

Ref No:

# SRI KRISHNA INSTITUTE OF TECHNOLOGY, BANGALORE



COURSE PLAN

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
Course Plan Author:	Smitha N

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
Credit / L-T-P:	3 / 2-2-0	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
	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 Module	
ule		ng	Concepts	Learning
		Hours		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 the	5	Differential	L3
	inverse laplace transforms and problems.Solution of linear		Equations	
	differential equations using Laplace transform.			
2	Fourier series of 2∏,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 transforms	4	Continuous	L3
	& 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-Taylor's	5	Ordinary	L3
	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-Kutta		Ordinary	L3
	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. Rese	3. Research: Recent developments on the concepts – publications in journals; conferences etc.						
Modul	Details	Chapters	Availability				
es		in book					
Α	Text books (Title, Authors, Edition, Publisher, Year.)	-	-				
1,2,3,4,	1; B.S Grewal, higher engineering mathematics		In Lib/dept				
5							
1,2,3,4,	2:Advanced engineering mathematics by ERWIN KREYZIG		In Lib/dept				
5							

1,2,3,4, 3:Advanced engineering mathematics by PETER V. O'NEIL       In Lib/dept         5       Reference books (Title, Authors, Edition, Publisher, Year.)       -       -         1,2,3,4, 1: N.P.BAIL AND MANISH GOYAL:A text book of engineering mathematics, laxmi publishers, 7th edition, 2010       In dept         5       mathematics, laxmi publishers, 7th edition, 2010       In dept         1,2,3,4, 2: BV Ramana:Higher engineering mathematics TATA McGRAW-HILL 2006       In Lib         2006       -       -         C       Concept Videos or Simulation for Understanding       -         1 https://www.khanacademy.org/math/differential-equations/laplace-transform_laplace-transform_tutorial/v/laplace-transform_1       -         2 https://www.youtube.com/watch?v-KeT6CB60i10       -       -         3 https://www.youtube.com/watch?v-GiPOQC5nYMs       -       -         D       Software Tools for Design       -       -         E       Recent Developments for Research       -       -         4       https://www.youtube.com/watch?v-Os80tXFBLKY       -       -         4       https://www.youtube.com/watch?v-r12pnzNoXI       -       -				
B       Reference books (Title, Authors, Edition, Publisher, Year.)       -       -         1.2.3.4, 1: N.P.BAIL AND MANISH GOYAL:A text book of engineering mathematics, laxmi publishers, 7th edition, 2010       In dept         5       mathematics, laxmi publishers, 7th edition, 2010       In dept         1.2.3.4, 2: B.V Ramana:Higher engineering mathematics TATA McGRAW-HILL 2006       In Lib         2006       -       -         C       Concept Videos or Simulation for Understanding -       -         1       https://www.khanacademy.org/math/differential-equations/laplace-transform/laplace-transform-tutorial/v/laplace-transform-1       -         1       https://www.youtube.com/watch?v=KeT6CB6Qi10       -         3       https://www.youtube.com/watch?v=GiPOQC5nYMs       -         D       Software Tools for Design       -         E       Recent Developments for Research       -       -         4       https://www.youtube.com/watch?v=Os8OtXFBLkY       -       -         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/       -       -	1,2,3,4,	3:Advanced engineering mathematics by PETER V. O'NEIL		In Lib/dept
1.2.3.4.       I: N.P.BAIL AND MANISH GOYAL:A text book of engineering mathematics, laxmi publishers, 7th edition, 2010       In dept         1.2.3.4       I: B.V. Ramana:Higher engineering mathematics TATA McGRAW-HILL 2006       In Lib         2006       -       -         C       Concept Videos or Simulation for Understanding -       -         1       https://www.khanacademy.org/math/differential-equations/Laplace-transform-1       -         2       https://www.youtube.com/watch?v-KeT6CB6Qi10       -         3       https://www.youtube.com/watch?v-MigVOVgjRZU       -         5       https://www.youtube.com/watch?v-GiPOQC5nYMs       -         D       Software Tools for Design       -         F       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			
5       mathematics.laxmi publishers,7th edition,2010         1.2.3.4       2: B.V Ramana:Higher engineering mathematics TATA McGRAW-HILL 2006         C       Concept Videos or Simulation for Understanding         1       https://www.khanacademy.org/math/differential-equations/laplace-transform-tutorial/v/laplace-transform-1         2       https://www.khanacademy.org/math/differential-equations/laplace-transform-1         2       https://www.youtube.com/watch?v-KeT6CB6Qi10         3       https://www.youtube.com/watch?v-MgVOVgiRZU         5       https://www.youtube.com/watch?v-GiPOQC5nYMs         D       Software Tools for Design         E       Recent Developments for Research         -       -         -       -         4       https://www.youtube.com/watch?v-Os8OtXFBLkY         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/	В	Reference books (Title, Authors, Edition, Publisher, Year.)	-	-
1.2.3.4       2: B.V Ramana:Higher engineering mathematics TATA McGRAW-HILL       In Lib         2006       -       -         C       Concept Videos or Simulation for Understanding       -       -         1       https://www.khanacademy.org/math/differential-equations/laplace-transform/laplace-transform-1       -       -         2       https://www.youtube.com/watch?v-KeT6CB6Qi10       -       -         3       https://www.youtube.com/watch?v-MJgVOVgiRZU       -       -         5       https://www.youtube.com/watch?v=GiPOQC5nYMs       -       -         0       Software Tools for Design       -       -         1       -       -       -       -         7       Others (Web, Video, Simulation, Notes etc.)       -       -       -         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/       -       -	1,2,3,4,	1: N.P.BAIL AND MANISH GOYAL:A text book of engineering		In dept
2006       -         C       Concept Videos or Simulation for Understanding       -         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=KeT6CB6Qi10       -         4       https://www.youtube.com/watch?v=GiPOQC5nYMs       -         C       Software Tools for Design       -         C       E       Recent Developments for Research       -         F       Others (Web, Video, Simulation, Notes etc.)       -       -         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/       -	5	mathematics,laxmi publishers,7th edition,2010		
C       Concept Videos or Simulation for Understanding       -       -       -         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=MgVOVgiRZU       -       -         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.)       -       -         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/       -       -	1,2,3,4	2: B.V Ramana:Higher engineering mathematics TATA McGRAW-HILL		In Lib
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=mJgVOVgiRZU         5       https://www.youtube.com/watch?v=GiPOQC5nYMs         D       Software Tools for Design         E       Recent Developments for Research         -       -         4       https://www.youtube.com/watch?v=Os80tXFBLkY         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/		2006		
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=mJgVOVgiRZU         5       https://www.youtube.com/watch?v=GiPOQC5nYMs         D       Software Tools for Design         E       Recent Developments for Research         -       -         4       https://www.youtube.com/watch?v=Os80tXFBLkY         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/				
transform/laplace-transform-tutorial/v/laplace-transform-1         2       https://www.youtube.com/watch?v=KeT6CB6Qi10         3       https://www.youtube.com/watch?v=mJgVOVgiRZU         5       https://www.youtube.com/watch?v=GiPOQC5nYMs         6	С	Concept Videos or Simulation for Understanding	-	-
2       https://www.youtube.com/watch?v=KeT6CB6Qi10         3       https://www.youtube.com/watch?v=mJgVOVgjRZU         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.)         4       https://www.youtube.com/watch?v=Os8OtXFBLkY         4       https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve-differential-equation/	1	https://www.khanacademy.org/math/differential-equations/laplace-		
3       https://www.youtube.com/watch?v=mJgVOVgjRZU		transform/laplace-transform-tutorial/v/laplace-transform-1		
5       https://www.youtube.com/watch?v=GiPOQC5nYMs	2	https://www.youtube.com/watch?v=KeT6CB6Qi10		
D       Software Tools for Design	3	https://www.youtube.com/watch?v=mJgVOV9jRZU		
E       Recent Developments for Research       -	5	https://www.youtube.com/watch?v=GiPOQC5nYMs		
F       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/       -       -	D	Software Tools for Design		
F       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/       -       -				
F       Others (Web, Video, Simulation, Notes etc.)       -	Е	Recent Developments for Research	-	-
4       https://www.youtube.com/watch?v=Os8OtXFBLkY		•		
4       https://www.youtube.com/watch?v=Os8OtXFBLkY				
4 https://www.geeksforgeeks.org/runge-kutta-4th-order-method-solve- differential-equation/	F		-	-
differential-equation/	4			
	4			
	5			

#### 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.

Juan	tudents must have team 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	
			of homogeneous and				
		Fourier Series	non homogeneous				
		and Numerical	differential equations.				
		Techniques					

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

#### 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.

N	1od	Course	Course Outcome	Teach.	Concept	Instr	Assessme	Blooms'
U	lles	Code.#	At the end of the course, student	Hours		Method	nt	Level
			should be able to				Method	

