

SRI KRISHNA INSTITUTE OF TECHNOLOGY, BANGALORE



Academic Year 2019-20

Program:	B E – Information Science& Engineering
Semester :	3
Course Code:	18MAT31
Course Title:	Transform Calculus, Fourier Series And Numerical Techniques
Credit / L-T-P:	3 / 2-2-0
Total Contact Hours:	50
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Academic Evaluation and Monitoring Cell

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Note: Remove "Table of Content" before including in CP Book

Each Course Plan shall be printed and made into a book with cover page

Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	IS
Semester:	3	Academic Year:	2019-20
Course Title:	Transform Calculus, Fourier Series and Numerical Techniques	Course Code:	18MAT31
,	- /	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	60 Marks
CIA Marks:	40 Marks	Assignment	1 / Module
Course Plan Author:	Smitha N	Sign	Dt:21-10-2019
Checked By:	Mallikarjun G D	Sign	Dt:26-10-2019
CO Targets	CIA Target: 90%	SEE Target:	70 %

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Mod	Content	Teachi	Identified	Blooms
ule		ng	Module	Learning
		Hours	Concepts	Levels
1	Laplace transforms of elementary functions.Laplace	5	Differential	L3
	transforms of periodic functions and unit step functions.		Equations	
1	Inverse laplace transforms, convolution theorem to find	5	Differential	L3
	the inverse laplace transforms and problems.Solution of		Equations	
	linear differential equations using Laplace transform.			
2	Fourier series of $2\Pi,2l$ period & half range fourier series	6	Analyze	L3
			circuits&system	

			communication	
2	Practical Harmonic analysis.	4	Analyze	L4
			circuits&system	
			communication	
3	Infinite Fourier transforms, fourier sine and cosine	4	Continuous	L3
	transforms & Fourier inverse transforms		signal process	
3	Z-transforms and inverse z-transforms	6	Discrete signal	L3
			process	
4	Numerical Solutions of ODE of first order and degree-	5	Ordinary	L3
	Taylor's Method, Modified Euler's Equations		Differential	
			Equations.	
4	RK method, Milne's and Adams Bashforth method	5	Ordinary	L3
			Differential	
			Equations.	
5	Numerical Solutions of second order ODE using Runge-	7	Ordinary	L3
	Kutta method and Milne's Method.		Differential	
			Equations.	
5	Variational problems, euler's equations, geodesics and	3	Maximum and	L4
	problems		minimum	

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

- 1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15
- 30 minutes
- 2. Design: Simulation and design tools used software tools used ; Free / open source
- 3. Research: Recent developments on the concepts publications in journals; conferences etc.

Modul	Details	Chapter	Availability
es		s in	
		book	
A	Text books (Title, Authors, Edition, Publisher, Year.)	-	-
1,2,3,	1;.B.S Grewal, higher engineering mathematics		In Lib/dept
4,5			
1,2,3,	2:Advanced engineering mathematics by ERWIN KREYZIG		In Lib/dept
4,5			
1,2,3,	3:Advanced engineering mathematics by PETER V. O'NEIL		In Lib/dept
4,5			
В	Reference books (Title, Authors, Edition, Publisher, Year.)	-	-
1,2,3,	1: N.P.BAIL AND MANISH GOYAL:A text book of engineering		In dept
4,5	mathematics,laxmi publishers,7th edition,2010		
1,2,3,	2: B.V Ramana:Higher engineering mathematics TATA McGRAW-HILL		In Lib
4	2006		
С	Concept Videos or Simulation for Understanding	-	-

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1	https://www.khanacademy.org/math/differential-		
	equations/laplace-transform/laplace-transform-tutorial/v/laplace-		
	transform-1		
2	https://www.youtube.com/watch?v=KeT6CB6Qi10		
3	https://www.youtube.com/watch?v=mJgVOV9jRZU		
5	https://www.youtube.com/watch?v=GiPOQC5nYMs		
D	Software Tools for Design		
E	Recent Developments for Research	-	-
F	Others (Web Video Simulation Notes etc.)		_
	Others (Web, Video, Simulation, Notes etc.)	-	-
4	https://www.youtube.com/watch?v=Os8OtXFBLkY		
4	https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential- equation/		
5	https://www.youtube.com/watch?v=zr12pnzNoXI		

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

Mod	Course	Course Name	Topic / Description	Sem	Remarks	Blooms
ules	Code					Level
1	17MAT21	Transform	Module-1/Evaluation	2	Revision	L2
		Calculus,	of homogeneous and			
		Fourier Series	non homogeneous			
		and	differential equations.			
		Numerical				
		Techniques				

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Mod	Topic / Description	Area	Remarks	Blooms
ules				Level
1				
2				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Mod	Course	Course Outcome	Teach.	Concept	Instr	Assessm	Blooms'
ules	Code.#	At the end of the course,	Hours		Method	ent	Level
		student should be able to				Method	
1	18MAT31.1	Use laplace transform in solving	5	Differentia	Lecture	Assignme	L3
		Differential equations arising in		ļ		nt and	
		network analysis, control		equations		Slip Test	
		systems and other fields of					
		engineering.					
1	18MAT31.2	Use inverse laplace transform in	5	Differentia	Lecture	Assignme	L3
		solving Differential/ integral		I		nt and	
		equations arising in network		equations		Slip Test	
		analysis, control systems and					
		other fields of engineering.					
2	18MAT31.3	Analyze expansion of Fourier	6	Analyze		Assignme	L3
		series using Euler formula		circuits&sy		nt and	
				stem .		Slip Test	
				communic			
	10044721 4	Annh. Familia ann an ion	4	ation	1	A :	1.4
2	18MA131.4	Apply Fourier expansion in	4	Analyze		Assignme	L4
		practical harmonic problems		circuits&sy		nt and	
				stem communic		Slip Test	
				ation			
3	18MAT31 5	Apply to transform form one to	5	Continuou	Lecture	Assianme	L3
	TOWIATOT.5	another domain by Fourier		s signal		nt and	LJ
		integrals		process		Slip Test	
3	18MAT31.6	Apply to transform one domain	5	Discrete	Lecture	Assignme	L3
		to another domain by z-		signal		nt and	
		transforms		process		Slip Test	
4	18MAT31.7	Use appropriate single step	6	O.D.E	Lecture	Assignme	L3
		numerical methods to solve first				nt and	
		order ordinary differential				slip test	
		equations.					
4	18MAT31.8	Use appropriate multi-step	4	O.D.E	Lecture	Assignme	L3
		numerical methods to solve first				nt and	
		order ordinary differential				slip test	
		equations arising in flow data					
		design problems.					
5	18MAT31.9	Use appropriate multi-step	5	Differentia	Lecture	Assignme	L3

		numerical methods to solve				nt and	
		second order ordinary		equations		slip test	
		differential equations arising in					
		flow data design problems.					
5	18MAT31.1	Analyze how to apply the Euler's	5	maximum	Lecture	Assignme	L4
	0	equations for a given function by		&minimum		nt and	
		Euler's equation				Slip Test	
-	-		50	-	-	-	-

2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

Mod	Application Area	СО	Level
	• •	CO	Level
ules	Compiled from Module Applications.		
1	To study the nature of signals and control systems.	CO1	L3
		&C02	
2	To solve equations arising in network analysis and other fields of engineering.	CO3	L3
2	To study the nature of wave forms in voltage- current characteristics .	CO4	L3
3	Used to convert to discrete time domain signal into discrete frequency domain	CO5	L3
	signal.		
3	To study the continuous and Apply to transform one domain to another	CO6	L3
	domain by z-transforms discrete signals and its properties.		
4	To solve first order ODE using single step numerical methods	CO7	L3
4	To solve first order ODE using single step and multistep numerical methods	CO8	L3
5	To solve first order and second order ODE using single step numerical	CO9	L3
	methods		
5	To determine extremal functions arising in dynamics of rigid bodies and	CO10	L4
	vibrational analysis in the field of civil engineering.		

