frac{1}{x}$	AP	3	2
9.	Give the Parseval's identity	R	3	2

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		PART - B (2 X 16 = 32 MARKS)	RBT/CO/ MARKS
10.	i)	Express $f(x)=(\pi-x)^2$ as a Fourier series of period 2π in the interval $0<x<2\pi$. Hence deduce the sum of the series $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots$	RBT: AP CO:CO2 Marks: 10
	ii)	Obtain the Fourier series to represent the function $f(x)=\lvert x\rvert$	RBT: AP CO:CO2 Marks: 6
		(OR)	
11.	i)	Obtain the Fourier series to represent $f(x)=x^2$ from $x=-l$ to $x=l$	RBT: AP CO:CO2 Marks: 10
	ii)	Obtain the half range cosine series of the function $f(x)=x$ in $0\le x\le\pi$	RBT: AP CO:CO2 Marks: 6
12.	i)	A string is stretched and fastened to two points **x=0** and **x=*l*** apart. Motion is started by displacing the string into the form $y=k(lx-x^2)$ from which it is released at time t=0. Find the displacement of any point on the string at a distance of x from one end at time t.	RBT: AP CO:CO2 Marks: 12
	ii)	Obtain the half range sine series of the function $f(x)=kx(x-l)$ in $0\le x\le l$	RBT: AP CO:CO2 Marks: 4
		(OR)	
13.	i)	Compute the Fourier transform of $f(x)=\begin{cases}a^2-x^2 & for\lvert x\rvert<a\\ 0 & \lvert x\rvert>a\end{cases}$ Hence show that (i) $\int_0^\infty\left(\frac{\sin t-t\cos t}{t^3}\right)dt=\frac{\pi}{4}$ (ii) $\int_0^\infty\left(\frac{\sin t-t\cos t}{t^3}\right)^2dt=\frac{\pi}{15}$	RBT: AP CO:CO3 Marks: 12
	ii)	Predict $F_s[e^{-ax}]$	RBT: AP CO:CO3 Marks: 4

//END//