· · · · · ·				1			
1		Use laplace transform in solving Differential equations arising in network analysis, control systems and other fields of engineering.	5	equations		Assignme nt and Slip Test	L3
1	18MAT31.2	Use inverse laplace transform in solving Differential/ integral equations arising in network analysis, control systems and other fields of engineering.	5	Differential equations	Lecture	Assignme nt and Slip Test	L3
2	18MAT31.3	Analyze expansion of Fourier series using Euler formula	6	Analyze circuits&sy stem communic ation	Lecture	Assignme nt and Slip Test	L3
2	18MAT31.4	Apply Fourier expansion in practical harmonic problems	4	Analyze circuits&sy stem communic ation	Lecture	Assignme nt and Slip Test	L4
3	18MAT31.5	Apply to transform form one to another domain by Fourier integrals	5	Continuous signal process	Lecture	Assignme nt and Slip Test	L3
3	18MAT31.6	Apply to transform one domain to another domain by z-transforms	5	Discrete signal process	Lecture	Assignme nt and Slip Test	L3
4	18MAT31.7	Use appropriate single step numerical methods to solve first order ordinary differential equations.	6	O.D.E	Lecture	Assignme nt and slip test	L3
4		Use appropriate multi-step numerical methods to solve first order ordinary differential equations arising in flow data design problems.	4	O.D.E		Assignme nt and slip test	L3
5		Use appropriate multi-step numerical methods to solve second order ordinary differential equations arising in flow data design problems.	5	Differential equations	Lecture	Assignme nt and slip test	L3
5	18MAT31.10	Analyze how to apply the Euler's equations for a given function by Euler's equation	5	maximum& minimum	Lecture	Assignme nt and Slip Test	L4
-	-		50	-	-	-	-

# 2. Course Applications

Write 1 or 2 applications per CO.

Stude	ents should be able to employ / apply the course learnings to $\ldots$		
Mod	Application Area	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 domain by	CO6	L3
	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 methods	CO9	L3
5	To determine extremal functions arising in dynamics of rigid bodies and vibrational	CO10	L4
	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.

<u> </u>			ipusirit.		
Mo	Мар	ping	Mappin		Lev
dul			g Level		el
es					
-	CO	PO	-	'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	L3
1	CO1	PO2	L4	To analyze and study the nature of signals and control systems.	L4
1	CO2	PO1	L3	Apply the knowledge of Laplace transforms and inverse laplace transforms to find the solution to complex engineering problems	L3
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 engineering problems.	L3
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 engineering problems.	L3
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 complex engineering problems.	L3
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 complex engineering problems.	L3
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 differential equations	L3
4	CO7	PO2	L4	To analyze and solve first order ODE using single step numerical methods	L4
4	CO8	PO1	L3	Apply the knowledge of Numerical techniques to solve ordinary differential equations	L3
4	CO8	PO2	L4	To analyze and solve first order ODE using single step and multistep numerical methods	L4
5	CO9	PO1	L3	Apply the knowledge of Numerical techniques to solve ordinary differential equations	L3
5	CO9	PO2	L4	To analyze and apply first order and second order ODE using single step numerical methods	L4
5	CO10	PO1	L3	Apply the knowledge of calculus in solving complex engineering problems.	L3
5	CO10	PO2	L4	To analyze the rotation of a rigid body using a reference frame with its axis fixed to the body.	L4

#### 4. Articulation Matrix

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

											,							
-	-	Course Outcomes						rogi										-
Mod	CO.#	At the end of the course	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS	Lev
ules		student should be able to	1	2	3	4	5	6	7	8	9	10	11	12	O1	02	03	el
1		Use laplace transform in solving Differential equations arising in network analysis, control systems and other fields of engineering.		2.5														L3
1	CO2	Use inverse laplace transform in solving Differential/ integral		2.5														L3

#### COURSE PLAN - CAY 2018-19

				1 1		
	tions arising in network					
	sis, control systems and					
	fields of engineering.					
	ze expansion of Fourier	2.5	2.5			L3
	s using Euler formula					
2 CO4 Apply	y Fourier expansion in 2	2.5	2.5			L4
pract	ical harmonic problems					
3 CO5 Apply	y to transform form one to	2.5	2.5			L3
anoth	ner domain by Fourier					
integ						
3 CO6 Apply	y to transform one domain	2.5	2.5			L3
to a	another domain by z-					
trans	forms					
		2.5	2.5			L3
nume	erical methods to solve first					
ordei	r ordinary differential					
	tions.					
4 CO8 Use a	appropriate multi-step	2.5	2.5			L3
nume	erical methods to solve first					
	ordinary differential					
	tions arising in flow data					
	jn problems.					
		2.5	2.5			L3
	erical methods to solve					
	nd order ordinary					
	ential equations arising in					
	data design problems.					
	/ze how to apply the Euler's	2.5	2.5			L4
	tions for a given function by					
Euler	's equation					

#### 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 Planned	Schedule	Resources	PO Mapping
ules				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. o	f quest	tion in	Exam		CO	Levels
ules		Hours	CIA-1	CIA-2	CIA-3	Asg	Extra	SEE		
							Asg			
1	Laplace transforms	10	2	-	-	1		2	CO1, CO2	L3
4	Numerical Methods-1	10	2	-	-	1		2	CO7,CO8	L3
5	Numerical methods and Calculus	10	-	2	-	1		2	CO9,CO10	L4
	of variations									

2	Fourier series	10	-	2	-	1	2	CO3,CO4	L4
3	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	-	Bloom
-	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.	CO2	L3
b	Course Schedule	-	-
Class No	Module Content Covered	СО	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 $(i)te^{(-4t)}\sin 3t$ $(ii)\frac{(e^{(at)}-e^{(-at)})}{t}$	CO1	L3
	Find the laplace transform of $(i)te^{-t}sin 3t$ $(ii) \frac{t}{t}$		
2	Express in terms of unit step function and hence find its laplace transform	CO1	L3
	$\cos(t) \cos(t) \cos(t) \cos(t) \cos(t)) \cos(t) \sin(t) \sin(t))$		
	$f(t) = \begin{cases} cost & 0 < t < \pi \\ 1 & \pi < t < 2\pi \end{cases}$		
	$sint t>2\pi$		
3	Solve by using laplace transforms $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ and	CO2	L3
	y(0) = y'(0) = 0		
4	If a periodic function of period $2a$ is defined by	CO1	L4
	$f(t) = \begin{cases} t & if \ 0 < t < a \\ 2a - t & if \ a < t < 2a \end{cases}  \text{then show that}  L[f(t)] = (\frac{1}{s^2}) \tanh(\frac{as}{2})$		
5	Find the inverse laplace transform of $\frac{(4s+5)}{((s-1)^2(s+2))}$	CO2	L3
	$((s-1)^2(s+2))$		
6	Find $L^{-1} \frac{1}{((s+1)(s^2+9))}$ using Convolution Theorem.	CO2	L3
	$((s+1)(s^2+9))$ using convolution mediem.		
7	Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with	CO2	L3
	y(0)=0=y'(0)		
8	If a periodic function of period $\frac{(2\pi)}{1}$ is defined by	CO1	L4
	W		
	Esinwt if $0 < t < \frac{\pi}{W}$		
	$f(t) = \begin{cases} Esinwt & if \ 0 < t < \frac{\pi}{w} \\ 0 & if \ \frac{\pi}{w} < t < \frac{(2 \ \pi)}{w} \end{cases} & \text{then show that} \end{cases}$		
	$0 \qquad lf \frac{1}{w} < t < \frac{1}{w}$		
	I[f(t)] = Ew		
	$L[f(t)] = \frac{Ew}{(s^2 + w^2)(1 - e^{\frac{(-as)}{w}})}$		
е	Experiences	-	-
1		_	
2			

### Module – 4

Title:	Numerical Solution Of ODE's:	Appr	10 Hrs
		Time:	
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Use appropriate single step numerical methods to solve first order ordinary differential equations.	CO7	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	СО	Level
1	Numerical solution of ordinary differential	C07	L3
	equations of first order and first degree, by Taylor's series method		
2	Taylor's series method	CO7	L3
3	Numerical solution of ordinary differential	C07	L3
	equations of first order and first degree, by modified Euler's method		
4	Numerical solution of ordinary differential	C07	L3
	equations of first order and first degree, by modified Euler's method		
5	Runge - Kutta method of fourth order.	CO7	L3
6	Runge - Kutta method of fourth order.	C07	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	Level
1	To solve first order ODE using single step numerical methods	CO7	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 $x=0.1, 0.2, 0.3$ of the problem	C07	L3
_		,	
	$\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ .Consider upto 3 <sup>rd</sup> degree terms.		
	un		
2	Using Euler's modified method, solve for y at $x=0.1$ if $\frac{dy}{dx}=\frac{y-x}{y+x}$ with	CO7	L3
	Using Ediel's modified method, solve for y at $x=0.1$ if $dx = y+x$		
	y(0)=1 . Carry out three modifications.		
3	Apply Runge Kutta method of order four compute $y=0.2$ given	C07	L3
3			L3
	$10\frac{dy}{dt} = x^2 + y^2$ with $y(0) = 1$ taking h=0.2		
	$10\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ taking h=0.2		
4	Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ find y at $x = 0.2$ using RK method	CO7	L3
	Solve $\frac{dy}{dx} = \frac{y}{2} \frac{x}{x^2}$ with $y(0) = 1$ find y at $x = 0.2$ using RK method		
	taking h=0.2		
5	Given $\frac{dy}{dx} = xy + y^2$ with	CO8	L3
	$\frac{dx}{dx} = \frac{dx}{dx} + \frac{dx}{dx}$		
	y(0)=1, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=1.5049 find		
	y(0.4) correct to three decimal places using Milne's method.		
6	Given $\frac{dy}{dx} = (1+y)x^2$ and	CO8	L3
	dx = (1 + y)x and $dx$		
	y(1)=1, y(1.1)=1.233, y(1.2)=1.548, y(1.3)=1.979 find $y(1.4)$ by		
	Adams-Bashforth method		
е	Experiences	-	-
1			
2			
			1