3. Mapping And Justification

CO - PO Mapping with mapping Level along with justification for each CO-PO pair. To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Мо	Мар	ping	Маррі	Justification for each CO-PO pair	Lev				
dul			ng		el				
es			Level						
-	CO PO -		O - 'Area': 'Competency' and 'Knowledge' for specified						
			'Accomplishment'						
1	CO1	PO1 L3 Apply the knowledge of Laplace transforms to find the solution to							
				complex engineering problems					
1	CO1	PO2	L4	To analyze and study the nature of signals and control systems.	L4				
1	CO2 PO1 L3		L3	L3 Apply the knowledge of Laplace transforms and inverse laplace					
				transforms to find the solution to complex engineering problems					

1	CO2	PO2	L4	To analyze and study the nature of signals and control systems.	L4
2	CO3	PO1	L3	Apply the knowledge of Fourier series to find the solution to complex	L3
				engineering problems.	
2	CO3	PO2	L4	To analyze boundary value problems for linear ODE's	L4
2	CO4	PO1	L3	Apply the knowledge of Fourier series to find the solution to complex	L3
				engineering problems.	
2	CO4	PO2	L3	To analyze boundary value problems for linear ODE's	L3
3	CO5	PO1	L3	Apply the knowledge of Fourier transforms to find solution to	L3
				complex engineering problems.	
3	CO5	PO2	L4	To analze time domain and frequency domain in signal processing.	L4
3	CO6	PO1	L3	Apply the knowledge of Z-Transforms to find the solution to	L3
				complex engineering problems.	
3	CO6	PO2	L4	To Analyze digital filters and discrete signal.	L4
4	CO7	PO1	L3	Apply the knowledge of Numerical techniques to solve ordinary	L3
				differential equations	
4	CO7	PO2	L4	To analyze and solve first order ODE using single step numerical	L4
				methods	
4	CO8	PO1	L3	Apply the knowledge of Numerical techniques to solve ordinary	L3
				differential equations	
4	CO8	PO2	L4	To analyze and solve first order ODE using single step and multistep	L4
				numerical methods	
5	CO9	PO1	L3	Apply the knowledge of Numerical techniques to solve ordinary	L3
				differential equations	
5	CO9	PO2	L4	To analyze and apply first order and second order ODE using single	L4
				step numerical methods	
5	CO10	PO1	L3	Apply the knowledge of calculus in solving complex engineering	L3
_				problems.	<u> </u>
5	CO10	PO2	L4	To analyze the rotation of a rigid body using a reference frame with	L4
				its axis fixed to the body.	

4. Articulation Matrix

CO - PO Mapping with mapping level for each CO-PO pair, with course average attainment.

_	-	Course Outcomes					Pr	og	ram	Οι	utc	ome	es					-
Mod	CO.#	At the end of the course	РО	РО	РО	РО	РО	РО	PS	PS	PS	Lev						
ules		student should be able to	1	2	3	4	5	6	7	8	9	10	11	12	01	02	О3	el
1	CO1	Use laplace transform in	2.	2.														L3
		solving Differential equations	5	5														
		arising in network analysis,																
		control systems and other	-															
		fields of engineering.																
1	CO2	Use inverse laplace transform	2.	2.														L3
		in solving Differential/ integra	5	5														

				Т		Т	Т			Т	
		equations arising in network									
		analysis, control systems and									
		other fields of engineering.									
2	CO3	Analyze expansion of Fourier	2.	2							L3
		series using Euler formula	5	5	;						
2	CO4	Apply Fourier expansion in	2.	2							L4
		practical harmonic problems	5	5	;						
3	CO5	Apply to transform form one to	2.	2							L3
		another domain by Fourier	5	5	;						
		integrals									
3	CO6	Apply to transform one domain	2.	2							L3
		to another domain by z-	5	5	;						
		transforms									
4	CO7	Use appropriate single step	2.	2							L3
		numerical methods to solve	5	5	;						
		first order ordinary differential									
		equations.									
4	CO8	Use appropriate multi-step	2.	2							L3
		numerical methods to solve	5	5	;						
		first order ordinary differential									
		equations arising in flow data									
		design problems.									
5	CO9	Use appropriate multi-step	2.	2							L3
		numerical methods to solve	5	5	;						
		second order ordinary									
		differential equations arising in									
		flow data design problems.									
5	CO10	Analyze how to apply the	2.	2							L4
		Euler's equations for a given		5	;						
		function by Euler's equation									
\Box				_						 	

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Mod	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
ules					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Mod	Gap Topic	Area	Actions	Schedule	Resources	PO Mapping
ules			Planned	Planned	Person	

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Mod	Title	Teach		No. of	quest		СО	Levels		
ules			CIA-	CIA-	CIA-	Asg	Extra	SEE		
		Hours	1	2	3		Asg			
1	Laplace transforms	10	2	_	-	1		2	CO1, CO2	L3
4	Numerical Methods-1	10	2	-	-	1		2	CO7,CO8	L3
	Numerical methods and Calculus of variations	10	-	2	-	1		2	CO9,CO10	L4
2	Fourier series	10	-	2	-	1		2	CO3,CO4	L4
	Fourier Transforms and Z– Transforms	10	-	-	4	1		2	CO5,CO6	L3
-	Total	50	4	4	4	5		10	-	-

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modu	Evaluation	Weightage in	СО	Levels
les		Marks		
1 &4	CIA Exam - 1	30	CO1, CO2, CO7,CO8	L3
2 & 5	CIA Exam - 2	30	CO3,CO4 ,CO9, CO10	L4
3	CIA Exam - 3	30	CO5,CO6	L3
1 &4	Assignment – 1	10	CO1, CO2, CO7,CO8	L3
2 & 5	Assignment – 2	10	CO3,CO4 ,CO9, CO10	L4
3	Assignment – 3	10	CO5,CO6	L3
	Seminar - 1	_	_	-
	Seminar - 2	_	_	-
	Seminar – 3	_	_	-
		_	- -	_
	Other Activities - define - Slip	_	_	-
	test			
	Final CIA Marks	40	-	-

D1. TEACHING PLAN - 1

Module - 1

Title:	Laplace Transforms and Inverse Laplace Transforms	Appr	10Hrs
		Time:	
а	Course Outcomes	_	Bloon
_	The student should be able to:	_	Level
1	Use laplace transform in solving Differential equations arising in network analysis, control systems and other fields of engineering.	CO1	L3
2	Use inverse laplace transform in solving Differential/ integral equations arising in network analysis, control systems and other fields of engineering.		L3
b	Course Schedule	_	_
Class No	Module Content Covered	CO	Level
1	Laplace transforms of elementary functions.	CO1	L3
2	Laplace transforms of periodic functions	CO1	L3
3	Problems on periodic functions	CO1	L3
4	Unit step functions	CO1	L3
5	Problems on unit step functions	CO1	L3
6	Inverse laplace transforms,	CO2	L3
7	Convolution theorem to find the inverse laplace transforms	CO2	L3
8	Additional problems	CO2	L3
9	Solution of linear differential equations using Laplace transform.	CO2	L3
10	Additional problems	CO2	L3
С	Application Areas	СО	Level
1	To study the nature of signals and control systems.	CO1	L3
2	To solve equations arising in network analysis and other fields of engineering.	CO2	L3
d	Review Questions	_	_
1	Find the laplace transform of $2e^{\frac{2}{3}4t}\sin 3t$	CO1	L3
2	Express in terms of unit step function and hence find its laplace transform $f = 0 \text{ and } \pi$	CO1	L3
3	Solve by using laplace transforms $\frac{d^2y}{dt} = \frac{dy}{dt} = y \cdot \mathbf{l} e^{-t}$ and	CO2	L3

	y T Ty ' T TO		
4	If a periodic function of period $2a$ is defined by	CO1	L4
	$f = \frac{t}{2} \frac{if \ 0 \ \exists t \ \exists a}{a-t} \text{ then show that } L = \frac{1}{s^2} \text{Q} \text{canh } \frac{ds}{2} \text{Q}$		
5	Find the inverse laplace transform of $\frac{2}{2}$ $\frac{2}{3}$	CO2	L3
6	Find $L^{-1} \frac{1}{\text{convolution Theorem}}$ using Convolution Theorem.	CO2	L3
7	Solve $y'' = y = 12t^2e^{-3t}$ by laplace transforms method with	CO2	L3
	y A B 0 B y ' A 0		
8	If a periodic function of period $\frac{2\pi \sqrt{3}}{w}$ is defined by $f = \frac{Esinwt}{w} \text{if } 0 = \frac{\pi}{w}$ then show that $\frac{Ew}{w} = \frac{Ew}{w} = \frac{e^{as}}{w} =$	CO1	L4
е	Experiences	_	_
1			
2			

Module - 4

Title:	Numerical Solution Of ODE's:	Appr	10 Hrs
		Time:	
а	Course Outcomes	-	Bloom
_	The student should be able to:	_	Level
1	Use appropriate single step numerical methods to solve first order ordinary differential equations.	C07	L3
2	Use appropriate multi-step numerical methods to solve second order ordinary differential equations arising in flow data design problems.	CO8	L3
b	Course schedule	_	_
Class No	Module Content Covered	CO	Level
1	Numerical solution of ordinary differential equations of first order and first degree, by Taylor's series method	C07	L3
2	Taylor's series method	C07	L3
3	Numerical solution of ordinary differential equations of first order and first degree, by modified Euler's method	C07	L3
4	Numerical solution of ordinary differential equations of first order and first degree, by modified Euler's method	CO7	L3

