Course Learning Syllabus *(// includes Learning Outcomes, Learning Plan & Assessment Plan)*

Course Code	18MAB201T	Course Name	TRANSFORMS AND BOUNDARY VALUE PROBLEMS	Course Category	B	Basic Sciences	L	T	P	C
							3	1	0	4

Pre-requisite Courses	18MAB102T	Co-requisite Courses	NIl	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Analyze different types of partial differential equations, interpret the solutions that relate PDE to the respective branches of engineering.
CLR-2:	Relate Fourier series expansion to examine Sine and Cosine Series.
CLR-3:	Apply PDE and Solve one dimensional wave and heat equations.
CLR-4:	Examine the various types of integral transforms.
CLR-5:	Analyze z transform for solving discrete-time Signal problems.
CLR-6	Distinguish the importance of PDE, Fourier series, one dimensional wave and heat equations, Fourier and Z – transform.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Learning Blooms Level (1-6)	Program Outcomes (PO) 1	2	3	4	5	6	7	8	9	10	11	12
			Engineering Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life-Long Learning
CO-1:	Construct and solve partial differential equations using various techniques	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-2:	Explain the Fourier series expansion of a function in terms of sine and cosine series.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-3:	Identify Partial differential equations and utilize Fourier series techniques to solve one dimensional wave and heat equations.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-4:	Apply Fourier transforms techniques in signal analysis.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-5:	Solve discrete-time signal problems using z transforms.	4	3	3	-	-	-	-	-	-	-	-	-	-
CO-6:	Utilize PDE, Fourier series, one dimensional wave and heat equations, Fourier and Z transforms to solve engineering problems.	4	3	3	-	-	-	-	-	-	-	-	-	-

		Learning Unit / Module 1	Learning Unit / Module 2	Learning Unit / Module 3	Learning Unit / Module 4	Learning Unit / Module 5
Duration (hour)		12	12	12	12	12
S-1	SLO-1	Formation of partial differential equation by eliminating arbitrary constants	Introduction of Fourier series - Dirichlet's conditions for the existence of Fourier Series	Classification of second-order partial differential equations	Introduction of Fourier Transforms	Introduction of Z-transform
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary constants	Fourier series–related problems in $(0,2\pi)$	Method of separation of variables	Fourier Transforms- problems	Z-transform-elementary properties
S-2	SLO-1	Formation of partial differential equation by eliminating arbitrary functions	Fourier series–related problems in $(-\pi,\pi)$	One dimensional Wave Equation and its possible solutions	Properties of Fourier transforms	Z-transform- change of scale property, shifting property
	SLO-2	Formation of partial differential equation by eliminating two or more arbitrary functions	Change of interval Fourier series–related problems in $(0,2l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 1 Algebraic function	Standard results of Fourier transform	Z-transform of $a^n, \frac{1}{n}, \frac{1}{n+1}$
S-3	SLO-1	Formation of partial differential equation by eliminating arbitrary functions of the form $\phi(u,v)=0$	Fourier series–related problems in $(-l,l)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 2 Trigonometric function	Fourier Sine Transforms - problems	Z-transform of $\frac{1}{n^2}, \frac{1}{(n+1)^2}$
	SLO-2	Solution of first-order nonlinear partial differential equations-standard type I F (p, q) =o	Fourier series –half range cosine series related problems $(0,\pi)$	One dimensional Wave Equation-initial displacement with zero initial velocity-type 3 – Midpoint of the string is displaced	Fourier Cosine Transforms - problems	Z-transform of $r^n \cos n\theta$
S-4	SLO-1	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
	SLO-2	Problem solving using tutorial sheet 1	Problem solving using tutorial sheet 4	Problem solving using tutorial sheet 7	Problem solving using tutorial sheet 10	Problem solving using tutorial sheet 13
S-5	SLO-1	Solution of first order nonlinear partial differential equations-standard type –II Clairaut's form	Fourier series –half range cosine series related problems $(0,l)$	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 1 Algebraic function	Properties of Fourier sine Transforms	Z-transform of $r^n \sin n\theta$