# E1. CIA EXAM – 1

### a. Model Question Paper - 1

De	pt:	IS	Sem / Div:	3 / A	Course:	Transform Calculus, Fourier Series and Numerical Techniques		ive:		N
Da	te:	18-09-2019 Time: 9:30 -11:00 C Code: 18MAT31 Max Ma						Marks:	50	
No	te: /	Answer all fu	Il questions.	All questions	carry 25	marks.				
Q	No			Ques			CO	Level	Marks	Module
1	а	Find the lapl	ace transfor	m of $(i)te^{(-)}$	$^{4t)}$ sin 3t	$(ii)\frac{(e^{(at)}-e^{(-at)})}{t}$	CO1	L3	6	1
	b	Express in terms $f(t) = \begin{cases} \cos t \\ 1 \\ \sin t \end{cases}$			and henc	e find its laplace transform	CO1	L3	6	1

		COURSE PLAN - CAY 2010-19				
	С	Solve by using laplace transforms $\frac{d^2 y}{dt^2} + 4 \frac{dy}{dt} + 4 y = e^{-t}$ and	CO2	L3	6	1
		y(0)=y'(0)=0				
	d	If a periodic function of period $2a$ is defined by	CO1	L4	7	1
		$f(t) = \begin{cases} t & \text{if } 0 < t < a \\ 2a - t & \text{if } a < t < 2a \end{cases} \text{ then show that } L[f(t)] = (\frac{1}{s^2}) \tanh(\frac{as}{2})$				
		OR				
2		Find the inverse laplace transform of $\frac{(4s+5)}{((s-1)^2(s+2))}$	CO2	L3	6	1
	b	Find $L^{-1} \frac{1}{((s+1)(s^2+9))}$ using Convolution Theorem.	CO2	L3	6	1
	С	Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with $y(0)=0=y'(0)$	CO2	L3	6	1
	d	If a periodic function of period $\frac{(2\pi)}{w}$ is defined by	CO1	L4	7	1
		$\int_{\mathbb{R}} E_{\text{sinwt}}  \text{if } 0 < t < \frac{\pi}{2}$				
		$f(t) = \begin{cases} 1 & \text{for } t \\ 0 & \text{for } t \end{cases}$ then show that				
		$f(t) = \begin{cases} Esinwt & \text{if } 0 < t < \frac{\pi}{w} \\ 0 & \text{if } \frac{\pi}{w} < t < \frac{(2\pi)}{w} \end{cases} \text{ then show that} \end{cases}$				
		$I[f(t)] = \underbrace{Ew}$				
		$L[f(t)] = \frac{Ew}{(s^2 + w^2)(1 - e^{\frac{(-as)}{w}})}$				
3	а	Use Taylor's method to find y at $x=0.1, 0.2, 0.3$ of the problem	CO7	L3	9	4
5	u	7		L)	9	4
		$\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ .Consider upto 3 <sup>rd</sup> degree terms.				
	b	Using Euler's modified method, solve for y at $x=0.1$ if $\frac{dy}{dx}=\frac{y-x}{y+x}$	CO7	L3	8	4
		· · ·				
	0	with $y(0)=1$ . Carry out three modifications.	C07		8	
	C	Apply Runge Kutta method of order four compute $y=0.2$ given	CO7	L3	0	4
		$10\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ taking h=0.2				
		OR				
4	а	Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ find y at $x = 0.2$ using RK	CO7	L3	9	4
<u> </u>	<u>لہ</u>	method taking h=0.2	CO8	L3	8	
	b	Given $\frac{dy}{dx} = xy + y^2$ with		Ľ٢	0	4
		y(0)=1, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=1.5049 find y(0.4) correct to three decimal places using Milne's method.				
	С	Given $\frac{dy}{dx} = (1+y)x^2$ and	CO8	L3	8	4
		y(1)=1, y(1.1)=1.233, y(1.2)=1.548, y(1.3)=1.979 find $y(1.4)$ by Adams-Bashforth method				

### b. Assignment -1

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

NOLC: A UIS												
Madal Assignment Questions												
	Model Assignment Questions											
Cue Ce des	10144704	C		N 4 a vil v a v	10/10	<b>T</b> !	a.a					
Crs Code:	18MAT31	Sem:	3	Marks:	10/10	l ime:	90 – 120 minutes					
	-		-			1	-					

Note:	Each student	to answer 2-3 assignments. Each assignment carries equal ma	rk.		
SNo	USN	Assignment Description	Marks	CO	Level
1		Find the laplace transform of $(i) t e^{(-4t)} \sin 3t$ $(ii) \frac{(e^{(at)} - e^{(-at)})}{t}$	6	CO1	L3
2		Express in terms of unit step function and hence find its laplace transform $f(t) = \begin{cases} cost & 0 < t < \pi \\ 1 & \pi < t < 2\pi \\ sint & t > 2\pi \end{cases}$	6	CO1	L3
3		Solve by using laplace transforms $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ and $y(0) = y'(0) = 0$	6	CO2	L3
4		If a periodic function of period $2a$ is defined by $f(t) = \begin{cases} t & if \ 0 < t < a \\ 2a - t & if \ a < t < 2a \end{cases}$ then show that $L[f(t)] = (\frac{1}{s^2}) \tanh(\frac{as}{2})$	7	CO1	L4
5		Find the inverse laplace transform of $\frac{(4s+5)}{((s-1)^2(s+2))}$	6	CO2	L3
6		Find $L^{-1} \frac{1}{((s+1)(s^2+9))}$ using Convolution Theorem.	6	CO2	L3
7		Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with $y(0)=0=y'(0)$	6	CO2	L3
8		If a periodic function of period $\frac{(2\pi)}{w}$ is defined by $f(t) = \begin{cases} Esinwt & if \ 0 < t < \frac{\pi}{w} \\ 0 & if \ \frac{\pi}{w} < t < \frac{(2\pi)}{w} \end{cases} \text{ then show that} \\ L[f(t)] = \frac{Ew}{(s^2 + w^2)(1 - e^{(\frac{-as}{w})})} \end{cases}$	7	CO1	L4
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 $y(0)=1$ .Consider upto 3 <sup>rd</sup> degree terms.	9	CO7	L3
10		Using Euler's modified method, solve for y at $x=0.1$ if $\frac{dy}{dx} = \frac{y-x}{y+x}$ 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 $y(0)=1$ taking h=0.2	8	CO7	L3
12		Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ find y at $x = 0.2$ using RK method taking h=0.2	9	CO7	L3
13		Given $\frac{dy}{dx} = xy + y^2$ with	8	CO8	L3

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	y(0)=1, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=1.5049 find $y(0.4)$ correct to three decimal places using Milne's method.			
14	Given $\frac{dy}{dx} = (1+y)x^2$ and y(1)=1, y(1.1)=1.233, y(1.2)=1.548, y(1.3)=1.979 find $y(1.4)$ 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 Time:	10 Hrs
a	Course Outcomes	-	Blooms
-	The student should be able to:	-	Level
1	Use appropriate multi-step numerical methods to solve second order ordinary differential equations arising in flow data design problems.	CO9	L3
2	Analyze how to apply the Euler's equations for a given function by Euler's equation	CO10	L4
b	Course Schedule		
Class No	Module Content Covered	со	Level
1	Numerical Solution of second order ODE-RK method	CO9	L3
2	Problems on RK method	CO9	L3
3	Numerical Solution of second order ODE-Milne's method	CO9	L3
4	Problems on Milne's Method	CO9	L3
5	Calculus of variation: Basic definitions and problems on Variation of functional	CO10	L4
6	Problems on functionals	CO10	L4
7	Derivation of Euler's equation.	CO10	L4
8	Applications of Calculus of Variation-Geodesics	CO10	L4
9	Problems on Geodesic and Hanging chain	CO10	L4
10	Additional problems	CO10	L4
с	Application Areas	со	Level
1	To solve first order and second order ODE using single step numerical methods	CO9	L3
2	To determine extremal functions arising in dynamics of rigid bodies and vibrational analysis in the field of civil engineering.	CO10	L4
d	Review Questions	_	_
1	By Runge Kutta method solve $\frac{d^2 y}{dx^2} = x \left(\frac{dy}{dx}\right)^2 - y^2$ for x=0.2 correct to 4	CO9	L3
	decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$		
2	$\int_{0}^{\frac{\pi}{2}} (y'^{2} - y^{2} + 2xy) dx  \text{On what curves can be the functional} y(0)=0, y(\frac{\pi}{2})=0  \text{be extremum.}$	CO10	L4
3	State and prove Euler's equation.	CO10	L4
4	Apply Milne's Method to compute $y(0.4)$ given the equation $y'' + y' = 2e^x$ and the following table of initial values.	CO9	L3
	X 0 0.1 0.2 0.3		
3MAT31 /	A Copyright ©2017. cAAS. All		