5	Runge – Kutta method of fourth order.	CO7	L3
6	Runge – Kutta method of fourth order.	CO7	L3
7	Milne's predictor and corrector methods	CO8	L3
8	Additional problems		
9	Adams-Bashforth predictor and corrector methods	CO8	L3
10	Additional problems	CO8	L3
С	Application Areas	СО	Leve
1	To solve first order ODE using single step numerical methods	C07	L3
2	To solve first order ODE using single step and multistep numerical methods	CO8	L3
d	Review Questions		_
1	Use Taylor's method to find y at $x \blacksquare 0.1$, 0.2, 0.3 of the problem	CO7	L3
	$\frac{dy}{dx}$ \mathbf{x}^2 \mathbf{y}^2 with y \mathbf{x} \mathbf{y} 1. Consider upto 3^{rd} degree terms.		
2	Using Euler's modified method, solve for y at $x = 0.1$ if $\frac{dy}{dx} = \frac{y-x}{y}$ with $y = 1$. Carry out three modifications.	CO7	L3
3	Apply Runge Kutta method of order four compute $y = 0.2$ given	C07	L3
	$10\frac{dy}{dx}$ x^2 with y x^2 x^2 with y		
4	Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 = x^2}$ with y (1) find y at x (2) using RK method taking h=0.2	CO7	L3
5	Given $\frac{dy}{dx} = xy = y^2$ with	CO8	L3
	y $2 \cdot 1$, $y \cdot 1 \cdot 1$.1169, $y \cdot 2 \cdot 1$.2773, $y \cdot 2 \cdot 1$.5049 find $y \cdot 2 \cdot 1$ correct to three decimal places using Milne's method.		
6	Given $\frac{dy}{dx}$ and $y \triangleq 1.233, y \triangleq 2 \approx 1.548, y \approx 3 \approx 1.979$ find $y \approx 4.0$	CO8	L3
	by Adams-Bashforth method		
е	Experiences	-	_
1			
2			

E1. CIA EXAM - 1

a. Model Question Paper - 1

Dept: I	IS	Sem / Div:	3 / A	Course:	Transform	Calcu	lus, Elective:	N
					Fourier	Series a	and	

COURSE PLAN - CAY 2018-19

						Numerical Techniques				
Dat	te:	18-09-	Time:	9:30 -11:00	C Code:	18MAT31	Max	Marks:	50	
		2019	C II	A.II		25				
		Answer all	full questio	ns. All questio	-	25 marks.			N#I -	NA11 -
QN	40			Ques	tions			Levei	wark s	Module
1	a	Find the lap	olace transf	orm of T e	$\sin 3$	$t \qquad \mathbf{r} = \mathbf{r} \cdot \mathbf{r} \cdot \mathbf{r} \cdot \mathbf{r}$	CO1	L3	6	1
	b	Express in	terms of ur	it step functio	on and he	ence find its laplace	CO1	L3	6	1
		transform	f Th Gost	$t \qquad 0 \exists t \exists \pi$ $\pi \exists t \exists 2 \pi$ $t \qquad t \textcircled{2} \pi$						
	С	Solve by us		transforms	$\frac{d^2y}{dt^2} = 2$	$\frac{dy}{dt} = y \mathbf{H}e^{-t}$ and	CO2	L3	6	1
	d	-		of period $2a$	is defir	ned by	CO1	L4	7	1
		f THE Z	$t if \ 0 \Box t$ $t - t if \ a \Box$	t = 2a then sl	how that	$L \mathcal{G} = \frac{1}{s^2} $ Chanh $\frac{as}{2}$	3			
				0	R					
2	a	Find the inv	erse laplac	e transform o	f ——	is = 0 1 0̂ ≈ = 2 00	CO2	L3	6	1
	b	Find L^{-1}	1	using Co	onvolutio	n Theorem.	CO2	L3	6	1
	С	Solve <i>y'' y</i> 2 1 2 1 1 1 1 1 1 1 1 1 1	■ y' ■ y	$12t^2e^{-3t}$ by	laplace	transforms method with	CO2	L3	6	1
	d	If a periodic	function o	of period $\frac{\mathbf{a}}{\nu}$	$\frac{\pi^{3}}{v}$ is de	fined by	CO1	L4	7	1
			$inwt if 0$ $if \frac{\pi}{w} = 0$ Ew	then $\frac{w}{w}$	show th	at				
3	a	, '		-	•	2, 0.3 of the problem	CO7	L3	9	4
		$\frac{dy}{dx}$ $\int dx^2$	⊮ with	<i>y</i> ☎ 1 .Cor	nsider up	to 3 rd degree terms.				
	b	1		l method, solv		$x \blacksquare 0.1$ if ree modifications.	CO7	L3	8	4
	С	Apply Rung	e Kutta me	thod of order	four con	npute $y \blacksquare 0.2$ given	C07	L3	8	4
		$10\frac{dy}{dx}$ $\blacksquare x^2$	with	<i>y</i> ₹ 1 ta		0.2				
				0	R					

4	a	Solve $\frac{dy}{dx} \frac{y^2 - x^2}{y^2 = x^2}$ with y (1) find y at $x = 0.2$ using RK	CO7	L3	9	4
		method taking h=0.2				
	b	Given $\frac{dy}{dx} \mathbf{E} x y \mathbf{E} y^2$ with	CO8	L3	8	4
		y ☎ 1, y ☎ 1 1 1169, y ☎ 2 1 1.2773, y ☎ 3 11.5049 find				
		y 1 40 correct to three decimal places using Milne's method.				
	c	Given $\frac{dy}{dx}$ \mathbf{R}^2 and	CO8	L3	8	4
		y ☎ 🖼 1, y ☎ 1 🖼 1.233, y ☎ 2 🖼 1.548, y ☎ 3 🖼 1.979 find				
		y 1 .4 1 by Adams-Bashforth method				

b. Assignment –1

Note: A distinct assignment to be assigned to each student.

SNo	U	JSN		Assign	ment Desc	ription		Ма	rk C	0	Level
Note:	Each	student to	answer 2	-3 assignm	ents. Each a	ssignmen	t carries ed	qual mar	k.		
		Numerical	Technique	es.							
Cour	se:	Transform	Calculus	, Fourier	Series and	d					
Crs C	ode:	18MAT31	Sem:	3	Marks:	10/10	Time:	90 - 1	20 mi	nut	es
				Model A	Assignment	Questions					

SNo	USN	Assignment Description	Mark	СО	Level
			S		
1		Find the laplace transform of $2e^{\frac{2}{3}t} \sin 3t$	6	CO1	L3
2		Express in terms of unit step function and hence find its laplace transform f and f and f and f and f are f are f and f are f are f and f are f and f are f are f and f are f are f and f are f and f are f are f and f are f are f and f are f and f are f and f are f are f and f are f are f and f are f and f are f and f are f are f and f are f are f and f are f and f are f are f and f are f are f are f and f are f are f are f and f are f are f are f and f are f and f are f and f are f and f are f are f and f are f are f are f are f and f are f are f and f are	6	CO1	L3
3		Solve by using laplace transforms $\frac{d^2y}{dt^2} = \frac{dy}{dt} = y = e^{-t}$ and $y = y = 0$	6	CO2	L3
4		If a periodic function of period $2a$ is defined by $f = \begin{cases} f & \text{if } 0 \text{ if } \text{ if } a if$	7	CO1	L4
5		Find the inverse laplace transform of $ $	6	CO2	L3
6		Find $L^{-1} \frac{1}{\text{constant}}$ using Convolution Theorem.	6	CO2	L3
7		Solve $y'' = y' = y = 12t^2e^{-3t}$ by laplace transforms method with $y = 0 = y' = 0$	6	CO2	L3
8		If a periodic function of period $\frac{2\pi \pi \Omega}{w}$ is defined by	7	CO1	L4

	$f = \frac{\pi}{w}$ $if \frac{\pi}{w} = \frac{\pi}{w}$ then show that			
	$L \mathcal{P} = \underbrace{Ew}_{w}$			
9	Use Taylor's method to find y at $x = 0.1$, 0.2 , 0.3 of the problem $\frac{dy}{dx} = x^2 = y^2$ with $y = x^2$ Consider upto $x^2 = y^2$ degree terms.	9	CO7	L3
10	Using Euler's modified method, solve for y at $x = 0.1$ if $\frac{dy}{dx} = \frac{y-x}{y}$ with $y = 0.1$. Carry out three modifications.	8	CO7	L3
11	Apply Runge Kutta method of order four compute $y = 0.2$ given $10 \frac{dy}{dx} = x^2 = y^2$ with $y = 0.2$ taking h=0.2	8	CO7	L3
12	Solve $\frac{dy}{dx} \frac{y^2 - x^2}{y^2 = x^2}$ with y (1) find y at x (2) using RK method taking h=0.2	9	CO7	L3
13	Given $\frac{dy}{dx} \blacksquare xy \blacksquare y^2$ with $y \blacksquare 1.1169, y \blacksquare 2.2 \blacksquare 1.2773, y \blacksquare 3.3 \blacksquare 1.5049$ find $y \blacksquare 4.4 \square$ correct to three decimal places using Milne's method.	8	CO8	L3
14	Given $\frac{dy}{dx}$ and $y = 1.233$, $y = 2.21.548$, $y = 3.21.979$ find $y = 4.2$ by Adams-Bashforth method	8	CO8	L3