	SLO-2	Solution of first order nonlinear partial differential equations-standard type III F(z, p, q)=o	Fourier series –half range sine series related problems $(0,\pi)$	One dimensional Wave Equation-initial displacement with non-zero initial velocity Type 2 Trigonometric function	Fourier sine Transforms applications	Initial value theorem
S-6	SLO-1	Solution of first order nonlinear partial differential equations-standard type-IV separation of variable f(x, p) = g(y, q)	Fourier series –half range sine series related problems $(0,l)$	Wave Equation-initial displacement with non-zero initial velocity Type 3 split function	Properties of Fourier cosine Transforms	Final value theorem
	SLO-2	Lagrange's linear equation: Method of grouping	Parseval's Theorem (without proof)-related problems in Fourier series	One dimensional heat equation and its possible solutions	Fourier cosine Transforms applications	Inverse Z-transform- long division method
S-7	SLO-1	Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in cosine series	One dimensional heat equation related problem	Convolution of two function	Inverse Z-transform, related problems, long division method
	SLO-2	More problems in Lagrange's linear equation: Method of multipliers	Parseval's Theorem (without proof)-related problems in sine series	One dimensional heat equation - Steady-state conditions	Convolution Theorem	Inverse Z-transform, Partial fraction method
S-8	SLO-1	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
	SLO-2	Problem solving using tutorial sheet 2	Problem solving using tutorial sheet 5	Problem solving using tutorial sheet 8	Problem solving using tutorial sheet 11	Problem solving using tutorial sheet 14
S-9	SLO-1	Linear Homogeneous partial differential equations of second and higher order with constant coefficients-CF and PI Type 1: e^{ax+by}	Introduction to Harmonic Analysis	One dimensional heat equation - Steady state conditions more problems	Parseval's Identity for Fourier transform	Inverse Z-transform, Partial fraction method related problems
	SLO-2	PI Type2.: sin(ax+by) or cos(ax+by)	Harmonic Analysis for finding harmonic in $(0,2\pi)$	One dimensional heat equation - Steady state conditions with zero velocity	Parseval's Identity for Fourier sine & cosine transforms	Inverse Z-transform - residue theorem method
S-10	SLO-1	PI Type 3: polynomials	Harmonic Analysis for finding harmonic in $(0,2l)$	One dimensional heat equation - Steady state conditions with zero velocity more problems	Parseval's Identity for Fourier sine & cosine transforms applications	Inverse Z-transform - residue theorem method-problems
	SLO-2	PI Type 4: Exponential shifting - $e^{ax+by}f(x,y)$	Harmonic Analysis for finding harmonic in periodic interval $(0,T)$	One dimensional heat equation - Steady state conditions with zero velocity more related problems	Fourier Transforms Using Differentiation property	Convolution theorem (without proof)
S-11	SLO-1	Linear Homogeneous partial differential equations of second and higher order with constant coefficients type 5 General rule	Harmonic Analysis for finding cosine series	Steady state conditions and non-zero boundary conditions- related problems	Solving integral equation	Convolution theorem applications
	SLO-2	Applications of Partial differential equations in Engineering	Harmonic Analysis for finding sine series	Steady state conditions and non-zero boundary conditions- more related problems	Self-reciprocal using Fourier Transform, sine and cosine transform	Solution of linear difference equations with constant coefficients using Z-transform
S-12	SLO-1	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15
	SLO-2	Problem solving using tutorial sheet 3	Problem solving using tutorial sheet 6	Problem solving using tutorial sheet 9	Problem solving using tutorial sheet 12	Problem solving using tutorial sheet 15

Learning Resources

1. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015.
3. Veerarajan T., Transforms and Partial Differential Equations, Tata McGraw-Hill, New Delhi, 3rd edition,2012.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2010 3rd Edition.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, New Delhi, Reprint,3rd edition,2014

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%		20%		20%	
Level 2	Understand	20%		20%		20%		20%		20%	
Level 3	Apply	30%		30%		30%		30%		30%	
Level 4	Analyze	30%		30%		30%		30%		30%	
Level 5	Evaluate	-		-		-		-		-	
Level 6	Create	-		-		-		-		-	
	Total	100 %		100 %		100 %		100 %		100 %	

 # CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,
SLO – Session Learning Outcome

Course Designers

(a) Experts from Industry							
1	Mr.V.Maheshwaran	CTS, Chennai	maheshwaranv@yahoo.com				
(b) Experts from Higher Technical Institutions							
2	Dr.K.C.Sivakumar	IIT, Madras	kcskumar@iitm.ac.in	3	Dr.Nanjundan	Bangalore University	nanzundan@gmail.com
(b) Internal Experts							
4	Dr.A. Govindarajan	SRMIST	govindarajan.a@ktr.srmuniv.ac.in	5	Dr.K.Ganapathy subramanian	SRMIST	ganapathy.k@ktr.srmuniv.ac.in

IMPORTANT DATES:

CLAT 1- 07-09-2022	ASSIGNMENT I 26-08-2022
CLAT 2- 13-10-2022	ASSIGNMENT II 26-09-2022
CLAT 3- 16-11-2022	

10.8.2022

SIGNATURE OF COURSE COORDINATORS

K. Veera 10.8.22

SIGNATURE OF HOD

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