	У	2	2.01	2.04	2.09			
	У'	0	0.2	0.4	0.6	-		
5	Find the fun extrer		which m	akes the	integral	$\int_{x_1}^{x_2} (1 + xy' + xy'^2) dx  \text{an}$	CO10	L4
	Prove that th straight line jo			e betwee	en two poir	nts in a plane is along the	CO10	L4
е	Experiences						-	-
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
	Course Cabadala		
b Class No	Course Schedule Module Content Covered	со	Level
1	Periodic functions, Dirichlet's conditions	CO3	Level L3
2	Fourier series of periodic functions of period 360	CO3	L3
		CO3	_
3	Fourier series of periodic functions of arbitrary period 2c	_	L3
4	Fourier series of even and odd functions	CO3	L3
5	Solving numericals	CO3	L3
<u>5</u>	half range cosine Fourier series	CO3	L3
7	half range sine Fourier series	CO3	 
8	Practical harmonic analysis	CO4	 L3
9	Solving numericals	CO4	 L3
10	Solving numericals	CO4	L3
С	Application Areas	CO	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	CO4	L3
	signal.		
d	Review Questions	_	_
 1	Find the fourier series for the function $f(x)=x(2\pi-x)$ over the interval	CO3	L3
1	$(0,2\pi)$ and hence deduce that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$	5	
2	$ \int_{\text{If}} f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi - x & \frac{\pi}{2} < x < \pi \end{cases} $ Show that	CO3	L3
3	$f(x) = \frac{4}{\pi} \left[ sinx - \frac{sin 3x}{3^2} + \frac{sin 5x}{5^2} - \dots \right]$ The following table gives variations of periodic current over a period T. Show that there	CO4	L4
J	is a direct current part of 0.75 amp in the variable current and obtain the amplitude of		

#### COURSE PLAN - CAY 2018-19

	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 fou	rier serie	s of the	 functic	 n					CO3	L3
	$f(x) = \begin{cases} 2-x & 0 \le x \le 4 \\ x-6 & 4 \le x \le 8 \end{cases} \text{ and hence deduce that} \\ \frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots \end{cases}$										
5	Find the half range cosine series for the function $f(x)=(x-1)^2$ in $0 < x < 1$										L3
6	Compute th given by	of $f(x)$	CO4	L4							
	X	0	$\frac{\Pi}{3}$	<u>2П</u> 3	Π	$\frac{4\Pi}{3}$	<u>5 П</u> 3	2П			
	f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0			
е	Experiences	5								-	-
1		-									
2											

# E2. CIA EXAM – 2 a. Model Question Paper - 2

De	pt:	IS	Sem / Div	/: 3 / A		Course:	Fourie	orm Calc r series a rical Tech	nd	Electi	ve:		N
Dat	te <sup>.</sup>	24-10-19	Time:	0.30-	11:00	C Code	18MAT		ii iiques.	Max	Marks:		50
		Answer all fu						-		I TOX I			
-	No				Ques		0	-		CO	Level	Marks	Module
1	а	Find the four	ier series fo	or the fu	nction	f(x) =	$x(2\pi -$	x) over	the	CO3	L3	9	2
		interval $(0)$											
		If $f(x) = \begin{cases} \\ \\ \\ \\ \\ \end{cases}$	$x  0 \cdot \pi - x$	$\frac{< x < \frac{\pi}{2}}{\frac{\pi}{2} < x < \frac{\pi}{2}}$	$\pi$ Sho	ow that				CO3	L3	8	2
		$f(x) = \frac{1}{\pi}$	$sinx - \frac{sin}{s}$	$\frac{10}{2^2}$ + $\frac{10}{2}$	5 <sup>2</sup>		]						
		$f(x) = \frac{4}{\pi} [sinx - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} - \dots]$ 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	2
		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				
					0								
2	а	Find the fou	urier series	of the	functio	on				CO3	L3	8	2

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$						
Image: constraint of the start range cosine series for the function $f(x)=(x-1)^2$ in $CO3$ L3820 $0 < x < 1$ $0 < x < 1$ $1 < x < 1$ 111 $1 < 1 < x < 1$ $1 < x < 1$			-			
Induction large control on the function of $f(x) = (x - 1)^{-1} x^{-1}$ cCompute the constant term and first two harmonic of the function of $f(x)$ given byCO4L492 $x$ 0 $\overline{13}$ $\overline{211}$ $\overline{11}$ $\overline{411}$ $\overline{511}$ $\overline{211}$ 103aBy Runge Kutta method solve $\frac{d^2y}{dx^2} = x(\frac{dy}{dx})^2 - y^2$ for x=0.2CO9L385correct to 4 decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$ CO10L485b $\frac{x}{2}$ $(y'^2 - y^2 + 2xy) dx$ On what curves can be the functional $y(0)=0, y(\frac{\pi}{2})=0$ be extremum.CO10L495cState and prove Euler's equation.CO10L4954aApply Milne's Method to compute $y(0.4)$ given the equation $y'' + y'=2e^x$ and the following table of initial values.CO9L395 $y'' + y'=2e^x$ and the following table of a state of $x_{x_1}$ $x_{x_2}$ $(1 + xy' + xy'^2) dx$ CO10L485bFind the function y which makes the integral $\int_{x_1}^{x_1} (1 + xy' + xy'^2) dx$ CO10L485bFind the function y which makes the integral $\int_{x_1}^{x_1} (1 + xy' + xy'^2) dx$ CO10L485cProve that the shortest distance between two points in a plane is CO10L485		$\frac{\pi}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$				
cCompute the constant term and first two harmonic of the function of $f(x)$ given byCO4L492 $x$ $0$ $\overline{13}$ $\overline{211}$ $\overline{11}$ $4\overline{11}$ $\overline{511}$ $211$ $f(x)$ $1.0$ $1.4$ $1.9$ $1.7$ $1.5$ $1.2$ $1.0$ $3$ $a$ By Runge Kutta method solve $\frac{d^2y}{dx^2} = x(\frac{dy}{dx})^2 - y^2$ for x=0.2 correct to 4 decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$ CO10L4 $8$ $5$ $b$ $\frac{\pi}{2}$ $\int_{0}^{\pi} (y'^2 - y^2 + 2xy) dx$ On what curves can be the functional $y(0)=0, y(\frac{\pi}{2})=0$ be extremum.CO10L4 $8$ $5$ $c$ State and prove Euler's equation.CO10L4 $9$ $5$ $x$ $0$ $0.1$ $0.2$ $0.3$ $0.4$ $0.6$ $x$ $0$ $0.1$ $0.2$ $0.3$ $0.6$ $0.4$ $8$ $5$ $y' = 2e^x$ and the following table of initial values. $CO10$ L4 $8$ $5$ $y'' = y' = 2e^x$ and the following table of initial values. $CO2$ L3 $9$ $5$ $y'' = y'' = 2e^x$ and the following table of initial values. $CO2$ L4 $8$ $5$ $b$ Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ $CO2$ L4 $8$ $5$ $b$ Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ $CO2$ L4 $8$ $5$ $c$ Prove that the shortest distance between two points in a plane is CO20L4 <td>k</td> <td></td> <td>CO3</td> <td>L3</td> <td>8</td> <td>2</td>	k		CO3	L3	8	2
x0II2IIII4II5II2IIf(x)1.01.41.91.71.51.21.03aBy Runge Kutta method solve $\frac{d^2 y}{dx^2} = x(\frac{dy}{dx})^2 - y^2$ for x=0.2 correct to 4 decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$ CO1L485b $\frac{\pi}{2}$ ( $y'^2 - y^2 + 2xy) dx$ On what curves can be the functional $y(0)=0, y(\frac{\pi}{2})=0$ be extremum.CO10L485cState and prove Euler's equation.CO10L495Image: Apply Milne's Method to compute $y(0.4)$ given the equation $y' = 2e^x$ and the following table of initial values.CO2L395Image: Image: Apply Milne's Method to compute $y' = 2e^x$ and the following table of initial values.CO2L395Image: Image:	C	Compute the constant term and first two harmonic of the function of	CO4	L4	9	2
By Runge Kutta method solve $\frac{d}{dx^2} = x(\frac{dy}{dx}) - y^2$ for x=0.2 correct to 4 decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$ b $\int_{0}^{\frac{\pi}{2}} (y'^2 - y^2 + 2xy) dx$ On what curves can be the functional $y(0)=0, y(\frac{\pi}{2})=0$ be extremum.CO10L485cState and prove Euler's equation.CO10L4954aApply Milne's Method to compute $y' + y'=2e^x$ and the following table of initial values.CO3L395y22.012.042.09CO10L485y22.012.040.6bFind the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ CO10L485an extremumcProve that the shortest distance between two points in a plane is CO10L485		$\begin{array}{c c c c c c c c c c c c c c c c c c c $				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	3 a	$d^2 y (dy)^2 z$	CO9	L3	8	5
b $\sum_{0}^{2} (y'^2 - y^2 + 2xy) dx$ On what curves can be the functional $y(0) = 0, y(\frac{\pi}{2}) = 0$ be extremum.CoreScState and prove Euler's equation.CO10L4954aApply Milne's Method to compute $y(0.4)$ given the equation $y'' + y' = 2e^x$ and the following table of initial values.CO9L395 $\frac{x}{y}$ $\frac{0}{2}$ $\frac{0.1}{2.04}$ $\frac{0.3}{2.09}$ $\frac{1}{y}$ $\frac{0}{2}$ $\frac{0.1}{2.04}$ $\frac{0.3}{2.09}$ bFind the function y which makes the integral $\int_{x_1}^{x_2} (1 + xy' + xy'^2) dx$ $\frac{an extremum}{x}$ CO10L485cProve that the shortest distance between two points in a plane is CO10L485		correct to 4 decimal places using the initial conditions $y=1$ and				
AAApply Milne's Method to compute $y(0.4)$ given the equation $y'' + y' = 2e^x$ and the following table of initial values.CO9L395 $x$ 00.10.20.30.10.20.30.10.	k	$\int_{0}^{2} (y'^{2} - y^{2} + 2xy) dx$ On what curves can be the functional	CO10	L4	8	5
4aApply Milne's Method to compute $y(0.4)$ given the equation $y'' + y' = 2e^x$ and the following table of initial values.CO9L395 $x$ 00.10.20.30.30.10.20.30.10.10.20.3 $y$ 22.012.042.090.60.10.20.40.60.10.20.40.6bFind the function y which makes the integral $\int_{x_1}^{x_2} (1 + xy' + xy'^2) dx$ CO10L485an extremumcProve that the shortest distance between two points in a plane is CO10L485	C	State and prove Euler's equation.	CO10	L4	9	5
$\frac{y'' + y' = 2e^{x}}{y' + y' = 2e^{x}}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y} = 2e^{x}$ and the following table of initial values. $\frac{x}{y$		OR				
$y$ $2$ $2.01$ $2.04$ $2.09$ $y'$ $0$ $0.2$ $0.4$ $0.6$ $b$ Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ $CO10$ $L4$ $8$ $5$ $an$ extremum $c$ Prove that the shortest distance between two points in a plane is $CO10$ $L4$ $8$ $5$	4 ĉ	=	CO9	L3	9	5
b       Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ CO10       L4       8       5         c       Prove that the shortest distance between two points in a plane is CO10       L4       8       5		X 0 0.1 0.2 0.3				
bFind the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ CO10L485an extremumcProve that the shortest distance between two points in a plane is CO10L485		y 2 2.01 2.04 2.09				
Find the function y which makes the integral $\int_{x_1} (1 + xy' + xy'^2) dx$ an extremum $x_1$ cProve that the shortest distance between two points in a plane is CO10L485		y' 0 0.2 0.4 0.6				
c Prove that the shortest distance between two points in a plane is CO10 L4 8 5	k		CO10	L4	8	5
	C		CO10	L4	8	5