D2. TEACHING PLAN - 2

Module - 5

Title:	Numerical solution of second order ODE's and Calculus of variations	Appr	10 Hrs
		Time:	
а	Course Outcomes	-	Bloom
			S
_	The student should be able to:	_	Level
1	Use appropriate multi-step numerical methods to solve second order	CO9	L3
	ordinary differential equations arising in flow data design problems.		
2	Analyze how to apply the Euler's equations for a given function by Euler's	CO10	L4
	equation		
b	Course Schedule		

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Class No	Module Content Covered				CO	Level
1	Numerical Solution of second of	rder C	DE-RK me	ethod	CO9	L3
2	Problems on RK method				CO9	L3
3	Numerical Solution of second of	rder C	DE-Milne	's method	CO9	L3
4	Problems on Milne's Method				CO9	L3
5	Calculus of variation: Basic def	inition	s and prob	olems on Variation of	CO10	L4
6	Problems on functionals				CO10	L4
7	Derivation of Euler's equation.				CO10	L4
8	Applications of Calculus of Varia	tion-G	eodesics		CO10	L4
9	Problems on Geodesic and Hang	ing cha	ain		CO10	L4
10	Additional problems				CO10	L4
С	Application Areas				СО	Level
1	To solve first order and second methods	d orde	r ODE usir	ng single step numerical		L3
2	To determine extremal function vibrational analysis in the field o		-	-	CO10	L4
d	Review Questions				_	_
1	By Runge Kutta method solve decimal places using the initial of $x \blacksquare 0$				CO9	L3
2	$\int_{0}^{\frac{\pi}{2}} \int_{0}^{2\pi} y^{2} - y^{2} 2 xy 2 x$ On what of $y = 0$, $y = 0$ be extremumant.		an be the fu	ınctional	CO10	L4
3	State and prove Euler's equation				CO10	L4
4	Apply Milne's Method to comput $y'' = 2e^x$ and the followin	e <i>y</i> 1	_		CO9	L3
		2.04	2.09			
	y' 0 0.2	0.4	0.6			
5	Find the function y which mak	es the	integral	$\int_{x_1}^{x_2} \mathbf{T} \mathbf{x} y' \mathbf{x} y'^2 \mathbf{x} dx \text{an}$	CO10	L4
6	Prove that the shortest distance the straight line joining them.	e betwo	een two po	oints in a plane is along	CO10	L4

е	Experiences	-	1
1			
2			

Module - 2

Title:	Fourier Series	Appr Time:	10 Hrs
а	Course Outcomes	-	Bloom
_	The student should be able to:	_	Level
1	Analyze expansion of Fourier series using Euler formula	CO3	L3
2	Apply Fourier expansion in practical harmonic problems	CO4	L4
b	Course Schedule		
Class No	Module Content Covered	СО	Level
1	Periodic functions, Dirichlet's conditions	CO3	L3
2	Fourier series of periodic functions of period 360	CO3	L3
3	Fourier series of periodic functions of arbitrary period 2c	CO3	L3
4	Fourier series of even and odd functions	CO3	L3
5	Solving numericals	CO3	L3
6	half range cosine Fourier series	CO3	L3
7	half range sine Fourier series	CO3	L3
8	Practical harmonic analysis	CO4	L3
9	Solving numericals	CO4	L3
10	Solving numericals	CO4	L3
С	Application Areas	СО	Level
1	To study the nature of wave forms in voltage- current characteristics .	CO3	L3
2	Used to convert to discrete time domain signal into discrete frequency domain signal.	CO4	L3
	Review Questions	_	_
d			
d 1	Find the fourier series for the function $f = x - x $ over the interval 2π and hence deduce that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{\pi}{n^2}$	CO3	L3
	_2 ∞ 🕿 1 🔠	CO3	L3

	there is a direct cur amplitude of first h	•	of 0.75a	ımp in t	he variab	ole currei	nt and ol	otain the		
	t(sec) 0	T/6	T/3	T/2	2T/3	5T/6	Т			
	A(amp) 1.98	1.3	1.05	1.3	-0.88	-0.25	1.98			
4	Find the fourier so $f = \frac{x^2 - x}{x - 6}$ $\frac{x^2}{8} = \frac{1}{1^2} = \frac{1}{3^2} = \frac{1}{5^2}$	$0 \le x \le 4$ $4 \le x \le 8$		and	hei	nce	deduc	e tha	CO3	L3
5	Find the half rang	e cosine	series	for the	functio	n <i>f</i>	F 7 – 1	🥎 in	CO3	L3
6	Compute the consideration of t	stant term $\frac{\Pi}{3}$ 1.4	$\frac{2\Pi}{3}$	T 1.7	$\frac{4\Pi}{3}$	$\frac{5 \Pi}{3}$	2 Π 1.0	ion of	CO4	L4
е	Experiences								_	
1	Exheriences									
2										

E2. CIA EXAM - 2

a. Model Question Paper - 2

De	pt:	IS	Sem / Div:	3 / A		rrse: Transform Calculus, Elective: Fourier series and Numerical Techniques.			N			
Da	te:	24-10-19	Time:	9:30- 11:00	C Code:	18MAT31	Max Marks:		Max Marks:			50
Note: Answer all full questions. All questions carry 25 marks												
QI	No			Ques	tions		СО	Level	Marks	Module		
1	a	Find the fou	rier series fo	or the functio	on f	$\mathbf{R} x \mathbf{T} \pi - x \mathbf{I}$ over the	CO3	L3	9	2		
		interval T	$1,2\pi$ and	hence deduc	e that <u>1</u> 1	$\frac{7}{2} \prod_{n=1}^{\infty} \frac{2 1 \sqrt[n]{n}}{n^2}$						
	b	If factor	$ \begin{array}{ccc} $	$\begin{array}{ccc} & \frac{77}{2} \\ & 2 \\ & 5h \\ & 2 \end{array}$	ow that		CO3	L3	8	2		

C The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic lit(sec) OR			$f = \frac{4}{\pi} \sin 3x = \frac{\sin 3x}{3^2} = \frac{\sin 5x}{5^2} - \dots$				
A(amp) 1.98 1.3 1.05 1.3 -0.88 -0.25 1.98			Show that there is a direct current part of 0.75amp in the variable	CO4	L4	8	2
OR 2 a Find the fourier series of the function $f \cong 2^-x 0 \le x \le 4$ and hence deduce that $f \cong 2^-x 0 \le 4$			t(sec) 0 T/6 T/3 T/2 2T/3 5T/6 T				
2 a Find the fourier series of the function $\int \frac{1}{x} \frac{1}{x^2} $			A(amp) 1.98 1.3 1.05 1.3 -0.88 -0.25 1.98				
$f = \frac{1}{x} - \frac{1}{x} - \frac{1}{3} - $			OR				
b Find the half range cosine series for the function $f \cong \square_2 - 1 \stackrel{?}{\odot} \text{ in } 0 \stackrel{?}{\odot} \stackrel{?}{\odot} \square$ c Compute the constant term and first two harmonic of the function of $f \cong 2$ given by $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2	a	Find the fourier series of the function	CO3	L3	8	2
b Find the half range cosine series for the function $f = \frac{1}{3} = \frac{1}{3} \text{ in } 0 = \frac{1}{3} = \frac{1}{3}$ c Compute the constant term and first two harmonic of the function of $f = \frac{1}{3} = 1$				t			
c Compute the constant term and first two harmonic of the function of f given by $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			$8 - 1^2 - 3^2 - 5^2$				
function of f given by $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		b		CO3	L3	8	2
X 0 $\frac{\Pi}{3}$ $\frac{2\Pi}{3}$ $\frac{4\Pi}{3}$ $\frac{5\Pi}{3}$ 2Π $\frac{4\Pi}{3}$ $\frac{5\Pi}{3}$ 2Π $\frac{4\Pi}{3}$ $\frac{5\Pi}{3}$ $\frac{2\Pi}{3}$ $\frac{4\Pi}{3}$ $\frac{5\Pi}{3}$ $\frac{2\Pi}{3}$ $\frac{2\Pi}{3}$ $\frac{4\Pi}{3}$ $\frac{5\Pi}{3}$ $\frac{2\Pi}{3}$ $\frac{2\Pi}{$		С	Compute the constant term and first two harmonic of the	CO4	L4	9	2
f(x) 1.0 1.4 1.9 1.7 1.5 1.2 1.0 3 a By Runge Kutta method solve $\frac{d^2y}{dx^2}$ at $\frac{dy}{dx}$ $\bigcirc -y^2$ for x=0.2 correct to 4 decimal places using the initial conditions $y \equiv 1$ and $y' \equiv 0$ when $x \equiv 0$ b $\int_{0}^{\frac{\pi}{2}} y'^2 - y'^2 \equiv xy \otimes x$ On what curves can be the functional $y \equiv 0$ be extremum. c State and prove Euler's equation. CO10 L4 9 5 OR 4 a Apply Milne's Method to compute $y \equiv 4 \bigcirc 3$ given the equation $y' \equiv 0$ $y'' \equiv y' \equiv 2e^x$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 2 = 2.01 = 2.04 = 2.09$ $y' = 0 = 0.2 = 0.4 = 0.6$			function of f 🖀 🤄 given by				
f(x) 1.0 1.4 1.9 1.7 1.5 1.2 1.0 3 a By Runge Kutta method solve $\frac{d^2y}{dx^2}$ at $\frac{dy}{dx}$ $\bigcirc -y^2$ for x=0.2 correct to 4 decimal places using the initial conditions $y \equiv 1$ and $y' \equiv 0$ when $x \equiv 0$ b $\int_{0}^{\frac{\pi}{2}} y'^2 - y'^2 \equiv xy \otimes x$ On what curves can be the functional $y \equiv 0$ be extremum. c State and prove Euler's equation. CO10 L4 9 5 OR 4 a Apply Milne's Method to compute $y \equiv 4 \bigcirc 3$ given the equation $y' \equiv 0$ $y'' \equiv y' \equiv 2e^x$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 2 = 2.01 = 2.04 = 2.09$ $y' = 0 = 0.2 = 0.4 = 0.6$							
3 a By Runge Kutta method solve $\frac{d^2y}{dx^2} = x \frac{dy}{dx} = y^2$ for x=0.2 CO9 L3 8 5 correct to 4 decimal places using the initial conditions $y = 1$ and $y' = 1$ when $x = 1$ CO10 L4 8 5 $\frac{\pi}{2}$ $y' = 1$ con what curves can be the functional $y' = 1$ be extremum. C State and prove Euler's equation. CO10 L4 9 5 $\frac{\pi}{2}$ OR 4 a Apply Milne's Method to compute $y = 4 = 1$ given the equation $y' = 1$ of initial values. $\frac{\pi}{2}$ $y' = 1$ of $y'' = 1$ of $y''' = 1$ of $y'' $							
correct to 4 decimal places using the initial conditions $y = 1$ and $y' = 0$ when $x = 0$ b $\int_{0}^{\frac{\pi}{2}} e^{-2} - y^2 = xy = 0$ On what curves can be the functional $y = 0$ be extremum. c State and prove Euler's equation. c State and prove Euler's equation. c Apply Milne's Method to compute $y = 40$ given the equation $y'' = 20$ $y'' = 20$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 20.1 = 2.04 = 2.09$ $y'' = 0 = 0.2 = 0.4 = 0.6$			f(x) 1.0 1.4 1.9 1.7 1.5 1.2 1.0				
correct to 4 decimal places using the initial conditions $y = 1$ and $y' = 0$ when $x = 0$ b $\int_{0}^{\frac{\pi}{2}} e^{-2} - y^2 = xy = 0$ On what curves can be the functional $y = 0$ be extremum. c State and prove Euler's equation. c State and prove Euler's equation. c Apply Milne's Method to compute $y = 40$ given the equation $y'' = 20$ $y'' = 20$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 20.1 = 2.04 = 2.09$ $y'' = 0 = 0.2 = 0.4 = 0.6$							
correct to 4 decimal places using the initial conditions $y = 1$ and $y' = 0$ when $x = 0$ b $\int_{0}^{\frac{\pi}{2}} e^{-2} - y^2 = xy = 0$ On what curves can be the functional $y = 0$ be extremum. c State and prove Euler's equation. c State and prove Euler's equation. c Apply Milne's Method to compute $y = 40$ given the equation $y'' = 20$ $y'' = 20$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 20.1 = 2.04 = 2.09$ $y'' = 0 = 0.2 = 0.4 = 0.6$	3	a	By Runge Kutta method solve $\frac{d^2y}{2} = x = \frac{y}{2} - y^2$ for x=0.2	CO9	L3	8	5
and $y' = 0$ when $x = 0$ b $\int_{0}^{\frac{\pi}{2}} y^{2} = y^{2} = xy \mathcal{M}x$ On what curves can be the functional $y = 0$ be extremum. c State and prove Euler's equation. CO10 L4 9 5 OR 4 a Apply Milne's Method to compute $y = 40$ given the equation $y'' = y' = 2e^{x}$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 2 = 2.01 = 2.04 = 2.09$ $y' = 0 = 0.2 = 0.4 = 0.6$			••••				
b $\int_{0}^{\frac{\pi}{2}} y^{2} - y^{2} = xy$ $\Re x$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ $\Re x$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ $\Re x$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = x^{2}$ On $y = x^{2} - y^{2} = xy$ On what curves can be the functional $y = x^{2} - y^{2} = x^{2}$ On $y = x^{2} - y^{2} = x^{2}$ O							
be extremum. c State and prove Euler's equation. OR 4 a Apply Milne's Method to compute $y = 4 \ 2$ given the equation $y'' = 2 e^x$ and the following table of initial values. $x $			$\frac{\pi}{2}$	CO10	L4	8	5
be extremum. c State and prove Euler's equation. OR 4 a Apply Milne's Method to compute $y = 4 \ 2$ given the equation $y'' = 2 e^x$ and the following table of initial values. $x $			$\int \mathcal{D}^{2} - y^{2} \mathbf{Z} xy \mathcal{D} x$ On what curves can be the functional				
State and prove Euler's equation. OR Apply Milne's Method to compute $y = 40$ given the equation $y'' = 2e^x$ and the following table of initial values. $x = 0 = 0.1 = 0.2 = 0.3$ $y = 2 = 2.01 = 2.04 = 2.09$ $y' = 0 = 0.2 = 0.4 = 0.6$							
4 a Apply Milne's Method to compute $y = 40$ given the equation $y'' = 2e^x$ and the following table of initial values. X			2				_
4 a Apply Milne's Method to compute $y = 40$ given the equation $y'' = 2e^x$ and the following table of initial values. $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		С		CO10	L4	9	5
$y'' \Rightarrow ' = 2e^x$ and the following table of initial values. $x = 0 = 0.1 = 0.3$ $y = 2 = 2.01 = 2.04 = 2.09$ $y' = 0 = 0.2 = 0.4 = 0.6$	1			CO9	13	0	5
y 2 2.01 2.04 2.09 y 0 0.2 0.4 0.6	4	a	•	209	LJ	9	,
y 2 2.01 2.04 2.09 y 0 0.2 0.4 0.6							
y' 0 0.2 0.4 0.6							
			2 2.01 2.04 2.09				
b Find the function y which makes the integral CO10 L4 8 5			y' 0 0.2 0.4 0.6				
, , , , , , , , , , , , , , , , , , ,		b	Find the function y which makes the integra	CO10	L4	8	5

	$\int_{x_1}^{x_2} \mathbf{A} = xy' = xy'^2 \mathbf{M}x \text{an extremum}$				
	Prove that the shortest distance between two points in a plane is along the straight line joining them.	CO10	L4	8	5

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Note:	A di	stinct as	sign	ment to b	oe assigne	ed to eac	h stuc	lent.					
					Model	Assignn	nent C	uestions					
Crs C	ode:	18MA ⁻	T3Se	m:	3	Marks	: 1	0/10	Tin	ne:	90 - 120	minut	es
Cour	se:	Transfo	rm	Calculus	Fourier	series	and						
		Numeri	cal T	echnique	S.								
Note:	Each	studen	t to a	answer 2	-3 assigni	ments. E	ach as	signmen	t car	ries equa	al mark.		
SNo	ı	USN			Assig	ınment	Desci	iption			Mark s	СО	Level
1					tta metho		ил	cist			8	CO9	L3
					t to 4 ded y ∏ 1 an			_					
2			<u>π</u> 2								8	CO10	L4
				$y'^2 - y^2$	$\mathbf{Z} xy \mathbf{Z} dx$	On wha oe extrem	t curve ium.	s can be t	the fu	inctional			
3			Stat	e and pro	ove Euler'	s equation	on.				9	CO10	L4
4			1	ation y	s Method '''᠍,''ſ¶2	-		,	_		9	CO9	L3
				Х	0	0.1	0.2	0.3	3				
				У	2	2.01	2.04	2.0	9				
				y'	0	0.2	0.4	0.6	3				
5			Find	d the	function	y wh	nich	makes	the	integra	al 8	CO10	L4
				$\int_{x_1}^{x_2} 1$	T≡xy'≡x	$y'^2 \mathcal{D} x$	an ext	tremum					
6					he shorte g the stra				vo p	oints in	a 8	CO10	L4
7			Find the	the fouri	er series for $\mathfrak{A}, 2\pi\mathfrak{I}$ and $\mathfrak{A}, \mathfrak{I}, \mathfrak{I}$	r the fun	ction	f P Dx	જ π-	-x ove	r 9	CO3	L3