### b. Assignment – 2

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

				Model	Assignm	ent C	Questions				
Crs Co	de:	18MAT31	Sem:	3	Marks:	1	.0/ 10	Time:	90 - 120	minute	S
Course	e:	Transform	Calculus,	Fourier	series	and					
		Numerica	l Techniques								
Note: E	Each	student to	answer 2-3	assignmen	ts. Each a	assig	nment carri	es equal ma	ark.		
SNo	ι	JSN		Assig	nment D	escr	iption		Marks	СО	Level
1		E	By Runge Kut	ta method	solve <u>(</u>	$\frac{d^2 y}{dy^2}$ =	$=x\left(\frac{dy}{dx}\right)^2 - \frac{1}{2}$	$y^2$ for x=0.2	2 8	CO9	L3
					(	ax	uл				

[]			1 1	
	correct to 4 decimal places using the initial conditions $y=1$ and $y'=0$ when $y=0$			
2	$y=1 \text{ and } y'=0 \text{ when } x=0$ $\int_{0}^{\frac{\pi}{2}} (y'^{2}-y^{2}+2xy) dx \text{ On what curves can be the functional}$ $y(0)=0, y(\frac{\pi}{2})=0 \text{ be extremum.}$	8	CO10	L4
		0	CO10	14
3	State and prove Euler's equation. Apply Milne's Method to compute $y(0.4)$ given the	9	CO10 CO9	L4 3
	equation $y'' + y' = 2e^x$ and the following table of initial values.	0		_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			
5	Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ an extremum	8	CO10	L4
6	Prove that the shortest distance between two points in a plane is along the straight line joining them.	8	CO10	L4
7	Find the fourier series for the function $f(x) = x(2\pi - x)$ over	9	CO3	L3
	the interval $(0,2\pi)$ and hence deduce that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$			
8	$\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$ If $f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi - x & \frac{\pi}{2} < x < \pi \end{cases}$ Show that $f(x) = \frac{4}{\pi} [sinx - \frac{sin 3x}{3^2} + \frac{sin 5x}{5^2}]$	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 0.75amp in the variable current and obtain the amplitude of first harmonic	8	CO4	L4
	t(sec) 0 T/6 T/3 T/2 2T/3 5T/ T 6			
	A(am         1.9         1.3         1.05         1.3         -         -         1.98           p)         8            0.88         0.25			
10	Find the fourier series of the function $f(x) = \begin{cases} 2-x & 0 \le x \le 4 \\ x-6 & 4 \le x \le 8 \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$	8	CO3	L3
11	Find the half range cosine series for the function $f(x)=(x-1)^2$ in $0 < x < 1$	8	CO3	L3
12	Compute the constant term and first two harmonic of the function of $f(x)$ given by	9	CO4	L4
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			

COURSE PLAN - CAY 2018-19

f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0		

# D3. TEACHING PLAN - 3

Module – 3

Title:	Fourier transform ; Difference equations and z-transforms	Appr Time:	10 Hrs
а	Course Outcomes	-	Bloom
-	The student should be able to:	-	Level
1	Apply to transform form one to another domain by fourier intergrals	CO5	L3
2	Apply to transform one domain to another domain by z-transforms	CO6	L3
b	Course Schedule		
ass N	o Module Content Covered	CO	Level
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	со	Level
1	To study the continuous and Apply to transform one domain to another domain	CO5	L3
2	by z-transforms discrete signals and its properties. Used to convert to discrete time domain signal into discrete frequency domain signal.	CO6	L3
d	Review Questions	-	-
1	Find the complex fourier transform of the function $f(x) = \begin{cases} 1 & \text{for }  x  \le a \\ 0 & \text{for }  x  > a \end{cases}$ hence deduce $\int_{0}^{\infty} \frac{\sin x}{x} dx$	CO9	L3
2	Find the complex fourier transform of the function $f(x) = \begin{cases} x & \text{for }  x  \le \alpha \\ 0 & \text{for }  x  > \alpha \end{cases}$ where $\alpha$ is a positive constant.	CO9	L3
3	Find the fourier transform of $f(x) = e^{- x }$	CO9	L3
4	Find the complex fourier transform of the function $f(x) = \begin{cases} 1 -  x  & \text{for }  x  \le 1 \\ 0 & \text{for }  x  > 1 \end{cases}$ hence deduce $\int_{0}^{\infty} \frac{\sin^{2} t}{t^{2}} dt = \frac{\pi}{2}$ If $f(x) = \begin{cases} 1 - x^{2} & \text{for }  x  < 1 \\ 0 & \text{for }  x  \ge 1 \end{cases}$ find the fourier transform of $f(x)$ and	CO9	L3
5	If $f(x) = \begin{cases} 1 - x^2 & \text{for }  x  < 1 \\ 0 & \text{for }  x  \ge 1 \end{cases}$ find the fourier transform of $f(x)$ and hence deduce $\int_0^\infty \frac{x \cos x - \sin x}{x^3} \cos(\frac{x}{2}) dx$	CO9	L3
6	Find the fourier sine and cosine transform of $f(x) = e^{-\alpha x}$	CO9	L3
7	Find the fourier sine transform of $f(x)=e^{- x }$ and hence evaluate	CO9	L3
/	$\int (x) = e^{-x}$ and hence evaluate	209	