8	If $f = \frac{x}{2}$ $\frac{x}{2}$ Show that $f = \frac{4}{\pi} \sin x - \frac{\sin 3x}{3^2} = \frac{\sin 5x}{5^2} - \dots$	8	CO3	L3
9	The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic	8	CO4	L4
10	Find the fourier series of the function $f = \frac{7}{8} - \frac{1}{1^2} = \frac{1}{3^2} = \frac{1}{5^2} = \frac{1}{5}$ and hence deduce that	8	CO3	L3
11	Find the half range cosine series for the function $f \text{ (a)} = 1 \text{ (b)}$ in $0 \text{ (a)} = 1 \text{ (b)}$	8	CO3	L3
12	Compute the constant term and first two harmonic of the function of f given by $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	9	CO4	L4

D3. TEACHING PLAN - 3

Module - 3

Class No	Module Content Covered	CO	Level
b	Course Schedule		
2	Apply to transform one domain to another domain by z-transforms	CO6	L3
<u> </u>	Apply to transform form one to another domain by fourier intergrals	CO5	L3
_	The student should be able to:	-	Level
а	Course Outcomes	_	Bloom s
riue.	Fourier transform; Difference equations and z-transforms	Appr Time:	то піз
Title:	Fourier transform - Difference equations and 7 transforms	Annr	10 Hrs

COURSE PLAN - CAY 2018-19

1	Infinite fourier transform	CO5	L3
2	Fourier sine transform	CO5	L3
3	Fourier cosine transform	CO5	L3
4	Basic definition, Z-transforms definition	CO5	L3
5	Standard Z-transforms, damping rule	CO5	L3
6	Shifiting rule, initial value and final value theorems	CO5	L3
7	Solving numerical	CO5	L3
8	Inverse Z-transform	CO6	L3
9	Numericals	CO6	L3
10	Applications to solve difference equations	CO6	L3
С	Application Areas	CO	Level
1	To study the continuous and Apply to transform one domain to another	CO5	L3
	domain by z-transforms discrete signals and its properties.		
2	Used to convert to discrete time domain signal into discrete frequency	CO6	L3
	domain signal.		
d	Review Questions	-	_
1	Find the complex fourier transform of the function	CO9	L3
	$f = \int_0^\infty \frac{for}{for} \frac{dx}{dx}$ hence deduce $\int_0^\infty \frac{sinx}{x} dx$		
2	Find the complex fourier transform of the function	CO9	L3
	$f = \bigcap_{\alpha} for \bullet \alpha$ where α is a positive constant.		
3	Find the fourier transform of $f = e^{-4\pi}$	CO9	L3
4	Find the complex fourier transform of the function		L3
	·	203	LJ
	$f = \int_{0}^{\infty} \frac{1}{for} \int_{0}^{\infty} \frac{\sin^{2} t}{t^{2}} dt = \frac{\pi}{2}$ hence deduce $\int_{0}^{\infty} \frac{\sin^{2} t}{t^{2}} dt = \frac{\pi}{2}$		
5	If $f = 0$ for $f = 0$ find the fourier transform of $f = 0$ and hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^{3}} \cos \frac{x}{2} dx$	CO9	L3
	for $\mathfrak{g} = 1$		
	hence deduce $\int_{-\infty}^{\infty} \frac{x \cos x - \sin x}{\cos x} \cos x$		
	$\int_{0}^{\infty} x^{3} $		
6	Find the fourier sine and cosine transform of $\int \mathbf{R} \mathbf{R} e^{-\alpha x}$	CO9	L3
7	Find the fourier sine transform of f	CO9	L3
	$\int_{0}^{\infty} \frac{x \sin mx}{1 \text{s}^{2}} dx, m \text{so}$		
8	Find the inverse fourier sine transform of $\int_{s}^{\infty} e^{-a\alpha} d\alpha$, $a = 0$	CO9	L3
9	Find the Z transforms of the following: $2ne^{-an}$; $2ne^{-an}$ n; $2ne^{-an}$. $2ne^{-an}$.	CO10	L3
10	Find the Z transform of $2n = 1$ $\frac{n\pi}{4}$	CO10	L3
11		CO10	L3
''	Show that $Z_T = \frac{1}{n!} \mathbf{G} e^{\frac{1}{z}}$. Hence find $Z_T = \frac{1}{2} \mathbf{G}$ and $Z_T = \frac{1}{2} \mathbf{G}$		

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13	Find the Z transform of $n \cos n \theta$	CO10	L3
14	Find Z_T \bigcirc \bigcirc	CO10	L3
15	If $2z^2 = z = 2$ find the value of u_0, u_1, u_2, u_3	CO10	L3
16	Given $Z_T \square_n \square \frac{2z^2 \square z \square d}{2n-3 \ 0 d}$,	CO10	L3
	Show that $u_1 \blacksquare 2$, $u_2 \blacksquare 21$, $u_3 \blacksquare 139$		
17	Find the inverse Z transform of $\frac{z}{2}$	CO10	L3
18	Find the inverse Z transform of $\frac{3z^2 \mathbb{Z}}{\mathbb{Z}z - 1 \mathbb{Z}z} \mathbb{Z}$	CO10	L3
19	Given $U = \frac{4z^2 - 2z}{2^3 - 5z^2 - 3z - 40}$ find u_n	CO10	L3
е	Experiences	_	-
1			

E3. CIA EXAM - 3

a. Model Question Paper - 3

b. Assignment - 3

Note: A distinct assignment to be assigned to each student.

Crs C	ode:	18MAT	31 Sem:	3	Marks:	10/10	Time:	90 - 120) minut	es
Cours	se:	Transfor	m Calculus	, Fourier	series and		·			
		Numeric	al Technique	es.						
Note:	Each	student	to answer 2	-3 assignn	nents. Each a	ssignmen	t carries equ	al mark.		
SNo	SNo USN Assignment Description									Level
								S		
1			Find the c	omplex f	ourier trans	form of	the function	n 6	CO9	L3
	f for α where α is a position									
			constant.							
2			Find the fou	rier transfo	orm of f	$\mathbf{m}e^{-\mathbf{e}\mathbf{e}}$		7	CO9	L3
3			Find the c	omplex f	ourier trans	form of	the function	n 7	CO9	L3
			f 2	U	* 4 1 * 4 1	hence	dedu	ce		
			$\int_{0}^{\infty} \frac{\sin^2 t}{t^2} dt$	$\frac{\pi}{2}$						
4			Find the inv	erse Z tran	sform of ${2}$	z - 1 2- 2	20	6	CO10	L3

Model Assignment Questions

5	Find the inverse Z transform of $\frac{3z^2 \mathbf{Z} z}{\mathbf{Z}z - 1 \mathbf{Z}z} \mathbf{Z}$	7	CO10	L3
6	Given $U = \frac{4z^2 - 2z}{2}$ find u_n	7	CO10	L3
7	If $f = 0$ for f find the fourier transform	6	CO9	L3
	of f and hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^{3}} \cos \frac{x}{2} \mathcal{D}x$			
8	Find the fourier sine and cosine transform of $f = e^{-\alpha x}$		CO9	L3
9	Find the fourier sine transform of $f \cong \mathbb{R}e^{-\Phi}$ and hence evaluate $\int_0^\infty \frac{xsinmx}{1 \operatorname{cm}^2} dx$, $m \cdot \mathfrak{D}$	7	CO9	L3
10	Find the Z transforms of the following: $ \mathbf{m} e^{-an}; \mathbf{m} \mathbf{m} e^{-an} n; \mathbf{m} \mathbf{n}^2 $	6	CO10	L3
11	Find the Z transform of $2n \le \ln \frac{n\pi}{4}$	7	CO10	L3
12	Show that $Z_T = \frac{1}{n!} \mathbf{m} e^{\frac{1}{z}}$. Hence find $Z_T = \frac{1}{n!} \mathbf{m} \mathbf{m}$ and $Z_T = \frac{1}{n!} \mathbf{m}$	7	CO10	L3
13	Find the Z transform of $\sin m \equiv 0$	6	CO10	L3
14	Find the Z transform of $n \cos n \theta$	7	CO10	L3
15	Find $Z_T = 1$	7	CO10	L3

F. EXAM PREPARATION

1. University Model Question Paper

Cou	ırse:	Transform Cal	culus Fourie	r Series and	Numerical T	echniques	Month	/ Year	May /	2019		
Crs	Code:	18MAT31	Sem:	3	Marks:	100	Time:		180			
									minut	es		
_	Note	Answer any FI	VE full quest	ions. All que	stions carry	equal mark	S.	Mark	CO	Leve		
								S		I		
1	a	Find the laplac	nd the laplace transform of $me^{\frac{2}{3}t}\sin 3t$ $me^{\frac{2}{3}t}\frac{d}{t}$ 6									
		•	Express in terms of unit step function and hence find its laplace transform $f = 0$ and $\pi = 0$ and									
	С	If a periodic function $f = \begin{cases} x & t \\ 2a - t \end{cases}$	7	CO1	L3							

		$L \mathcal{G} = \frac{1}{s^2} \operatorname{Granh} = \frac{4s}{2} \operatorname{Granh} = \frac{1}{2} \operatorname{Granh} =$			
		s^2 OR			
2	a	Find the inverse laplace transform of $\frac{3}{2}$	6	CO2	L3
	b	Find $L^{-1} \frac{1}{\text{ convolution Theorem.}}$ using Convolution Theorem.	7	CO2	L3
	С	Solve $y'' = y = 12t^2e^{-3t}$ by laplace transforms method with $y = 0 = y' = 0$	7	CO2	L3
3	a	Find the fourier series for the function $f = \pi x = \pi - x$ over the interval $\pi x = \pi - x$ and hence deduce that $\frac{\pi^2}{12} = \frac{\pi}{n^2} = \frac{\pi}{n^2}$	6	CO3	L3
	b	If $f = \frac{x}{2}$ Show that $f = \frac{4}{\pi} \sin x - \frac{\sin 3x}{3^2} = \frac{\sin 5x}{5^2} - \dots$	7	CO3	L3
	С	The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic	7	CO4	L4
		OR			
4	a	Find the fourier series of the function $f = \begin{cases} 2 - x & 0 \le x \le 4 \\ x - 6 & 4 \le x \le 8 \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} = \frac{1}{3^2} = \frac{1}{5^2} = \frac{1}{3^2} = \frac{1}{5^2} = $	6	CO3	L3
	b	Find the half range cosine series for the function $f = 1 \ \hat{0}$ in $0 = x = 1 \ \hat{0}$	7	CO3	L3
	С	Compute the constant term and first two harmonic of the function of f given by $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	7	CO4	L4
5	a	Find the complex fourier transform of the function $f = \int_0^\infty \frac{\sin x}{x} dx$	6	CO9	L3

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	b	Find the inverse Z transform of $\frac{z}{2}$	7	CO10	L3
	С	If $\frac{2z^2 - 2z}{2z - 1}$ find the value of u_0, u_1, u_2, u_3	7	CO10	L3
		OR			
6	a	If $f = \frac{1}{\sqrt{2}} - x^2$ for $f = \frac{1}{\sqrt{2}}$ find the fourier transform of $f = \frac{1}{\sqrt{2}}$	6	CO9	L3
		and hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^{3}} \cos \frac{x}{2} dx$			
	b	Find the Z transform of $2n \le n \frac{\pi}{4}$	7	CO10	L3
	С	Show that $Z_T = \frac{1}{n!} (\mathbf{E} e^{\frac{1}{z}})$. Hence find $Z_T = \frac{1}{2} (\mathbf{E} e^{\frac{1}{z}})$ and	7	CO10	L3
7	a	Use Taylor's method to find y at $x = 0.1, 0.2, 0.3$ of the problem	6	CO7	L3
		$\frac{dy}{dx}$ \mathbf{x}^2 \mathbf{y}^2 with y \mathbf{x} \mathbf{y} 1. Consider upto 3^{rd} degree terms.			
	b	Using Euler's modified method, solve for y at $x = 0.1$ if	7	CO7	L3
		$\frac{dy}{dx}$ $y = x$ with y x y x y x with y x y y x y			
	С	Apply Runge Kutta method of order four compute $y = 0.2$ given $10 \frac{dy}{dx} = x^2 = y^2$ with $y = 0.2$	7	CO8	L3
		CEUV			
_		OR			
8	a	Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 = x^2}$ with y and y are y and y are y are y with y and y are y are y with y and y are y are y are y and y are y are y are y and y are y are y are y and y are y are y are y and y are y are y are y and y are y are y are y and y are y and y are y are y and y are y are y and y are y and y are y are y and y are y are y and y are y and y are y and y are y are y and y are y and y are y and y are y are y are y and y are y are y are y and y are y are y are y and y are y are y are y and y are y are y and y are y are y and y are y are y are y are y are y and y are y are y are y are y and y are y and y are y are y and y are y are y are y and y are y are y and y are y are y and y are y are y are y are y are y and y are y are y are y and y are y are y and y are y and y are y are y are y are y are y are y	6	CO8	L3
	b	Given $\frac{dy}{dx} \mathbf{E} xy \mathbf{E} y^2$ with	7	CO8	L3
		cist .			
		$y \triangleq 1, y \triangleq 1 \triangleq 1.1169, y \triangleq 2 \triangleq 1.2773, y \triangleq 3 \triangleq 1.5049$ find $y \triangleq 4 = 2$ correct to three decimal places using Milne's method.			
	С	Given $\frac{dy}{dx}$ and	7	CO8	L3
		y 2 (1), y 2 .1 (1).233, y 2 .2 (1).548, y 2 .3 (1).979 find			
		y 2 .4 ② by Adams-Bashforth method			
9	a	By Runge Kutta method solve $\frac{d^2y}{dx^2} = x \frac{dy}{dx} = y^2$ for x=0.2 correct	6	CO9	L3
		to 4 decimal places using the initial conditions $y = 1$ and $y' = 0$ when $x = 0$			
	b	$\int \frac{\pi}{2} y^2 = y^2 = xy \Re x$ On what curves can be the functional	7	CO10	L3

		y 4 (10 , y	2 10 0	be extrem	num.						
	c	State and pro	ove Euler	's equati	on.			7	CO10	L4	
					OR						
10	a	Apply Milne's	s Method	l to comp	oute y 1	2 .4 0 give	n the equation	6	CO9	L3	
		y'' □ y' □ 2	e^x and	the follow	wing tabl	e of initial	values.				
		X	0	0.1	0.2	0.3					
		У	2	2.01	2.04	2.09					
		y'	0	0.2	0.4	0.6					
	b	Find the fun	Find the function y which makes the integral $\int_{x}^{x_2} x^2 dx$								
		an ex	tremum								
	С	Prove that t	he short	est dista	nce betv	veen two	points in a plane is	7	CO10	L4	
		along the str	aight lin	e joining	them.						

2. SEE Important Questions

Course:		Transform Calculus, Fourier series and Numerical Techniques. Month								2019	
Crs Code:		18MAT31 Sem: 3 Marks: 100 Time:								es	
	Note	Answer any FI	VE full quest	ions. All que	stions carry	equal marks	5.	_	_		
Mod ule	Qno.	Important Question						Mark s	СО	Year	
1	1	Find the lapla	ce transform	of 2 e 2 4	$\sin 3t$	$\frac{e^{-a}}{t}$		6	CO1		
		Express in ter transform f	√Gost	$0 \Box t \Box \tau$	and hence f	ind its laplac	e	7	CO1		
	3	If a periodic for f	$ \begin{array}{ccc} if & \Box t \Box a \\ t & if & a \Box t \Box 2 \end{array} $					7	CO1		
	4	Find the inver	se laplace tra	ansform of				6	CO2		
	5	Find L^{-1}	1 1	using Conv	olution The	orem.		7	CO2		
	6	Solve <i>y''</i> <u>₹</u>	-	t^2e^{-3t} by la	place transf	orms metho	d with	7	CO2		

2	1	Find the fourier series for the function $f = 2\pi x - x $ over the interval and hence deduce that $\frac{\pi^2}{12} = \frac{\pi}{n^2} = \frac{\pi}{n^2}$	6	CO3
	2	If $f = \frac{x}{2}$ Show that $f = \frac{4}{\pi} \sin x - \frac{\sin 3x}{3^2} = \frac{\sin 5x}{5^2} - \dots$	7	CO3
	3	The following table gives variations of periodic current over a period T. Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of first harmonic	7	CO4
	4	Find the fourier series of the function $f = \begin{cases} 2 - x & 0 \le x \le 4 \\ x - 6 & 4 \le x \le 8 \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} = \frac{1}{3^2} = \frac{1}{5^2} = \frac{1}{3^2} = \frac{1}{5^2} = $	6	CO3
	5	Find the half range cosine series for the function $f = 1 \ \hat{j}$ in $0 = x = 1$	7	CO3
	6	Compute the constant term and first two harmonic of the function of f given by $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	7	CO4
3	1	Find the complex fourier transform of the function $f = \int_0^\infty \frac{\sin x}{x} dx$	6	CO9
	2	If f and hence deduce $\int_{0}^{\infty} \frac{\sin x}{x} dx$ and hence deduce $\int_{0}^{\infty} \frac{\sin x}{x} dx$ $\int_{0}^{\infty} \frac{\sin x}{x} dx$ find the fourier transform of f and hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$	7	CO9
	3	Find the inverse fourier sine transform of $\int_{s}^{\infty} e^{-a\alpha} dx$, $a = 0$	7	CO9
	4	Find $Z_T = 1$	6	CO10
	5	Find the inverse Z transform of $\frac{3z^2 \mathbb{Z}}{\mathbb{Z}z - 1 \mathbb{Z}z} \mathbb{Z}$	7	CO10