	$\int_{0}^{\infty} \frac{x sinmx}{1+x^2} dx, m > 0$		
8	Find the inverse fourier sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}, a > 0$	CO9	L3
9	Find the Z transforms of the following: (i) $e^{-an}$ ; (ii) $e^{-an}n$ ; (iii) $e^{-an}$ . $n^2$	CO10	L3
10	Find the Z transform of $2n + \sin(\frac{n\pi}{4}) + 1$	CO10	L3
11	Show that $Z_T(\frac{1}{n!}) = e^{\frac{1}{z}}$ . Hence find $Z_T(\frac{1}{(n+1)!})$ and $Z_T(\frac{1}{(n+2)!})$	CO10	L3
12	Find the Z transform of $sin(3n+5)$	CO10	L3
13	Find the Z transform of $n \cos \theta$	CO10	L3
14	Find $Z_T(\frac{1}{(n+1)})$	CO10	L3
15	Find $Z_T(\frac{1}{(n+1)})$ If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$ find the value of $u_0, u_1, u_2, u_3$	CO10	L3
16	Given $Z_T(u_n) = \frac{2z^2 + 3z + 4}{(z-3)^3}$ , $ z  > 3$	CO10	L3
	Show that $u_1 = 2, u_2 = 21, u_3 = 139$		
17	Find the inverse Z transform of $\frac{z}{(z-1)(z-2)}$	CO10	L3
18	Find the inverse Z transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$	CO10	L3
19	Given $U(z) = \frac{4z^2 - 2z}{(z^3 - 5z^2 + 8z - 4)}$ find $u_n$	CO10	L3
<u>e</u>	Experiences	-	-
1			

# E3. CIA EXAM – 3

## a. Model Question Paper - 3

### b. Assignment – 3

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

				Mod	el Assign	ment Ques	stions					
Crs C	ode:	18MAT31	L Sem:	3	Marks	5: 10/	10	Tim	e:	90 - 120	minute	S
Cours	se:	Transforr	n Calculus,	Fourier	series	and		•				
		Numerica	al Techniques									
Note:	Each	student f	to answer 2-3	assignme	ents. Eac	h assignme	ent ca	arries e	equal ma	ırk.		
SNo		USN		Ass	ignment	Description	on			Marks	СО	Level
1			Find the c	complex	fourier	transform	n of	the	functio	n 6	CO9	L3
			$f(x) = \begin{cases} x \\ 0 \end{cases}$	for $ x  \le$ for $ x $	≤a >a wh	here $lpha$ is	s a po	sitive	constant			
2			Find the fouri	er transfc	orm of	$f(x)=e^{- x }$				7	CO9	L3
3			Find the c	complex	fourier	transform	n of	the	functio	n 7	CO9	L3
			$f(x) = \begin{cases} 1 - c \\ 0 \\ \int_{0}^{\infty} \frac{\sin^2 t}{t^2} dt \end{cases}$	x  for for	$ x  \le 1$ $ x  > 1$	h	ence		deduc	e		
			$\int_{0}^{\infty} \frac{\sin^2 t}{t^2} dt$	$=\frac{\pi}{2}$								

4	Find the inverse Z transform of $\frac{z}{(z-1)(z-2)}$	6	CO10	L3
5	Find the inverse Z transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$	7	CO10	L3
6	Given $U(z) = \frac{4z^2 - 2z}{(z^3 - 5z^2 + 8z - 4)}$ find $u_n$	7	CO10	L3
7	Given $U(z) = \frac{4z^2 - 2z}{(z^3 - 5z^2 + 8z - 4)}$ find $u_n$ If $f(x) = \begin{cases} 1 - x^2 & \text{for }  x  < 1\\ 0 & \text{for }  x  \ge 1 \end{cases}$ find the fourier transform of	6	CO9	L3
	$f(x)$ and hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^{3}} \cos(\frac{x}{2}) dx$			
8	Find the fourier sine and cosine transform of $f(x) = e^{-\alpha x}$	7	CO9	L3
9	Find the fourier sine transform of $f(x)=e^{- x }$ and hence evaluate $\int_{0}^{\infty} \frac{xsinmx}{1+x^{2}} dx$ , $m>0$ Find the Z transforms of the following:	7	CO9	L3
10	Find the Z transforms of the following: (i) $e^{-an}$ ; (ii) $e^{-an}n$ ; (iii) $e^{-an}$ . $n^2$	6	CO10	L3
11	Find the Z transform of $2n + \sin(\frac{n\pi}{4}) + 1$	7	CO10	L3
12	Show that $Z_T(\frac{1}{n!}) = e^{\frac{1}{z}}$ . Hence find $Z_T(\frac{1}{(n+1)!})$ and $Z_T(\frac{1}{(n+2)!})$	7	CO10	L3
13	Find the Z transform of $sin(3n+5)$	6	CO10	L3
14	Find the Z transform of $n \cos \theta$	7	CO10	L3
15	Find $Z_T(\frac{1}{(n+1)})$	7	CO10	L3

# F. EXAM PREPARATION

## 1. University Model Question Paper

Cour	se:	Transform Calculus Fourier Series and Numerical Techniques Month .	/ Year	May /2	2019
Crs C	Code:	18MAT31 Sem: 3 Marks: 100 Time:	_	180 mi	nutes
-		Answer any FIVE full questions. All questions carry equal marks.	Marks	CO	Level
1	а	Find the laplace transform of $(i)te^{(-4t)}\sin 3t$ $(ii)rac{(e^{(at)}-e^{(-at)})}{t}$	6	CO1	L3
	b	Express in terms of unit step function and hence find its laplace transform $f(t) = \begin{cases} cost & 0 < t < \pi \\ 1 & \pi < t < 2\pi \\ sint & t > 2\pi \end{cases}$	7	CO1	L3
	С	If a periodic function of period $2a$ is defined by $f(t) = \begin{cases} t & if \ 0 < t < a \\ 2a - t & if \ a < t < 2a \end{cases}$ then show that $L[f(t)] = (\frac{1}{s^2}) \tanh(\frac{as}{2})$	7	CO1	L3
		OR			
2	а	Find the inverse laplace transform of $\frac{(4s+5)}{((s-1)^2(s+2))}$	6	CO2	L3

	b	. 1	7	CO2	L3
	D	Find $L^{-1} \frac{1}{((s+1)(s^2+9))}$ using Convolution Theorem. Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with	/		
	С	Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with $y(0)=0=y'(0)$	7	CO2	L3
3	а	Find the fourier series for the function $f(x)=x(2\pi-x)$ over the interval $(0,2\pi)$ and hence deduce that $\frac{\pi^2}{12}=\sum_{n=1}^{\infty}\frac{(-1)^{n+1}}{n^2}$	6	CO3	L3
		$(0,2,7,7)$ and $(0,2,7,7)$ and $(0,2,7,7)$ $(0,2,7,7)$ $(12)$ $n=1$ $n^2$			
	b	If $f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi - x & \frac{\pi}{2} < x < \pi \end{cases}$ Show that	7	CO3	L3
		$f(x) = \frac{4}{\pi} [sinx - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2} - \dots]$			
	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
		t(sec) 0 T/6 T/3 T/2 2T/3 5T/6 T			
		A(amp)         1.98         1.3         1.05         1.3         -0.88         -0.25         1.98			
		OR			
4	a	Find the fourier series of the function $f(x) = \begin{cases} 2-x & 0 \le x \le 4 \\ x-6 & 4 \le x \le 8 \end{cases}$ and hence deduce that	6	CO3	L3
		$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$			
	b	Find the half range cosine series for the function $f(x)=(x-1)^2$ in $0 < x < 1$	7	CO3	L3
	С	Compute the constant term and first two harmonic of the function of $f(x)$ given by	7	CO4	L4
		$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			
		f(x) 1.0 1.4 1.9 1.7 1.5 1.2 1.0			
5	a	Find the complex fourier transform of the function $f(x) = \begin{cases} 1 & for   x  \le a \\ 0 & for   x  > a \end{cases}$ hence deduce $\int_{0}^{\infty} \frac{sinx}{x} dx$	6	CO9	L3
	b	Find the inverse Z transform of $\frac{z}{(z-1)(z-2)}$	7	CO10	L3
	С	If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$ find the value of $u_0, u_1, u_2, u_3$	7	CO10	L3
6		OR	6		
6	a	$  f f(x)  = \begin{cases} 1 - x^2 & \text{for }  x  < 1\\ 0 & \text{for }  x  \ge 1 \end{cases} $ find the fourier transform of $f(x)$ and $\int_{\infty}^{\infty} x \cos x = \sin x$	6	CO9	L3
		hence deduce $\int_{0}^{\infty} \frac{x \cos x - \sin x}{x^{3}} \cos(\frac{x}{2}) dx$			
	b		7	· · · · · · · · · · · · · · · · · · ·	

		1		0010	
	С	Show that $Z_T(\frac{1}{n!}) = e^{\frac{1}{z}}$ . Hence find $Z_T(\frac{1}{(n+1)!})$ and	7	CO10	L3
		$Z_T(\frac{1}{(n+2)!})$			
7	а	Use Taylor's method to find y at $x=0.1, 0.2, 0.3$ of the problem	6	CO7	L3
		$\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ .Consider upto 3 <sup>rd</sup> degree terms.			
	b	Using Euler's modified method, solve for y at $x=0.1$ if $\frac{dy}{dx}=\frac{y-x}{y+x}$	7	CO7	L3
		with $y(0)=1$ . Carry out three modifications.			
	С	Apply Runge Kutta method of order four compute $y=0.2$ given	7	CO8	L3
		$10\frac{dy}{dx} = x^2 + y^2$ with $y(0) = 1$ taking h=0.2			
		OR			
8	a	Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ find y at $x = 0.2$ using RK method taking h=0.2	6	CO8	L3
	b		7	CO8	L3
	5	Given $\frac{dy}{dx} = xy + y^2$ with	/		-5
		y(0)=1, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=1.5049 find			
		y(0.4) correct to three decimal places using Milne's method.			
	С		7	CO8	L3
		Given $\frac{dy}{dx} = (1+y)x^2$ and			Ū
		y(1)=1, y(1.1)=1.233, y(1.2)=1.548, y(1.3)=1.979 find			
		y(1.4) by Adams-Bashforth method			
9	а	By Runge Kutta method solve $\frac{d^2 y}{dx^2} = x \left(\frac{dy}{dx}\right)^2 - y^2$ for x=0.2 correct to 4	6	CO9	L3
		decimal places using the initial conditions $y=1$ and $y'=0$ when $x=0$			
	b	$\frac{\pi}{2}$	7	CO10	L3
		$\int (y'^2 - y^2 + 2xy) dx$ On what curves can be the functional			
		$\int_{0}^{\infty} (y'^{2} - y^{2} + 2xy) dx  \text{On what curves can be the functional} y(0)=0, y(\frac{\pi}{2})=0  \text{be extremum.}$			
		$y(0)=0, y(\frac{\pi}{2})=0$ be extremum.			
	С	State and prove Euler's equation.	7	CO10	L4
		OR			
10	а	Apply Milne's Method to compute $y(0.4)$ given the equation	6	CO9	L3
		$y'' + y' = 2e^x$ 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			
		y' 0 0.2 0.4 0.6			
	b	$X_2$	7	CO10	L3
		Find the function y which makes the integral $\int (1+xy'+xy'^2) dx$ an			
		extremum			
	С	Prove that the shortest distance between two points in a plane is along	7	CO10	L4
		the straight line joining them.			

## 2. SEE Important Questions

Cour		Transform Calculus, Fourier series and Numerical Techniques. Month .	/ Year	May /	2019
	Code:	18MAT31 Sem: 3 Marks: 100 Time:		180 mi	
		Answer any FIVE full questions. All questions carry equal marks.	-	-	
Mod ule	Qno.	Important Question	Marks		Year
1	1	Find the laplace transform of $(i)te^{(-4t)}\sin 3t$ $(ii)\frac{(e^{(at)}-e^{(-at)})}{t}$	6	CO1	
	2	Express in terms of unit step function and hence find its laplace transform $f(t) = \begin{cases} cost & 0 < t < \pi \\ 1 & \pi < t < 2\pi \\ sint & t > 2\pi \end{cases}$	7	CO1	
	3	If a periodic function of period $2a$ is defined by $f(t) = \begin{cases} t & if \ 0 < t < a \\ 2a - t & if \ a < t < 2a \end{cases}$ then show that $L[f(t)] = (\frac{1}{s^2}) \tanh(\frac{as}{2})$	7	CO1	
	4	Find the inverse laplace transform of $\frac{(4s+5)}{((s-1)^2(s+2))}$	6	CO2	
	5	Find $L^{-1} \frac{1}{((s+1)(s^2+9))}$ using Convolution Theorem. Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with	7	CO2	
	6	Solve $y''+6y'+9y=12t^2e^{-3t}$ by laplace transforms method with $y(0)=0=y'(0)$	7	CO2	
2	1	Find the fourier series for the function $f(x) = x(2\pi - x)$ over the interval $(0,2\pi)$ and hence deduce that $\frac{\pi^2}{12} = \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^2}$	6	CO3	
	2	$f(x) = \begin{cases} x & 0 < x < \frac{\pi}{2} \\ \pi - x & \frac{\pi}{2} < x < \pi \end{cases}$ Show that $f(x) = \frac{4}{\pi} [sinx - \frac{\sin 3x}{3^2} + \frac{\sin 5x}{5^2}]$	7	CO3	
		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	
		t(sec)       0       T/6       T/3       T/2       2T/3       5T/6       T         A(amp)       1.98       1.3       1.05       1.3       -0.88       -0.25       1.98			
	4	Find the fourier series of the function $f(x) = \begin{cases} 2-x & 0 \le x \le 4 \\ x-6 & 4 \le x \le 8 \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$	6	CO3	
	5	Find the half range cosine series for the function $f(x)=(x-1)^2$ in $0 < x < 1$	7	CO3	