6	Given $U = 4z^2 - 2z$	7	C010
	$2 - 5z^2 3z - 40$ Tind u_n		
1	Use Taylor's method to find y at $x = 0.1, 0.2, 0.3$ of the problem	6	CO7
ļ		0	(07)
2	· · · · · · · · · · · · · · · · · · ·	7	CO7
	$\frac{dy}{dx} = \frac{y}{y} \frac{x}{3}$ with $y = 1$. Carry out three modifications.		
3	Apply Runge Kutta method of order four compute $y \blacksquare 0.2$ given	7	CO8
	CGSC		
4	Solve $\frac{dy}{dx} y^2 - x^2$ with y 3 (1) find y at x 10 2 using RK	6	CO8
5		7	CO8
	ax		
6	•	7	CO8
	as a		
1	By Runge Kutta method solve $\frac{d^2y}{dx^2} = x \frac{dy}{dx} - y^2$ for x=0.2 correct	6	CO9
	to 4 decimal places using the initial conditions $y \blacksquare 1$ and $y' \blacksquare 0$ when $x \blacksquare 0$		
2		7	CO10
	y = 0, y = 0 be extremum.		
3	State and prove Euler's equation.	7	CO10
4	Apply Milne's Method to compute $y = 40$ given the equation	6	CO9
	y Egy Maze and the following table of initial values.		
	x 0 0.1 0.2 0.3		
	x 0 0.1 0.2 0.3		
5	X 0 0.1 0.2 0.3 y 2 2.01 2.04 2.09 y' 0 0.2 0.4 0.6	7	CO10
5	x 0 0.1 0.2 0.3 y 2 2.01 2.04 2.09 y' 0 0.2 0.4 0.6	7	CO10
	1 2 3 4 5 6 3 3	Given $U = \frac{1}{2} - 5z^2 = 8z - 40$ find u_n 1 Use Taylor's method to find y at $x = 10.1$, 0.2 , 0.3 of the problem $\frac{dy}{dx} = x^2 = y^2$ with $y = 10.1$. Consider upto 3^{rd} degree terms. 2 Using Euler's modified method, solve for y at $x = 10.1$ if $\frac{dy}{dx} = \frac{y - x}{y = 10.1}$ with $y = 10.1$. Carry out three modifications. 3 Apply Runge Kutta method of order four compute $y = 10.2$ given $10 = 10.2$ with $y = 10.1$ taking 10.2 using RK method taking 10.2 with 10.2 with 10.2 using RK method taking 10.2 with 10.2 with 10.2 using RK method taking 10.2 with 10.2 using RK method taking 10.2 with 10.2 using RK method taking 10.2 with 10.2 using RK method 10.2 solve 10.2 using RK method taking 10.2 with 10.2 using RK method taking 10.2 using RK method 10.2 using	1 Use Taylor's method to find y at $x \equiv 0.1$, 0.2 , 0.3 of the problem $\frac{dy}{dx} \equiv x^2 \equiv^2 $ with $y \equiv 1$.Consider upto 3^{rd} degree terms. 2 Using Euler's modified method, solve for y at $x \equiv 0.1$ if $\frac{dy}{dx} \equiv \frac{y - x}{y} = \frac{1}{2}$ with $y \equiv 1$. Carry out three modifications. 3 Apply Runge Kutta method of order four compute $y \equiv 0.2$ given $10 \frac{dy}{dx} \equiv x^2 \equiv^2$ with $y \equiv 1$ taking $y \equiv 0.2$ taking $y \equiv 1$

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along the straight line joining them.			ĺ
		 1	Ĺ

G. Content to Course Outcomes

1. TLPA Parameters

Table 1: TLPA – Example Course

Мо	Course Content or Syllabus	Content	Blooms'	Final	Identifie	Instructi	Assessmen
dul	(Split module content into 2 parts which	Teachin	Learnin	Bloo	d Action	on	t Methods
e-	have similar concepts)	g Hours	g Levels	ms'	Verbs	Methods	to Measure
#			for	Level	for	for	Learning
			Content		Learning	Learning	
\overline{A}	В	C	D	E	F	G	Н
1	Laplace transforms of elementary	5	L3	L3	Apply	Lecture	Assinments
	functions.Laplace transforms of periodic						and Slip
	functions and unit step functions.						test
1	Inverse laplace transforms, convolution	5	L3	L3	Apply	Lecture	Assinments
	theorem to find the inverse laplace						and Slip
	transforms and problems.Solution of linear						test
	differential equations using Laplace						
	transform.						
2	Fourier series of 2Π , $2I$ period & half range	6	L3	L3	Apply	Lecture	Assinments
	fourier series						and Slip
							test
2	Practical Harmonic analysis.	4	L4	L4	Analyze	Lecture	Assinments
							and Slip
							test
3	Infinite Fourier transforms, fourier sine and	4	L3	L3	Apply	Lecture	Assinments
	cosine transforms & Fourier inverse						and Slip
	transforms						test
3	Z-transforms and inverse z-transforms	6	L3	L3	Apply	Lecture	Assinments
							and Slip
							test
4	Numerical Solutions of ODE of first order		L3	L3	Apply	Lecture	Assinments
	and degree–Taylor's Method,Modified						and Slip
_	Euler's Equations						test
	RK method,Milne's and Adams Bashforth	5	L3	L3	Apply	Lecture	Assinments
	method						and Slip
							test
	Numerical Solutions of second order ODE		L3	L3	Apply	Lecture	Assinments
	using Runge-Kutta method and Milne's						and Slip
-	Method.				_		test
	Variational problems, euler's	3	L4	L4	Analyze	Lecture	Assinments
	equations,geodesics and problems						and Slip
							test

2. Concepts and Outcomes:

Table 2: Concept to Outcome - Example Course

Мо	Learning or	Identified	Final	Concept	CO Components	Course Outcome
dul	Outcome	Concepts	Concept	Justification	(1.Action Verb,	
e-	from study	from		(What all Learning	2.Knowledge,	
#	of the	Content		Happened from	3.Condition /	Student Should
	Content or			the study of	Methodology,	be able to
	Syllabus			Content / Syllabus.		
	•			A short word for	,	
				learning or		
				outcome)		
\overline{A}	I	J	K	L	M	N
1	Solution of	Laplace	Differential	Methods to solve	Apply	Use laplace
	DE using	transfor	Equations	differential	Differentiation	transform in
	laplace	mation		equations using	Problem Solving	solving Differential
	transforms			laplace		equations arising
				transformation		in network
						analysis, control
						systems and other
						fields of
						engineering.
1	Solution of	Laplace	Differential	Methods to solve	Apply	Use inverse laplace
	DE using	transfor	Equations	differential	Differentiation	transform in
	laplace and	mation		equations using	Problem Solving	solving
	inverse			laplace		Differential/
	laplace			transformation		integral equations
	transforms					arising in network
						analysis, control
						systems and other
						fields of
						engineering.
2	Solution of	Fourier	Analyze	Methods to solve	Apply	Analyze expansion
	DE using	series	circuits&syst	DE using fourier	Integration	of Fourier series
	fourier		em	series expansion	Problem Solving	using Euler formula
	expansion		communicati			
			on			
2	Solution of	Harmonic	Analyze	Methods to solve	I .	Apply Fourier
	DE using	Analysis	circuits&syst	partical harmonic	Problem Solving	expansion in
	fourier		em	problem over a		practical harmonic
	expansion		communicati	period using		problems
			on	fourier expansion		

2	Solution of	Laplace	Continuous	Methods to solve	Apply	Apply to transform
3	DE using	transfor	signal	differential	Integration	form one to
	fourier	mation	process	equations using	Problem Solving	another domain by
	transforms	IIIation	process	fourier		Fourier integrals
	liansioniis			transformation		rouner integrals
3	Solution of	Laplace	Discrete	Methods to solve	Apply	Apply to transform
	DE using Z	transfor	signal	differential	Integration	one domain to
		mation	process	equations using Z	Problem Solving	another domain by
	Z transforms	IIIacion	process	and inverse Z		z-transforms
	Z transioniis			transformation		2 (141131311113
4	Numerical	Differenti	Ordinary	Methods to solve	Apply	Use appropriate
	Methods to	al	Differential	DE using	Differentiation	single step
	solve DE	Equations	Equations.	Numerical	Problem Solving	numerical methods
				Methods		to solve first order
						ordinary
						differential
						equations.
4	Numerical	Differenti	Ordinary	Methods to solve	Apply	Use appropriate
	Methods to	al	Differential	DE using	Differentiation	multi-step
	solve DE	Equations	Equations Equations.	Numerical	Problem Solving	numerical methods
				Methods		to solve first order
						ordinary
						differential
						equations arising
						in flow data design
						problems.
5	Numerical	Differenti	_		Apply	Use appropriate
	Methods to	al	Differential	DE using	Differentiation Problem Solving	multi-step
	solve DE	Equations	Equations.	Numerical	Problem Solving	numerical methods
				Methods		to solve second
						order ordinary
						differential
						equations arising
						in flow data design
F	Applications	Fytre ::	Maxim	Calculus of	Apply	problems.
)	Applications of Calculus	m	Maximum and	variations	Differentiation	Analyze how to apply the Euler's
	of Variations		minimum	variations	Problem Solving	
	oi variations		IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII			equations for a given function by
						Euler's equation
						Luiei 3 equation