f(x)  given by $x = 0$ $f(x) = 0$ $f(x) = 1  for   x  = 1  for$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	7         CO4           6         CO9           7         CO9           7         CO9           6         CO10           7         CO10	
f(x)1.0311Find the complete f (x)= $\begin{bmatrix} 1 & for &  x  = \\ 0 & for &  x  = \\ 1 - x^2 & forhence deduce & \int_0^{\infty} \frac{xc}{dx} = \frac{x^2}{dx} = $	$\overline{3}$ $\overline{3}$ $\overline{3}$ $\overline{3}$ $\overline{3}$ $\overline{3}$ $\overline{3}$ 1.4       1.9       1.7       1.5       1.2       1.0         ex       fourier       transform of the function       function       function $\leq a$ hence deduce $\int_{0}^{\infty} \frac{sinx}{x} dx$ function       function $\geq a$ hence deduce $\int_{0}^{\infty} \frac{sinx}{x} dx$ function       function $a$ hence deduce $\int_{0}^{\infty} \frac{sinx}{x} dx$ function       function $a$ hence deduce $\int_{0}^{\infty} \frac{sinx}{x} dx$ function       function $a$ <	7 CO9 7 CO9 7 CO9 6 CO10	
$f(x) = \begin{cases} 1 & \text{for }  x  = \\ 0 & \text{for }  x  = \\ 0 & \text{for }  x  = \\ 0 & \text{for }  x  = \end{cases}$ $\stackrel{2}{\text{If } f(x) = \begin{cases} 1 - x^2 & \text{for } \\ 0 & \text{for } \\ 0 & \text{for } \end{cases}$ $\stackrel{3}{\text{Hence deduce } \int_{0}^{\infty} \frac{xC}{dx} = \\ 0 & \text{for } \\ 0 & \text{for } \\ 0 & \text{for } \end{cases}$ $\stackrel{4}{\text{Find } Z_T(\frac{1}{(n+1)})$ $\stackrel{5}{\text{Find the inverse fouries}}$ $\stackrel{6}{\text{Given } U(z) = \frac{4}{(z^3 - 5)^3}$ $\stackrel{4}{\text{I } \text{Use Taylor's method to } \\ \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 2 & \text{Using Euler's modified } \\ \text{with } y(0) = 1 & \text{Carreson } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \end{cases}$	$ \frac{\leq a}{>a}  \text{hence deduce}  \int_{0}^{\infty} \frac{\sin x}{x} dx $ $ \frac{ x  < 1}{ x  \geq 1}  \text{find the fourier transform of}  f(x)  \text{and}  \frac{\cos x - \sin x}{x^{3}} \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $	7 CO9 7 CO9 7 CO9 6 CO10	
$f(x) = \begin{cases} 1 & \text{for }  x  = \\ 0 & \text{for }  x  = \\ 0 & \text{for }  x  = \\ 0 & \text{for }  x  = \end{cases}$ $\stackrel{2}{\text{If } f(x) = \begin{cases} 1 - x^2 & \text{for } \\ 0 & \text{for } \\ 0 & \text{for } \end{cases}$ $\stackrel{3}{\text{Hence deduce } \int_{0}^{\infty} \frac{xC}{dx} = \\ 0 & \text{for } \\ 0 & \text{for } \\ 0 & \text{for } \end{cases}$ $\stackrel{4}{\text{Find } Z_T(\frac{1}{(n+1)})$ $\stackrel{5}{\text{Find the inverse fouries}}$ $\stackrel{6}{\text{Given } U(z) = \frac{4}{(z^3 - 5)^3}$ $\stackrel{4}{\text{I } \text{Use Taylor's method to } \\ \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 2 & \text{Using Euler's modified } \\ \text{with } y(0) = 1 & \text{Carreson } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \\ 10 \frac{dy}{dx} = x^2 + y^2 & \text{with } \end{cases}$	$ \frac{\leq a}{>a}  \text{hence deduce}  \int_{0}^{\infty} \frac{\sin x}{x} dx $ $ \frac{ x  < 1}{ x  \geq 1}  \text{find the fourier transform of}  f(x)  \text{and}  \frac{\cos x - \sin x}{x^{3}} \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $ $ \frac{ x  < 1}{ x  \geq 1}  \cos(\frac{x}{2}) dx $	7 CO9 7 CO9 7 CO9 6 CO10	
3Find the inverse fourier4Find $Z_T(\frac{1}{(n+1)})$ 5Find the inverse Z transmit6Given $U(z) = \frac{4}{(z^3 - 5)^2}$ 41Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with2Using Euler's modified with $y(0)=1$ . Carr 33Apply Runge Kutta method $10 \frac{dy}{dx} = x^2 + y^2$ with4Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ method taking h=0.2	r sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}, a > 0$	7 CO9 6 CO10	
3Find the inverse fourier4Find $Z_T(\frac{1}{(n+1)})$ 5Find the inverse Z transmit6Given $U(z) = \frac{4}{(z^3 - 5)^2}$ 41Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with2Using Euler's modified with $y(0)=1$ . Carr 33Apply Runge Kutta method $10 \frac{dy}{dx} = x^2 + y^2$ with4Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ method taking h=0.2	r sine transform of $\hat{f}_s(\alpha) = \frac{e^{-a\alpha}}{\alpha}, a > 0$	6 CO10	
4Find $Z_T(\frac{1}{(n+1)})$ 5Find the inverse Z transmit6Given $U(z) = \frac{4}{(z^3-5)}$ 41Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with2Using Euler's modified with $y(0)=1$ . Carr3Apply Runge Kutta method $10\frac{dy}{dx} = x^2 + y^2$ with4Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ method taking h=0.2	e	6 CO10	
4Find $Z_T(\frac{1}{(n+1)})$ 5Find the inverse Z tran6Given $U(z) = \frac{4}{(z^3-5)}$ 41Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with2Using Euler's modified with $y(0)=1$ . Carr3Apply Runge Kutta method $10\frac{dy}{dx} = x^2 + y^2$ with4Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ method taking h=0.2	e		1 1
6 Given $U(z) = \frac{4}{(z^3-5)^2}$ 4 1 Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with 2 Using Euler's modified with $y(0)=1$ . Carr 3 Apply Runge Kutta method taking h=0.2	sform of $\frac{3z^2+2z}{(z-z)(z-z)}$	7 CO10	,
6 Given $U(z) = \frac{4}{(z^3 - 5)^2}$ 4 1 Use Taylor's method to $\frac{dy}{dx} = x^2 + y^2$ with 2 Using Euler's modified with $y(0)=1$ . Carr 3 Apply Runge Kutta method taking h=0.2	(5z-1)(5z+2)		,
$\frac{dy}{dx} = x^2 + y^2 \text{ with}$ $2 \text{ Using Euler's modified}$ $\frac{y(0) = 1 \text{ . Carr}}{3 \text{ Apply Runge Kutta me}}$ $10 \frac{dy}{dx} = x^2 + y^2 \text{ with}$ $4 \text{ Solve } \frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ $\frac{4}{3 \text{ method taking h=0.2}}$	$\frac{z^2 - 2z}{z^2 + 8z - 4}$ find $u_n$	7 C010	
<sup>2</sup> Using Euler's modified with $y(0)=1$ . Carr 3 Apply Runge Kutta me $10\frac{dy}{dx}=x^2+y^2$ with 4 Solve $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2}$ method taking h=0.2	y(0)=1 .Consider upto 3 <sup>rd</sup> degree terms.	6 CO7	
3 Apply Runge Kutta me $10 \frac{dy}{dx} = x^2 + y^2$ with 4 Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ method taking h=0.2	method, solve for y at $x=0.1$ if $\frac{dy}{dx}=\frac{y-x}{y+x}$	7 CO7	
method taking h=0.2	thod of order four compute $y=0.2$ given	7 CO8	
	y(0)=1 taking h=0.2 with $y(0)=1$ find y at $x=0.2$ using RK	6 CO8	
y(0)=1, y(0.1)=1	with .1169, $y(0.2)=1.2773$ , $y(0.3)=1.5049$ find nree decimal places using Milne's method.	7 CO8	
$\begin{array}{ c c c c } \hline 6 & \\ \hline \\ \hline$		7 CO8	
5 1 By Runge Kutta metho decimal places using t x=0	and $(233, y(1.2)=1.548, y(1.3)=1.979$ find	6 CO9	

2	$\int_{0}^{\frac{\pi}{2}} (y'^{2} - y^{2} + 2xy) dx  \text{On what curves can be the functional} y(0)=0, y(\frac{\pi}{2})=0  \text{be extremum.}$								
3	State and prove Euler's equation.								
4	Apply Milne's Method to compute $y(0.4)$ given the equation $y'' + y' = 2e^x$ and the following table of initial values.							CO9	
	X	0	0.1	0.2	0.3				
	У	2	2.01	2.04	2.09				
	y'	0	0.2	0.4	0.6				
5	Find the function y which makes the integral $\int_{x_1}^{x_2} (1+xy'+xy'^2) dx$ an extremum								
6	Prove that the shortest distance between two points in a plane is along the straight line joining them.							CO10	

# G. Content to Course Outcomes

### 1. TLPA Parameters

#### Table 1: TLPA – Example Course

		<u> </u>					1
Мо						Instructi	Assessment
dul	(Split module content into 2 parts which have					on	Methods to
e-	similar concepts)	g Hours	Levels	ms'	Verbs for	Methods	Measure
#			for	Level	Learning	for	Learning
			Content			Learning	
A	В	С	D	Ε	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 2∏,2l 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 and	5	L3	L3	Apply	Lecture	Assinments
	degree-Taylor's Method,Modified Euler's						and Slip
	Equations						test
4	RK method,Milne's and Adams Bashforth	5	L3	L3	Apply	Lecture	Assinments
	method						and Slip
							test
5	Numerical Solutions of second order ODE	7	L3	L3	Apply	Lecture	Assinments
		-	-	-			]

	using Runge-Kutta method an Method.	ıd Milne's						and Slip test
5	Variational problems, equations,geodesics and problems	euler's	3	L4	L4	Analyze	Lecture	Assinments and Slip test

### 2. Concepts and Outcomes:

### Table 2: Concept to Outcome – Example Course

				ept to Outcome – Ex		
Mo dul e-	Learning or Outcome from study of	Concepts from	Final Concept	Justification (What all Learning	CO Components (1.Action Verb, 2.Knowledge,	Course Outcome
#	the Content or Syllabus	Content		Happened from the study of Content / Syllabus. A short word for learning or outcome)	Methodology, 4.Benchmark)	Student Should be able to
A	1	J	K	L	М	N
	laplace transforms	ation	Differential Equations	differential equations using laplace transformation	Apply Differentiation Problem Solving	Use laplace transform in solving Differential equations arising in network analysis, control systems and other fields of engineering.
	0	Laplace transform ation	Differential Equations	differential	Apply Differentiation Problem Solving	Use inverse laplace transform in solving Differential/ integral equations arising in network analysis, control systems and other fields of engineering.
	Solution of DE using fourier expansion	Fourier series	Analyze circuits&syste m communicati on		Apply Integration Problem Solving	Analyze expansion of Fourier series using Euler formula
		Harmonic Analysis	Analyze circuits&syste m communicati on	Methods to solve partical harmonic problem over a period using fourier expansion	Apply Problem Solving	Apply Fourier expansion in practical harmonic problems
	fourier transforms	ation	Continuous signal process	differential equations using fourier transformation	Apply Integration Problem Solving	Apply to transform form one to another domain by Fourier integrals
	and inverse Z transforms		process	differential equations using Z and inverse Z transformation	Apply Integration Problem Solving	Apply to transform one domain to another domain by z-transforms
	Numerical Methods to solve DE	Differentia l Equations	Ordinary Differential Equations.	DE using Numerical	Apply Differentiation Problem Solving	Use appropriate single step numerical methods to solve first order

						ordinary differential equations.
	Methods to	Differentia l Equations	Differential	DE using Numerical		Use appropriate multi-step numerical methods to solve first order ordinary differential equations arising in flow data design problems.
	Methods to	Differentia l Equations	Differential	DE using Numerical		Use appropriate multi-step numerical methods to solve second order ordinary differential equations arising in flow data design problems.
5	Applications of Calculus of Variations		Maximum and minimum	variations	Differentiation Problem Solving	Analyze how to apply the Euler's equations for a given function by Euler's equation